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Record of Decision:

BERKS LANDFILL
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RECORD OF DECISION

BERKS LANDFILL SUPERFUND SITE
SPRING TOWNSHIP, BERKS COUNTY,
PENNSYLVANIA

<IMG SRC 97058A>

JULY 1997

PREPARED BY
THE U. S. ENVIRONMENTAL PROTECTION AGENCY

RECORD OF DECISION
BERKS LANDFILL SUPERFUND SITE

DECLARATION

SITE NAME AND LOCATION

Berks Landfill Superfund Site
Spring Township, Berks County, Pennsylvania

STATEMENT OF BASIS AND PURPOSE

This decision document presents the final selected remedial action for the Berks Landfill Superfund Site ("the Site"). The remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA") and the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"). This decision is based on the Administrative Record for the Site.

Although the Commonwealth of Pennsylvania agrees with the approach of the Selected Remedy, it has not concurred with this Record of Decision.

ASSESSMENT OF THE SITE

Pursuant to duly delegated authority, I hereby determine pursuant to Section 106 of CERCLA, 42 U.S.C. º 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 the public, health, welfare, or environment.

DESCRIPTION OF SELECTED REMEDY

The selected remedy described below is the only planned action for the Site. This selected remedy addresses on-site ground water contamination with natural containment through institutional controls; natural attenuation and existing site specific hydrogeologic conditions in conjunction with long term monitoring; continued existing leachate management system repair, operation and maintenance; and repairs to the existing landfill caps.

The selected remedy includes the following major components:

1.) Institutional Controls, including title restrictions, restrictive covenants, etc. to prevent future consumption of on-site ground water, restrict future development at the Site and limit future earth moving activities at the Site;

2.) Long-term Monitoring, including installation of a sentinel monitoring well cluster, sampling of residential wells, on-site monitoring wells, aquatic habitat and combustible gases;

3.) Leachate Management System Operation & Maintenance; and

4.) Cap Repair and Maintenance, to include, a minimum 1 foot in final cover thickness on the eastern landfill and non-forested portions of the western landfill. The eastern landfill and non-forested portions of Western Landfill will be maintained as wildflower/grass meadow (mowed once per year). Forested portions of western landfill will remain and be maintained.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment and is cost effective. EPA believes that the selected remedy will comply with all Federal and State requirements that are legally applicable or relevent and appropriate to the remedial action with the exception of the Commonwealth of Pennsylvania's requirements for closure of municipal waste landfills. Therefore, in accordance with 40 C.F.R. º 300.430(e)(9)(B), I hereby waive the provisions of 25 PA Code º 273 on the basis that EPA will achieve an Equivalent Standard of Performance in the protection of human health and the environment by the implementation of the Selected Remedy. The selected remedy utilizes a permanent solution to the maximum extent practicable and satisfies the statutory preference for a remedy that employs treatment that reduces toxicity, mobility, or volume.

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

<IMG SRC 97058B>

BERKS LANDFILL SUPERFUND SITE
SPRING TOWNSHIP, BERKS COUNTY, PENNSYLVANIA

RECORD OF DECISION
DECISION SUMMARY

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BERKS LANDFILL SUPERFUND SITE

DECISION SUMMARY

I. SITE NAME, LOCATION AND DESCRIPTION

The Berks Landfill Superfund Site is located in Spring Township, Berks County, Pennsylvania, approximately 2.3 miles southwest of the Borough of Sinking Spring and approximately 7 miles southwest of the City of Reading. Figure 1 (Figures are located in Appendix A) presents the US Geologic Survey ("USGS") Sinking Spring quadrangle map showing the Site location. The coordinates for the approximate center of the Site are 405 17'41" North latitude and 76502'06" West longitude.

The Site consists of two closed municipal refuse landfills and associated features located south of Wheatfield Road, the areal extent of contamination which includes the ground water plume and property necessary to implement the Selected Remedy set forth below. The two landfills are referred to as the eastern landfill, which covers an area of approximately 47 acres, and the western landfill, which covers an area of approximately 19 acres. There are two other disposal areas associated with the Site which received mostly municipal waste when access to the eastern and western landfills was impossible due to inclement weather. The northern disposal area is located north of the access road at the toe of the eastern landfill. The area behind the equipment building is located just south of the Zerbe Auction House. There is an existing leachate management system at the Site which consists of a series of collection pipes at the toe of the eastern landfill and a small portion of the western landfill. Conveyance piping and manholes carry leachate to three hyphalon lined gravity fed leachate collection lagoons. Leachate is then pumped from these lagoons by an automated dual pump station to the Sinking Spring Borough Publicly Operated Treatment Works. Figure 2 shows the main Site features.

Cover on the western landfill consists mainly of forested/maturing shrub tree areas except for the crown, or south central portion of the landfill which is covered with a meadow type area. Cover on the eastern landfill, northern disposal area and area behind the equipment building consists primarily of grasses, shrubs and small trees. The eastern landfill and the lagoon area is fenced.

An unnamed tributary to Cacoosing Creek, and its associated wetlands and riparian zone, approximately parallels Wheatfield Road north of the landfills and flows in an east to west direction. This creek, which will be hereinafter referred to as the Cacoosing Creek tributary, is a perennial stream which originates east of the Site. Surface water is carried from the Site by the southern, central and western drainageways. These drainageways discharge to the Cacoosing Creek Tributary. A Spring Township sewer main is aligned adjacent to the Cacoosing Creek tributary channel.

Two private residences and a business are located along Wheatfield Road within the Site boundary. The Property north of Wheatfield Road is primarily undeveloped and wooded along a fairly steep southern facing slope on an east-west trending ridge. Former mine workings are

located just north of Wheatfield Road within this wooded area and east of the Site.

II. SITE HISTORY AND ENFORCEMENT ACTIVITY

Landfilling of predominantly municipal refuse and demolition debris began in the 1950's and continued through 1986 on the eastern landfill. From approximately 1975 to 1986, landfilling was conducted under a Pennsylvania Department of Environmental Resources ("PADER") permit. The southeastern portion of the eastern landfill is referred to as the Wood Dump due to the large amount of trees, stumps, and other construction debris placed in this section of the landfill. As reported by former landfill employees, industrial wastes including hazardous substances were also disposed of at the Wood Dump. The northeastern portion of the eastern landfill covers the abandoned Wheatfield Mine Workings which, as reported by former landfill employees, were filled with low permeability soil prior to landfilling. The eastern landfill was closed in 1986, as required by PADER, and covered with a vegetated soil cap. The soil cap consists of a compacted low permeability graded soil cover with erosion control side slope benches and rip-rap lined channels to convey surface water off of the landfill.

The western landfill, according to former landfill employees, received predominantly municipal refuse. Landfilling activities occurred there from the 1960's until the mid 1970's. The western landfill, in 1979 and 1980, also received some industrial waste and alkali sludges. The sludges were stabilized and disposed of in the south central portion of the landfill, in an area referred to as the Stabatrol area. Following closure during the 1970's, the western landfill was covered with a graded, low permeability soil cap. The side slopes of the landfill, which were closed in the early to mid 1970's, are currently covered by deciduous woodlands with trees estimated to be up to 20 years in age. The crown of the landfill in the Stabatrol area, which was capped in 1980, is currently covered with grass and brush vegetation.

Landfilling at the Site ceased in 1986 and the landfill was closed in accordance with a consent order issued by PADER. Response systems constructed at the Site during landfill operations or during landfill closure include the following: 1) a compacted low permeability soil liner beneath the permitted portion of the eastern landfill; 2) a leachate collection system; 3) three hyphalon lined leachate storage lagoons and one low permeability soil lined lagoon for additional storage capacity; and, 4) a graded low permeability soil cap over each landfill (See Figure 2.). Sampling of on-Site monitoring wells installed prior to and during closure of the eastern landfill showed that on-Site ground water was contaminated with volatile organic chemical ("VOCS") including, benzene, vinyl chloride, trichloroethene, 1,2 dichloroethene and 1,1 dichloroethene.

On June 24, 1988, the United States Environmental Protection Agency ("US EPA") proposed the Site for inclusion on the Comprehensive Environmental Response, Cleanup and Liability Act ("CERCLA") National Priorities List ("NPL"), and it was formally included on the NPL on October 2, 1989.

On August 7, 1990 US EPA issued a Unilateral Order for Removal Action (Docket No. III-90-39-D-C) ("Order) to potentially responsible parties ("PRPs") at the Site. The Order required the PRPs to implement the following removal actions, which have been completed: construction of an 8-foot high chain-link security fence and locking gates surrounding the eastern landfill and lined leachate collection lagoons; repairs to approximately 1.5 acres of the existing landfill cap on the eastern landfill which were damaged by erosion; installation, operation, and maintenance of an automatic leachate management system which pumps leachate from the hyphalon lined lagoons to the Spring Township sewerage system. The operation and maintenance of the leachate management system will continue until a final remedy for the Site is selected and implemented.

On July 5, 1991, the US EPA and Sonoco Fibre Drum, Inc., Carpenter Technology Corporation, and The Glidden Company ("Respondents) entered into an Administrative Order on Consent ("Consent Order"), Docket No. III-90-32-DC, to conduct a Remedial Investigation/Feasibility Study ("RI/FS") at the Site. Under the Consent Order, the Respondents submitted a RI/FS Work Plan after receiving notice of contractor acceptance from US EPA. US EPA had approved Golder Associates Inc. ("Golder") as the contractor to prepare and implement the RI/FS Work Plan (Work Plan). US EPA approved the Work Plan on June 8, 1992, and work outlined within the Work Plan proceeded. The major objective of the RI for the Berks Landfill Site was to provide an assessment of the nature and extent of chemical constituents for the various environmental media. On November 27, 1996, US EPA approved a baseline risk assessment for the Site prepared by the Respondents, the findings of which are described below. The Respondents submitted a feasibility study ("FS) which evaluated various remedial alternatives to address risks posed by the Site in February, 1997; US EPA approved the FS, contingent upon inclusion of US EPA's comment letter on April 24, 1997.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Community interest and concern about the Berks Landfill Site has been steady throughout US EPA's involvement. US EPA held a public availability session on January 29, 1990 at the Wilson Southern Jr. High School to introduce US EPA staff, review the Superfund process and update the community on upcoming Site activities. US EPA issued a Fact Sheet in August 1990 discussing the Superfund process and removal actions planned by US EPA to address conditions at the Site which US EPA felt posed an immediate risk to human health while Site-wide long-term remedial actions were contemplated.

In January 1991 US EPA issued a Fact Sheet discussing the removal actions taken at the Site and upcoming remedial actions to be taken to identify the nature and extent of contaminants at the Site.

On August 28, 1991 US EPA completed a Community Relations Plan for the Site. The Plan highlighted issues, concerns and interests of the community located near the Site which were raised during community interviews.

In July, 1992 US EPA issued a Fact Sheet announcing the approval of the Remedial Investigation/Feasibility Study Work Plan. The July 1992 Fact Sheet briefly outlined the work to be performed during the RI/FS and gave a general time line for completion of the work. The July 1992 Fact Sheet also announced a public meeting which was held on July 27, 1992 at the Southern Junior High School. Questions regarding the RI/FS work plan and a draft Community Relations Plan were discussed at the meeting.

In July 1996 US EPA issued a Fact Sheet to keep the community informed of Site related activities. The Fact Sheet briefly explained the findings of the RI, the Superfund Process, and the nature and extent of Site contamination.

Pursuant to CERCLA º 113(k)(2)(B)(I)-(v), US EPA released for public comment the final RI/FS reports and the Proposed Remedial Action Plan setting forth US EPA's preferred alternative for the Berks Landfill Site on April 25, 1997. US EPA made these documents available to the public in the Administrative Record located at the US EPA Docket Room in Region III's Philadelphia office, and at the Sinking Spring Public Library, Sinking Spring, Pennsylvania. The notice of availability of these documents was published in the Reading Eagle and the Merchandiser on April 25, 1997 and May 14, 1997, respectively.

A public comment period on the documents was held from April 25, 1997 to May 26, 1997. In May, 1997 US EPA issued a Fact Sheet announcing the availability of the Proposed Remedial Action plan

and public meeting. The May 1997 Fact Sheet discussed US EPA's Preferred Alternative, as well as other alternatives evaluated by US EPA and solicited comments from all interested parties. In addition, US EPA conducted a public meeting on May 14, 1997. At this meeting, US EPA representatives answered questions about conditions at the Site and the remedial alternatives under consideration.

The responses to all comments received during the public comment periods are included in the Responsiveness Summary, which is Appendix D of this Record of Decision ("ROD").

This decision document presents the selected remedial action for the Berks Landfill Site, Spring Township, Berks County, Pennsylvania, 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.

IV. SCOPE AND ROLE OF THE RESPONSE ACTION WITH SITE STRATEGY

The Selected Remedy described in this Record of Decision will comprehensively address the threats posed by the release of hazardous substances at the Site. The threats posed by the Site are due to VOC and metals contamination in on-Site ground water.

The preamble to the National Oil and Hazardous Substances Contingency Plan ("NCP") establishes that US EPA can at its discretion as the lead Agency at a Site move the point of compliance away from a waste management area based on Site-specific conditions. However, this alternate point of compliance must also be protective of human health and the environment. The preamble also states that "institutional controls...should not be used as the primary remedy when more active remediation measures...provide greater reliability in the future." US EPA is using its discretion based on Site-specific conditions established in the Remedial Investigation to establish the point of compliance for ground water at the Site as the western, eastern and southern Site property boundaries and Wheatfield Road to the north. This point of compliance for ground water will be protective of human health and the environment.

The concentrations of contaminants in the ground water at the point of compliance do not exceed Maximum Contaminant Levels ("MCLs") which are enforceable, health-based drinking water standards established under the Safe Drinking Water Act ("SDWA"), 42 U.S.C. °° 300f to 300j-26, or non-zero Maximum Contaminant Level Goals ("MCLGs"), compliance with which is set forth in CERCLA.

The primary objectives of US EPA's remedial action at the Site are to prohibit future consumption of on-Site ground water at the point of compliance; long-term monitoring to ensure that MCLs, or MCLGs, continue to be maintained at the point of compliance; continued effective collection of Site leachate; repair and maintenance of the existing landfill caps.

Natural containment through institutional controls, natural attenuation and existing Site-specific hydrogeologic conditions in conjunction with long-term monitoring is preferred as the primary ground water remedy at the point of compliance after having been evaluated against more active remediation methods which will provide no greater long-term reliability.

V. SUMMARY OF SITE CHARACTERISTICS AND EXTENT OF CONTAMINATION

A. Site Characteristics

1. Topography

Topographically high ridges in the Site area range between 700 and 800 feet above Mean Sea Level ("MSL"). Local ridges include Colonial Hills approximately one mile to the southwest Mohn's Hill, approximately 3/4 of a mile to the south, and Laurel Ridge just north of Gelsinger Road. Cushion Peak, the highest point in the Sinking Spring Quadrangle with an elevation of 1116 feet MSL, is located one mile to the west.

Topography at the Site ranges from approximately 660 feet above MSL to the south on the northern face of Colonial Hills, decreases to approximately 470 feet above MSL along the Cacoosing Creek tributary and rises again to approximately 680 feet above MSL north of the Site. An east-west trending valley crosses the northern half of the Site (See Figures 1. & 2.).

2. Surface Hydrology

The major surface water body at the Site is the Cacoosing Creek tributary which flows from east to west, cutting across the north central portion of the Site at the base of the east-west trending valley. Surface water runoff discharges into drainage patterns and secondary tributaries (southern, southeastern, and western drainageways) to the Cacoosing Creek tributary, which in turn, flows northwestwardly approximately one mile off-Site and joins Cacoosing Creek. Cacoosing Creek then flows in a northerly direction into Tulpehocken Creek, which in turn, joins the Schuylkill River in Reading, about seven miles north of the Site.

Overall, the surface water flow data show that the Cacoosing Creek tributary gains flow (in addition to contributions from drainageways which flow into the Cacoosing Creek tributary) from the eastern edge of the Site to the western edge of the Site, notwithstanding local variations. This gaining flow is attributed to the discharge of shallow groundwater as discussed below.

3. Groundwater Use

Within a three mile radius of the Site approximately 26,495 people utilize either public or private groundwater wells as water supply. Approximately 2,968 people are served by private wells within the same three mile radius.

In the immediate vicinity of the landfill, along Wheatfield Road, water is supplied by private groundwater well systems. The water from two local residential wells is also used for filling in-ground swimming pools. A farm which is located southwest of the Site utilizes groundwater for agricultural purposes (dairy farming). A residential well and a business well are located on-Site.

It should be noted that no contaminants were detected in the five rounds of residential well sampling conducted as part of the remedial investigation on or in the vicinity of the Site at concentrations greater than the applicable Federal Maximum Contaminant Levels.

The Citizens Utilities Water Authority Well No. 23 is the closest public water supply well to the Site. The well is located approximately 1/2 mile east of the Site at the intersection of Grings Hill Road and Wheatfield Road. This well services Grings Hill Estates, Tallowyck, Wheaton Heights, Shiloh Hills, and extended areas of Cumru and Spring Townships. This well is hydrogeologically isolated from the Site.

4. Demography and Land Use

The 1987 estimate by the Bureau of Census for Berks County shows approximately 324,300 persons within Berks County. The highest population densities occur in the larger towns and cities.

The population for Berks County is projected to grow to 362,225 persons by the year 2000.

The 1988 Existing Land Use Map developed for the Berks County Comprehensive Plan designates the majority of the Site for industrial use because the land was previously devoted to landfilling activities. In addition, two residential properties and a business exist at the Site along Wheatfield Road. The areas surrounding the Site are predominantly shown as agricultural/open space and residential areas. Sparse residential properties occur along Wheatfield, Gelsinger, and Chapel Hill Roads in the Site vicinity.

Aerial photographs of the Site also show that the area has historically been forested or farmed with some residential development particularly east of the Site becoming more prevalent within recent years.

5. General Site Geology

The Site is located within the Piedmont Physiographic Province which is characterized by the presence of a system of rift grabens and half grabens, or basins. These features are associated with extensional forces exerted on the continental crust during the early stages of the opening of the Atlantic Ocean during the Mesozoic Era (70 to 240 million years ago). The basins are infilled with Triassic sedimentary sandstones, siltstones and conglomerates. This deposition was accompanied by massive intrusions of Triassic diabase.

The rock strata in the vicinity of the Site are composed of Triassic sandstones, siltstones, mudstones and conglomerates of the Hammer Creek Formation (part of the Newark Group), and Triassic age diabase associated with the Morgantown Sill. Also present are Ordovician age (440 to 505 million years old) phyllites and argillaceous sandstones of the Martinsburg Formation, Cambrian (505 to 570 million years old) sandstones, and limestones of the Millbach Formation and sandstones of the Hardyston Formation. Figure 3 presents a regional geology map and cross-section.

As illustrated by Figure 3 the Triassic diabase outcrop almost entirely encircles the Site with the exception of a small area to the southwest. Along the north edge of the Site is a thin outcropping of Cambrian Millbach limestone and a small, fault-slice of the Ordovician Martinsburg Formation.

The geologic investigation has identified the intrusive diabase mass at surface, which encircles (except for the southwest corner of the Site), and lies beneath the Site as the most important geologic feature at the Site. While the lithologies overlying the diabase at the Site have been identified, they do not influence groundwater flow as significantly as the diabase which hydraulically controls groundwater flow due to its orientation and low permeability. The diabase and its orientation have been identified through regional geologic mapping performed by the U.S. Geological Survey, Golder's surface geology mapping at and in the vicinity of the Site, and subsurface exploration borings performed by Peffer and Golder.

6. Regional Hydrogeology

In the region of the Site, groundwater exists in both the shallow soil mantle overlying the bedrock as well as within the fractured bedrock. Groundwater within the soil mantle overlying bedrock, and the upper weathered bedrock, is under water table conditions and mimics topography very closely. The water table aquifer discharges to surface water bodies (drainageways and Cacoosing Creek tributary). In the deeper aquifer systems, the majority of the flow occurs through the secondary porosity (bedding plane factures, joints and faults) within the rock mass. As reported by Longwill and Wood (1965), groundwater flow within the deeper bedrock is less influenced by the topography and flows under anisotropic conditions

dictated by the strike of bedding.

7. Local Hydrogeology

Consistent with the regional hydrogeology, the Site hydrogeology is characterized by the presence of three flow systems, a water table aquifer which extends to a depth of about 100 feet, a deeper semi-confined flow system which extends to the diabase contact, and an underlying diabase confining unit. The shallow water table aquifer and the deeper semi-confined system, much like the regional system, are topographically controlled. The shallow aquifer system very closely mimics the topographic surface, while the deeper semi-confined system is not as dramatically influenced. The transition between the shallow phreatic system and the deeper semi-confined system is gradational across the Site. These two systems flow northward across the Site toward the Cacoosing Creek tributary. As discussed above, the diabase, which encompasses the Site, acts as a major hydraulic barrier that controls groundwater flow at the Site and prevents downward migration of groundwater from the overlying units. The diabase effectively acts as a confining unit beneath the Site and causes the shallow phreatic and deeper semi-confined groundwater systems to merge and discharge to the Cacoosing Creek tributary system (drainageways and tributary) at the northwestern portion of the Site and west of the Site boundary (See Figures 4. & 5.).

B Nature and Extent of Contamination

1. Soil

Eleven (11) surface soil samples were collected and analyzed from the eastern and western landfills from areas not impacted by leachate during the remedial investigation. Eight (8) samples were collected and analyzed at locations which, based upon visual inspection, had been impacted by leachate seepage. These samples were considered collected at worst-case locations. Also, six soil borings were advanced in the Stabatrol area, and a total of three samples of solid material were collected and analyzed by Toxicity Characteristic Leaching Procedure ("TCLP") for metals. Three background soil samples were collected from locations outside the Site boundary on the landfills.

Figure 6 and Table 1, Table 2 and Table 3 (Tables are located in Appendix B) present the soil and leachate seep sampling locations and a summary of the analysis results, respectively.

The majority of VOCS were detected in the soil samples which were collected at leachate-impacted areas and hence are considered worst-case locations and are not representative of overall Site conditions. In all cases, even the worst case locations, VOCS were detected at concentrations less than 200 parts per billion ("ppb") and in most cases were less than 50 ppb.

Semivolatile organic chemicals ("SVOCs") were detected in background soils as well as leachate, and non-leachate impacted soils mostly at concentrations less than 200 ppb and all SVOCs were detected at mean concentrations of 333 ppb or less.

No pesticide compounds were detected in any of the twenty-two background and on-Site soil samples. Only one PCB, Aroclor-1248, was detected at an estimated concentration of 270 ppb (.27 parts per million ("ppm)) at one location, which is an order of magnitude less than the US EPA cleanup level of 1 ppm.

Metal detections, as expected, were frequent. Background and non-leachate impacted soils showed very similar concentrations, while leachate impacted soil showed higher concentrations. However, except for selenium, the metals detected in both background and on-Site soil samples were within the range of typical background soils for the eastern United States.

2. Surface Water

Surface water samples were collected from eleven locations along the Cacoosing Creek tributary and the first order streams (drainageways) which drain through or adjacent to the Site. Three sample locations were located upstream of the Site and eight sample locations were located downstream of the Site.

In addition, surface water samples were collected as part of the benthic macroinvertebrate survey conducted in May 1992, and were analyzed for conventional water quality parameters: alkalinity, hardness, and total suspended solids, as well as field parameters: pH, temperature, specific conductance, and dissolved oxygen.

A summary of the surface water sample locations and analyses results for detected constituents are presented in Figure 7 and Table 4 and Table 5, respectively.

VOCs, SVOCs, pesticides, and PCBs were not detected in either upstream (background) or downstream (on-Site) surface water samples collected during the RI. Cyanide was detected in one of eleven surface water samples. Because cyanide was not detected in any other media at the Site (except for one sample in groundwater) and because of its infrequent detection in surface water, cyanide is believed to be an anomaly and not a concern in surface water.

Seven metals (barium, calcium iron, magnesium, manganese, potassium, and sodium) were detected in surface water at both upstream and downstream locations. Copper and selenium were only detected in upstream samples and aluminum and vanadium were only detected in downstream samples. All metals were detected at concentrations less than the Federal and Pennsylvania AWQS, except for iron and manganese. Both upstream and downstream detections of iron exceeded the Federal AWQS and are attributable to naturally occurring magnetite which was historically mined on-Site. Both upstream and downstream concentrations of manganese exceeded the Federal AWQS, however, dissolved manganese was also detected in background groundwater at concentrations above the AWQS strongly suggesting that its presence is not Site related.

3. Sediment

Sediment samples were collected from eleven locations along the Cacoosing Creek tributary and the drainageways which ran through or adjacent to the Site (Set Figure 7.). Four sample locations are located upstream of the Site and eight sample locations are located downstream of the Site.

US EPA, United States Fish and Wildlife Service ("US FWS"), and Golder jointly located field sampling locations for sediment. Samples collected from these locations were analyzed for TCL and SVOC and target analyte list ("TAL") metals. In addition, laboratory analyses of grain size distribution and total organic carbon (TOC) were performed on each of the samples. Field parameters (pH, temperature, specific conductance) were also monitored during sampling. A summary of the sediment sample results for detected constituents is presented in Table 6 and Table 7.

No VOCs, pesticides, or PCBs were detected in sediment during the RI.

The SVOCs detected in sediment were polynuclear aromatic hydrocarbons ("PAHs") and were in most cases detected at higher concentrations in upstream samples than in downstream samples. All PAH concentrations in sediment are less than the corresponding most conservative environmental effects range low value ("ER-L") established by the National Oceanic and

Atmospheric Administration ("NOAA"). An ER-L value defines the concentration at the low-end of the range in which effects were observed.

Sixteen metals were detected in both upstream and downstream sediment samples at similar concentrations. Two metals, cadmium, and mercury were only detected in downstream samples. Only mercury (in two samples) and nickel (in one sample) were detected at concentrations above the most conservative ER-L value. However, the results for both of these metals are less than the effects range midway ("ER-M") values. An ER-M concentration defines a point midway in the range of reported values associated with biological effects.

The sediment data were normalized for both TOC and particle size. The normalized data support the trend that in most cases, downstream SVOC and metal concentrations are comparable to and/or are less than the upstream concentrations. In every case (except for cadmium, calcium, magnesium, mercury, and potassium), the normalized upstream metal concentrations are higher than the normalized downstream metal concentrations. Of the PAH compounds detected, only phenanthrene was detected at higher normalized downstream concentrations than the upstream concentration.

4. Air Monitoring

The remedial investigation air screening program addressed ambient air, soil gas, and passive vents. In addition to the air screening, a methane migration survey was conducted around the perimeter of each of the landfills. Samples were collected from soil gas, passive vents, and ambient air (See Figure 8.).

Methane Migration Survey

Methane was detected at concentrations less than or equal to six percent of the lower explosive limit ("LEL") at the eastern landfill perimeter except at four locations where methane was detected at 100 percent LEL. These four locations are at monitoring point 2 (southeast corner of the eastern landfill), monitoring points 18 and 20 (between the eastern landfill and the lagoons), and monitoring point 23A (southwest corner of the eastern landfill). Additional on-Site sampling conducted radially outward from each of these four monitoring points detected readings of methane at five percent or less LEL. All methane readings along the perimeter of the western landfill were less than 6 percent LEL.

Six methane monitoring points were sampled around an on-Site residence. Methane readings were not detected in this area.

Methane was either not detected or detected at levels less than six percent of the LEL at the perimeter of the eastern and western landfills. The only exceptions were three small areas around the perimeter of the eastern landfill exhibited methane readings at 100% LEL (southeast corner, southwest corner, and between the landfill and lined leachate collection lagoons). At each of these three areas, sampling radially away from the landfill showed levels less than six percent LEL. All methane readings along the perimeter of the western landfill were less than five percent LEL.

Soil Gas Sampling

Soil gas sample analyses within the Stabatrol area on the western landfill detected aromatic hydrocarbons, but no chlorinated VOCS. In addition, soil gas sample analyses from the Wood Dump detected both aromatic hydrocarbons as well as chlorinated VOCS and CFCs. These data are consistent with the results of groundwater sample analyses which, as will be discussed below, detected aromatic hydrocarbons in wells in the vicinity of the crown of the western

landfill and chlorinated VOCS in wells in the vicinity of the Wood Dump on the eastern landfill.

The presence of low concentration CFCs in sample WDSG8B may be attributed to past disposal of freon containers, aerosol cans, or other CFC containing canisters. Only trace levels of xylenes were detected in the on-Site residence soil gas sample; the source of which is unknown. In addition, xylene was not detected in the on-Site residential well (a shallow groundwater well) or other nearby shallow groundwater wells.

Passive Vent Sampling

Samples from one passive vent on the western landfill and two passive vents on the eastern landfill were sampled and analyzed during the remedial investigation. The VOCS detected from each vent were similar and consisted of aromatic hydrocarbons, chlorinated VOCS, and CFCs. In each case, over seventy-five percent of the VOCS detected (excluding methane and NMOC) were composed of toluene, ethylbenzene, and total xylenes. The passive vent on the western landfill exhibited the lowest VOC levels.

Hydrogen sulfide was detected in the two passive vents on the eastern landfill but not in the western landfill passive vent. Methane and NMOCs were detected at each of the three passive vents with the highest levels (570,000 ppmv and 1,600 ppmv, respectively) detected in passive vent ELPV13 and the lowest levels (90,000 ppmv and 37 ppmv, respectively) were detected in the western landfill passive vent. The lower methane and NMOC levels detected in the western landfill passive vent are to be expected because municipal waste landfilling activities ceased approximately 10 years before municipal waste landfilling ceased on the eastern landfill.

Ambient Air Sampling

A total of nine 8-hour and 24-hour composite ambient air samples were collected to assess the potential impacts from the lined leachate collection lagoons and a leachate seep and also to assess the potential for off-Site migration of VOCS from the Site. No VOCS were detected at the leachate lagoons and only trace levels of toluene were detected at the leachate seepage location.

No VOCS were detected in the the ambient air samples collected at the eastern landfill in the vicinity of the Wood Dump. Only trace levels of one VOC were detected (2-hexanone) on the western landfill. This VOC was not detected in any other media and therefore is considered an anomaly. Only trace levels of acetone, toluene, and xylenes were detected in the three samples collected in the vicinity of the on-Site residence.

5. Leachate

Leachate seepage samples were collected in apparent worst-case locations. Seven leachate seepage samples and one leachate lagoon sample were analyzed.

Figure 6 shows the leachate seep sampling locations and Table 8 provides a summary of the leachate sampling analysis results.

While several VOCS were detected in leachate, most of the concentrations were less than 25 ug/l. Toluene and total xylenes were the only VOCS detected at concentrations slightly higher than the aquatic life AWQS. In general, SVOCs were also detected in leachate at low concentrations less than 20 ug/l. Phenol was the only SVOC to be detected at a concentration above the aquatic life AWQS. Pesticides and PCBs were not detected in landfill leachate.

Seventeen metals were detected in leachate. Four of these metals (iron, cadmium, copper, and

lead) were detected at concentrations above the aquatic life AWQS. It is notable that total and/or dissolved concentrations of iron, cadmium, copper, and lead were detected at higher concentrations in background groundwater samples above the aquatic life AWQS. Furthermore, significant biological populations for which the AWQS were derived (e.g., fish) are not intended to inhabit, nor should they inhabit the leachate seeps and leachate holding lagoons.

6. Leachate Collection/Management System

Leachate from the landfils is collected and conveyed through underground pipes and manholes to a series of three lined leachate collection lagoons (See Figure 2.). Under the 1990 US EPA removal order the PRPs have enhanced the system by which the leachate is conveyed from the last of the three lined leachate collection lagoons to a township sewer main by installing new piping, pumps, controls, and various safety mechanisms, such as an auto-dialer, if electrical or mechanical problems arise. The following paragraphs discuss further details with respect to the leachate collection and management system.

Drawings show piping interconnections between manholes identified during the remedial investigation Site reconnaissance. These interconnections are consistent with observations of the manholes and piping configurations made during the RI. The drawings and RI inspection records indicate that four manholes art located at the toe of the slope of the eastern landfill and were installed to convey the leachate to a junction manhole located along the Site access road. This manhole also is believed to interconnect piping from the manhole located at the toe of the slope of the western landfill. The western manhole appears to be collecting leachate from a perimeter toe drain on the western landfill. The extent of the toe drain is unknown. Leachate is conveyed from the western manhole via piping which is believed to pass under the southernmost lagoon, which is currently filled with freshwater, and interconnects with the junction manhole. Leachate is then conveyed into the first of three hyphalon lined leachate collection lagoons. Leachate passes by gravity flow between the hyphalon lined lagoons and then is pumped via an on-Site leachate management pumping station to the POTW manhole. As mentioned above, the pumping station was installed as part of the removal action activities at the Site.

7. Cap Conditions

As previously discussed, landfill caps were constructed on both the eastern and western landfills after closure. The materials used for capping of the landfills are believed to have included on-Site borrow from excavations prior to landfilling, borrow from the southwest corner of the Site, and borrow from the area immediately east of the southeast corner of the Site.

The existing condition of the landfill caps were investigated as part of the remedial investigation. Initially, the landfill cap thickness was recorded at seventeen points on the eastern landfill and six points on the western landfill. The landfill cap thickness was determined by both hand excavation and power augering. Thickness was estimated to be the depth at which refuse or refusal was first encountered. Cap thickness data for the western landfill was also obtained from nine borings used to evaluate the extent of refuse and to locate the Stabatrol area.

In-situ density and moisture content were measured using a Troxler nuclear density gauge at four points on the eastern landfill and two points on the western landfill. Soil samples were also collected at these six points for geotechnical laboratory testing.

During Site reconnaissance conducted as part of the remedial investigation, two cracks in the landfill cap were observed near the crest of the northern slope on the eastern landfill. These observations were reported to US EPA. In order to determine if these cracks could be caused by settlements or slope instability, six settlement plates were installed at three locations with a

settlement plate installed on both sides of the cracks at each location.

After considering the results of the initial cap investigation, US EPA decided that additional information was needed to better describe the in-situ characteristics of the landfill caps and the geotechnical properties of the cap soil. The additional information would also be needed for developing and evaluating landfill capping alternatives during the Feasibility Study and to substantiate the use, possibly with enhancement, of the existing landfill caps as part of a permanent capping remedy.

In order to accomplish these objectives, the cap investigation program was expanded and designed to collect the following information:

Twenty-four additional sample locations on the eastern landfill and six additional sampling locations on the western landfill were included in the investigation. Samples could not be collected on the northern portion of the western landfill due to the extremely thick vegetative growth which limited access.

The following field tests were performed at each of the thirty additional sample locations: a power auger was used to estimate the thickness of the existing cap material; and a nuclear density gauge was used to determine the field density and moisture content of the existing cap material.

Nuclear density gauge readings could not be made at seven of the thirty points due to obstructions such as gravel and cobbles preventing the proper setting of the nuclear density probes or to insufficient cap thickness. Soil samples were obtained at twenty-seven of the thirty points for geotechnical laboratory testing. Samples at three locations were not collected for geotechnical testing due to insufficient thickness of the cap to yield sufficient sample volume.

Also based on an evaluation of the grain size distribution and Atterberg Limits test results of the initial cap investigation, and in conjunction with US EPA and its oversight contractor, three additional sample locations representing the fine, medium, and coarse gradation of the samples tested were selected for ftirther testing. An additional soil sample was collected at each of these three selected locations for the following geotechnical laboratory tests: grain size distribution and Atterberg Limits (to confirm the similarity with the original sample); Standard Proctor compaction for moisture-density relationship, and, permeability.

The Standard Proctor compaction tests were performed to establish the moisture-density relationships that would be expected from the range of cap materials encountered. Two permeability tests were run for each sample, remolded to 90 and 95 percent of their maximum Standard Proctor dry density at moisture contents approximately 3% wet of optimum. These densities correspond to densities easily obtainable through conventional field soil compaction techniques.

Evaluations of the landfill cap thickness indicate that large areas of the eastern landfill have a cap thickness of 24 inches or greater. The southern and central portions of the western landfill exhibit cap thicknesses also greater than 24 inches in five of seven samples. More than half of the Site is covered with cap material exceeding 12 inches in thickness although there remain large areas that have limited cap thickness. In addition, a thin lens (an approximately 20 foot by 50 foot area of exposed refuse on the steep northern slope of the eastern portion of the eastern landfill) was identified during the remedial investigation Site reconnaissance. (See Figure 10.)

Both landfill caps exhibit in place densities of about 89% to 90% of the Standard Proctor

maximum dry density. This suggests that the cap material was compacted when put in place. The grain size distribution for the cap materials indicates that the caps are constructed of material containing about 38% to 43% clay or silt size particles. The eastern landfill cap exhibits the higher clay percentage. The clay/silt portion of the cap material is of low to moderate plasticity which would be capable of achieving low permeabilities and have a low to moderate susceptibility to volume change due to changes in moisture content. The cap investigation indicated that the in-situ permeability of the existing landfill caps is in the 10 -7 cm/sec to 10 -8 cm/sec range. However, local variations in the in place density may result in a few localized higher permeability zones in the 10 -5 cm/sec range. Overall, the existing cap material is of the quality and character appropriate for landfill caps.

Based on the evaluation of the settlement crack survey data, some landfill settlement is occurring, as would be expected. The type of settlement is typical of conditions at clay capped landfills where invariably some differential settlement of refuse occurs causing tension cracks in the clay to form.

The eastern landfill is predominantly covered with grasses, shrubs and small trees which control erosion, although them are some bare areas. Bushes, shrubs and small trees are scattered over the landfill in isolated locations. The side slopes of the western landfill are covered by deciduous woodlands with trees estimated to be up to and possibly older than 20 years in age. The mature nature of these deciduous woodlands suggest well established root systems in the existing cap as well as considerable cap thickness to support its growth.

8. Groundwater

Groundwater samples were collected from a total of fifty locations, including eight on-Site and off-Site background locations (monitoring and residential wells), thirty-four on-Site downgradient locations, and eight off-Site residential wells. Based on the hydraulic gradients and direction of groundwater flow, the following monitoring wells are identified as being upgradient of potential Site impacts: G-2, G-3, G-7, G-8, G-10.

Figure 9 and Table 9, Table 10, Table 11 provide the background, monitoring well and residential well locations and a summary of the detected constituents in background, on-Site (downgradient), and off-Site residential well groundwater, respectively.

Except for low concentrations of 1,2-dichloroedme, chloromethane, and bromomethane, VOCS were not detected in background monitoring wells during the RI. Of the twenty VOCS detected in on-Site wells, sixteen VOCS were detected at concentrations less than 40 ug/l. The four VOCS which were detected at higher concentrations (total xylenes, trichloroethene, total-1,2-dichloroethene, and vinyl chloride) were detected in only three monitoring wells, C-3D, MP-18S, and MP-16. Total 1,2 dichloroethene was detected at 3,700 ppb, trichloroethene was detected at 2,000 ppb and vinyl chloride was detected at 370 ppb in well C-3D. Total 1,2 dichloroethene was detected at 2,200 parts per billion ("ppb"), trichloroethene was detected at 3,100 and vinyl chloride was detected at 180 ppb in well MP-18S. Total xylenes was detected at 110 ppb in well MP-16. These wells exhibited the highest VOC concentrations on-Site which are believed to be the result of localized rather than Site-wide conditions.

Only five VOCS (benzene, vinyl chloride, 1,1-dichloroethene, total 1,2-dichloroethene, and trichloroethene) were detected at concentrations above the Federal Maximum Contaminant Level ("MCLs") in on-Site downgradient wells. The further downgradient on-Site VOC concentrations were significantly less than those detected on or immediately adjacent to the landfill and, except for one location (G-13) did not exceed tho MCLs.

Except for bis(2-ethylhexyl)phthalate, no SVOCs were detected at concentrations above the

MCLs. However, the data suggest that bis(2-ethylhexyl)phthalate is not Site related as it was not detected above blank levels during the remedial investigation. Pesticides and PCBs were not detected in groundwater.

Metals were detected in background and on-Site monitoring wells, and in off-Site residential wells. A statistical comparison of background and on-Site metal concentrations indicate that ome metals are attributable to background conditions and some metals are Site-related. The ubiquitous nature of metal detections was not surprising given the highly mineralized nature of the native bedrock at the Site. Four total metals were detected above applicable MCLs in on-Site wells and included beryllium, cadmium, lead, and nickel. Three of these four metals (beryllium, cadmium, and lead) were also detected in background groundwater samples at concentrations greater than the MCL. Only dissolved antimony concentrations exceeded Federal MCLs on-Site.

Only trace levels of VOCS were detected in four of eight off-Site residential wells (excluding the upgradient residences). All of the reported VOC concentrations were less than the MCLs. It should be noted that no contaminants were detected in the five rounds of residential well sampling conducted as part of the remedial investigation on or in the vicinity of the Site at concentrations greater than the applicable MCLs.

VI. SUMMARY OF SITE RISKS

The Respondents prepared a Baseline Risk Assessment for the Site 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 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 entire July 1996 Baseline Risk Assessment and the November 6, 1996 Addendum letter can be found in the Administrative Record. The Human Health Baseline Risk Assessment is composed of four parts, including Selection of Potential Chemicals of Concern (or, Hazard Evaluation); Exposure Assessment, Toxicity Assessment and Risk Characterization.

A. Human Health Risk Evaluation

1. Selection of Chemicals of Potential Concern

Numerous chemicals, including VOCS, semivolatiles, metals, and PAHs were detected in the environmental media (groundwater, surface water, air, soil, sediment, leachate and air) sampled during the Remedial Investigation. Although many of the detected substances were found not to contribute significantly to overall public health risks, the risk assessment considered risks from all detected chemicals (i.e. all chemicals were considered of potential concern). The complete rational for selection and listing of contaminants of potential concern can be found in the July 1996 Baseline Risk Assessment a copy of which is in the Administrative Record for the Site.

Groundwater

The following chemical constituents were selected as contaminants of potential concern "COPCs") for the groundwater medium:

Background Groundwater	On-Site Groundwater	
Aluminum	Aluminum	Benzene

Arsenic	Arsenic	Carbon Disulfide
Beryllium	Barium	Chlorobenzene
Cadmium	Beryllium	Chloromethane
Copper	Cadmium	1,4-Dichlorobenzene
Lead	Copper	1,1-Dichloroethane
Manganese	Lead	1,2-Dichloroethane
Nickel	Manganese	1,1-Dichloroethene
Vanadium	Vanadium	Total- 1,2-Dichloroethene
		Hexachloroethane
		Trichloroethene
		Vinyl Chloride

Off-Site Residential Groundwater

Arsenic
Chloroform
1,2-Dichloroethane
1,1,2-Trichloroethane

Surface Soil

The following compounds were selected as COPCs for the surface soil medium:

Background Soil	On-Site Soil
Beryllium	Arsenic
	Beryllium
	Manganese
	Benzo(a)pyrene

Surface Water

None of the detected chemical constituents in surface water exceeded the calculated risk-based screening concentrations. Therefore, COPCs were not selected for the surface water medium at the Site.

Sediment

The following chemicals were selected as COPCs for the sediment medium:

Background Sediment	On-Site Sediment
Arsenic	Arsenic
Beryllium	Beryllium
Manganese	Manganese

Leachate

No COPCs were selected for the leachate lagoon water or leachate seep water at the Site because the detected chemicals in these media do not pose potential health risks.

Air

The following constituents detected in passive gas vents were selected as COPCs for the air medium:

Benzene	Trichloroethene
Chlorobenzene	Vinyl Chloride
Chloroethane	Total Xylenes
Ethylbenzene	Dichlorodifluoromethane
Hydrogen Sulfide	1,2,4-Trimethylbenzene
Toluene	1,3,5-Trimethylbenzene

These COPCs were selected for ambient air in order to perform a very conservative assessment of potential risks from exposure to airborne chemicals both on-Site and downwind of the Berks Landfill. It should also be emphasized that none of the chemicals detected in ambient air, either on-Site or at the property boundary, exceed Agency screening levels. Potential receptors are also not expected to inhale pure landfill gas at the Site.

2. 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). There are three primary routes through which individuals may be exposed to site related contaminants: incidental ingestion, inhalation and dermal contact.

Receptors can be either directly or indirectly exposed to site related contaminants via the environmental media addressed in the Remedial Investigation - groundwater, surface water, air, soil, sediment, leachate and air. Exposure routes involved include dermal contact, ingestion, and/or inhalation.

Adult residents are assumed to ingest 2 liters of water per day, 350 days per year, over a 30-year exposure duration. Child residents are assumed to ingest 1 liter of water per day, 350 days per year for six (6) years. Bodyweights, are specified as 70 kg for adults and 15 kg for children.

Inhalation exposures during showering are estimated using modeling techniques. The modeling techniques account for inhalation during showering for adults as well as after the shower while the receptor remains in the room. Dermal exposures during bathing for children are estimated assuming total body contact for .2 hours per day, 350 days per year for six years.

Carcinogenic risks are calculated as an incremental lifetime risk, and therefore incorporate terms to represent the exposure duration (years) over the course of a lifetime (70 years, or 25,550 days). Noncarcinogenic risks are calculated using the concept of an average annual exposure.

The following discusses the potential human exposure routes at the Site which were evaluated in the Baseline Risk Assessment.

a. Use of groundwater by an off-Site resident under both current and future land use scenarios downgradient of the Site. Potential exposure is assumed to be via ingestion of groundwater, dermal contact with groundwater, and inhalation of vapors from groundwater while showering.

b. Use of groundwater downgmdient of the landfills by an on-Site resident at the Nein property under a hypothetical future use scenario. Potential exposure is assumed to be

via ingestion of groundwater, dermal contact with groundwater, and inhalation of vapors from groundwater while showering.

c. Direct contact with surface soil by a child trespasser and a periodic maintenance worker at the Site. Potential exposure for the on-Site child trespasser is assumed to be via incidental ingestion of, and dermal contact with soil. These pathways are assumed for both the current and future land use scenarios. Potential exposure for an on-Site future maintenance worker is assumed to be via incidental ingestion and dermal contact.

d. Potential exposures to constituents in the surface water, sediments, leachate lagoon water, and leachate seeps. As stated above, no COPCs were identified for surface water, leachate lagoon water, or leachate seep water. Consequently, exposure pathways for these media were not evaluated.

e. Potential exposures to vapor phase chemicals from leachate lagoon water, leachate seep water and passive gas vents by an on-Site child trespasser, on-Site maintenance worker, on-Site resident, and off-Site resident in the vicinity of the landfill. Potential exposures to the on-Site child trespasser (current and future scenarios), on-Site periodic maintenance worker (future scenario), on-Site resident (future scenario), and off-Site resident in the vicinity of the landfill (current and future scenarios) were evaluated.

There are currently no plans to develop the Site for future residential use, but because there are currently no prohibitions in place, a future residential use scenario was considered in the risk assessment

3. Toxicity Assessment

The toxicity assessment characterizes the inherent toxicity of a compound and helps to identify the potential health hazard associated with exposure to each of the chemicals of concern. Toxicological values, reference doses ("RfDs") for non-carcinogenic chemicals, and the non-carcinogenic effects of carcinogens, and cancer slope factors ("CSFs") for known, suspected, and possible human carcinogens, derived by US EPA were used in the Risk Assessment.

RfDs have been developed by US EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, we estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

CSFs have been developed by US EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of (mg/kg-day) -1, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the CSF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CSFs 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.

4. Risk Characterization

The July 1996 Baseline risk Assessment and November 1996 Addendum letter characterize the potential health risks associated with both current and future exposures to affected environmental media at the Berks Landfill Site.

Carcinogenic risk is presented as the incremental probability of an individual contracting some form of cancer over a lifetime as a result of exposure to the carcinogen. For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1.0 x 10 -4 (or 1 in 10,000), and 1.0 X 10 -6 (or 1 in 1,000,000) using information on the relationship between dose and response. Risk standards for non-carcinogenic compounds are established at acceptable levels and criteria considered protective of human populations from the possible adverse effects from exposure. The ratio of the average daily doses ("ADD") to the RfD values, defined as the Hazard Quotient, provides an indication of the potential for systemic toxicity to occur. To assess the overall potential for non-carcinogenic effects posed by multiple chemicals, a Hazard Index ("HI") is derived by adding the individual hazard quotients for each chemical of concern. This approach assumes additivity of critical effects of multiple chemicals. US EPA considers any HI exceeding one (1.0) to be an unacceptable risk to human health.

a. Background Risks and Hazards

Groundwater

Potential risks and hazards from the exposure to background-related inorganic chemicals are estimated for potentially exposed human receptors to groundwater under both current and future scenarios. Specifically, hypothetical exposure via ingestion of groundwater is evaluated for potential adult and child receptors. A cancer risk of 3 x 10 -4 is postulated for the potential ingestion of background groundwater. This risk estimate is entirely attributable to the presence of arsenic and beryllium in groundwater. The estimated HI for the potential ingestion of background groundwater is 6. Manganese concentradons in groundwater represent the major contributor to this estimate. However, because manganese is considered an essential nutrient, the true risk of adverse health effects is uncertain.

Surface Soil and Sediment

Potential risks are estimated for a child trespasser for hypothetical exposure to beryllium in background surface soil under both current and future conditions. The estimated potential cancer risk for incidental ingestion of beryllium in background soil is 2 x 10 -7 and the HI is estimated to be 7 x 10 -5.

Cumulative Risks and Hazards

The total lifetime excess cancer risk from combined potential exposures to the background groundwater and surface soil pathways is 3 x 10 -4. The total HI value for the combination of these pathways is 6. The potential ingestion of arsenic, beryllium, and manganese in affected background groundwater contributes most of the estimated total excess cancer risk and noncancer hazard for the potential receptors.

b. Off-Site Residential Risks and Hazards

Groundwater

In the case of the current and hypothetical future exposures to inorganic and organic chemicals

in residential wells located downgradient of the Site, potential cancer risks and noncancer hazards are estimated for off-Site residents. Specifically, potential exposures via ingestion, dermal contact, and inhalation of volatiles while showering or bathing are evaluated.

The potential cancer risk for hypothetical exposure to off-Site groundwater is mainly attributable to potential ingestion of arsenic. An estimated cancer risk of 2 x 10 -4 is postulated for potential ingestion of affected groundwater by off-Site residents which is less than the estimated risk due to exposures to background groundwater. However, the infrequent and detected low concentrations of organic constituents in residential well water resulted in an estimated potential excess cancer risk of 2 x 10 -6, which is well within the US EPA acceptable risk range.

Air

In the case of potential exposure via inhalation of vapor-phase chemicals from passive gas vents by an off-Site resident the estimated potential cancer risk is 2 x 10 -5, while the HI is 0.7, under both current and future exposure conditions. The estimated cancer risk for potential inhalation of vapor-phase chemicals is due primarily to the presence of vinyl chloride in passive landfill gas vents while the esdmated hazard index is due primarily to the presence of hydrogen sulfide in passive landfill gas vents.

Cumulative Risks and Hazards

For an off-Site resident, the total lifetime excess cancer risk from combined potential exposures to groundwater and air pathways is 2 x 10 -4. The total HI value for combined pathways associated with these media exceeds 1. The potential ingestion of arsenic in groundwater contributes virtually all of the estimated total excess cancer risk for the off-Site resident. It should also be particularly noted that arsenic is the primary contributor to excess cancer risk for hypothetical exposure to background groundwater. Noncancer risk for the off-Site resident is due primarily to ingestion of arsenic in groundwater and exposure to hydrogen sulfide gas from passive landfill vents. Because arsenic and hydrogen sulfide have different toxic endpoints and target organs, the addition of the individual HIs is not appropriate. Neither HI individually exceeds 1.

c. On-Site Trespasser Risks and Hazards

Surface Soil and Sediment

Potential risks and hazards from exposure to on-Site surface soil are estimated for a child trespasser under both current and future exposure scenarios. A cancer risk of 1 x 10 -6 is estimated for the potential incidental ingestion of surface soil. This estimate is primarily related to the presence of arsenic and beryllium in soils. The estimated HI for the potential ingestion of surface soil by a trespasser is 0.01.

Air

Potential risks and hazards are estimated for an on-Site trespasser who is potentially exposed to volatiles from passive gas vents under both current and future exposure scenarios. The estimated potential cancer risk via inhalation of volatiles is 3 x 10 -8, while the HI is estimated to be 4 x 10 -3.

Cumulative Risks and Hazards

The total lifetime excess cancer risk for a child trespasser from combined exposures to surface

soil and air pathways is 1 x 10 -6 The total HI value from combined pathways associated with these media is 0.01. The potential ingestion of arsenic and beryllium in surface soil accounts for all estimated total cancer risk for the on-Site trespasser. Once again, arsenic and beryllium are the primary contributors to the background soil risk estimates.

d. On-Site Worker Risks and Hazards

Surface Soil

The cancer risk and HI estimates for potential exposure to surface soil by future on-Site maintenance workers are based on incidental ingestion of chemical constituents. The estimated cancer risk for this exposure scenario is 5 x 10 -7, while the estimated HI is 0.002.

Air

Potential risks and hazards are estimated for a future on-Site maintenance worker who is potentially exposed to volatiles present in passive gas vents via inhalation. The estimated potential cancer risk is 1 x 10 -7, while the HI is estimated at .005.

Cumulative Risks and Hazards

The total lifetime excess cancer risk from combined soil and air exposure pathways is 6 x 10 -7. The total HI value for these combined exposure pathways is 0.007. Most of the estimated total cancer risk for the on-Site worker is attributed to the incidental ingestion of detected chemicals in surface soil.

e. On-Site Residential Risks and Hazards

Groundwater

In the case of future hypothetical exposure to chemicals in selected on-Site monitoring wells, potential cancer risks and noncancer hazards are estimated. Specifically, potential exposures via ingestion, dermal contact, and inhalation of vapors while showering or bathing are evaluated. An estimated cancer risk of 1 x 10 -3 is postulated for the potential ingestion of groundwater by future on-Site residents. The estimated cancer risk for dermal exposure is 4 x 10 -6 and a cancer risk of 2 x 10 -4 is estimated for the inhalation of vapors while showering. The potential excess cancer risk for hypothetical exposure to on-Site groundwater is mainly attributable to ingestion of vinyl chloride, although the estimated risk from the potential inhalation of this compound's vapors while showering is also significant. The estimated HI for the potential ingestion of affected groundwater by future on-Site residents is 14. Manganese concentrations in groundwater are primarily responsible for this value.

Air

In the case of hypothetical exposure via inhalation of volatiles from passive gas vents by a future on-Site resident the estimated cancer risk is 1 x 10 -7, while the HI is 4 x 10 -3.

Cumulative Risks and Hazards

For a future on-Site resident, the total lifetime excess cancer risk from combined hypothetical exposures to groundwater and air pathways is 1 x 10 -3. The total HI value for the combined pathways is 15. The potential ingestion of vinyl chloride in groundwater, and the inhalation of volatiles while showering contribute most of the estimated total cancer risk. The potential ingestion of manganese is primally responsible for the estimated total noncancer hazard for the

hypothetical future on-Site resident.

A summary of the cumulative risks and hazards posed by the Site by exposure route can be found in Table 12. Toxicological Profiles of major contaminants of concern are located in Appendix C.

B. Environmental Risk Evaluation

The principal purpose of the ecological risk assessment is to determine the likelihood that biological species habitats in the Site area are exposed to unacceptable risks from Site contaminants. The ecological risk assessment consisted of three primary components; site characterization (ecosystem components), exposure analysis, and risk characterization.

1. Site Characterization

The site characterization briefly describes the major plant and animal species that comprise the ecosystem components in the Site area. The majority of the area encompassed by the eastern landfill, the southern portion of the top of the western landfill, and the majority of the former borrow area to the west of the western landfill are early to mid succession old field. Areas on the landfill surface generally exhibit only minor impacts resulting from landfilling practices. Also, several localized areas of bare ground surface result from poor soil or steep slopes; otherwise, vegetation is healthy and abundant. The primary plant cover species are yellow and white sweet clover, crown vetch, and grasses utilized to stabilize the soil cover. Meadow voles and sparrows were most frequently observed during the terrestrial habitat assessment.

The majority of the western landfill is shrub/brush habitat. In addition, areas under the high tension electric towers and cables to the east of the Site and areas further to the east of the electric utility right-of-way are shrub/brush habitat. This habitat type provides good cover for wildlife. Eastern cottontail and white-tailed deer were the most frequently observed wildlife species in this habitat.

The majority of forested areas at the landfill are mesophytic second stand, mature forest. Black locust, white ash, red maple, and honeylocust were commonly observed. Most forested areas at the Site have a dense understory of shrubs and saplings. Also, on the eastern landfill, multiflora rose and climbing bittersweet were commonly observed. These species also were commonly seen on the western landfill, as were the bush honeysuckle and Japanese honeysuckle.

Wildlife diversity is typically higher in this habitat type than most others as a result of the greater variety of forage habitats and feeding guilds. Species that utilize both hard and soft mast (e.g., gray squirrel) or cavity dwellers (e.g., squirrels, raccoons, owls, bats or woodpeckers) could occur in this habitat type. Raccoon, striped skunk, and gray squirrel were among the mammals observed at the Site. Also, birds seen at the Site include those species utilizing both hard and soft mass, such as the hairy woodpecker and downy woodpecker.

Both wetlands and streams are located within stream corridors and floodplain areas of the Site. Because the first order streams are upper headwater tributaries, only a few non-game fish species are expected in such a habitat. During the terrestrial habitat-assessment, minnows were observed at five of the six sample locations. Raccoons were also observed in this habitat.

Inhabitants of streambeds were qualitatively evaluated during the aquatic habitat assessment. Diverse communities of benthic macroinvertebrate species were found throughout the six sample locations, two of which were background sample points. In most cases, more than 100 organisms were collected at each of eight kick sample collection points per sample location.

Notably, pollution intolerant species predominated, including those species that US EPA has identified as pollution intolerant species, commonly referred to as "EPT" -- Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). Furthermore, relatively low levels of pollution tolerant orders, such as Diptera and Annelida, were observed at the Site. Key receptors evaluated in this ecological assessment are the meadow vote for the soil medium, and generic aquatic species for the sediment, surface water, and leachate media.

2. Exposure Assessment

For exposure characterization, the reasonable maximum exposure ("RME") concentrations for detected chemicals are used as the basis for calculating chemical uptake by terrestrial plants, soil intake for the meadow vole, and chemical exposure for aquatic species. It is assumed that these concentrations are uniformly distributed in the sampled media, are biologically active, and are available for transport into the biosphere.

For chemicals found in soil, the toxicity measurement endpoint used for evaluation is the median lethal dose ("LD 50"). The LD 50s used in this ecological assessment are based on animal study (rat or mouse) data listed in the Registry of Toxic Effects of Chemical Substances ("RTECS") data base (NIOSH, 1994). Studies based on intraperitoneal administered doses are used only when studies using oral administered doses are unavailable. The results of the rat and mouse studies are scaled to the meadow vote to account for differences in body surface area by using the methodology presented in Opresko et al. (1993). In addition, No Observed Adverse Effects Levels ("NOAELs") for the meadow vole are derived from animal studies (rat or mouse) listed in the Integrated Risk Information System ("IRIS") data base (US EPA, 1994b) to evaluate toxicity of chemicals found in soil. Uncertainty factors are applied to the rat or mouse toxicity data to modify lowest observed effects levels to NOAELs or to adjust subchronic values to chronic values. The rat or mouse NOAELs are scaled to the meadow vole to account for differences in body surface area

For chemicals found in sediment, the toxicity measurement endpoints are the effects range-low ("ER-L") and effects range-median ("ER-W") data from Long and Morgan (1991). An ER-L value defines the concentration at the low-end of the range in which effects were observed. An ER-M concentration defines a point midway in the range of reported values associated with biological effects.

For chemicals found in surface water, leachate lagoon, and leachate seep, chronic toxicity benchmarks are the lower of ambient water quality criteria ("AWQC") for aquatic life established by US EPA in "Quality Criteria for Water Update #2 1987," (US EPA, 1987) and 40 CFR Part 131, or Pennsylvania Water Quality Standards for aquatic life established by PADER in Pennsylvania Code, Title 25, Chapter 16.

For chemicals with no reported ER-L, ER-M or AWQC, both RTECs and the Hazardous Substance Data Bank (HSDB, 1994) were examined for equivalent toxicity information for representative aquatic species (e.g., Notropis, spp.). For several constituents, no toxicity information was available after an exhaustive search of appropriate data bases. As a result, these constituents are not evaluated.

3. Risk Characterization

Potential risks to ecological receptors are characterized in this ERA by using the quotient method (Suter, 1993). In this method, the environmental concentration or receptor dose is divided by an appropriate toxicological endpoint. An environmental hazard quotient ("EHQ") less than one (1) or unity indicates a negligible probability of adverse effects. If the EHQ is greater than one, then there may be a possible ecological effect. As the magnitude of the

quotient increases, the likelihood of possible effects is assumed to increase. EHQs of the same order of magnitude are assumed to indicate equivalent risk as a result of the evaluation methods. The environmental hazard index ("EHI"), which is the sum of EHQs for all chemicals, is used to assess the potential adverse effect to a receptor from exposure to multiple chemicals. The EHI assumes that the toxicity of chemicals to the receptors is additive, and does not consider synergistic, antagonistic, or potentiating effects of chemicals. This risk characterization is suitable for identifying possible organism-level effects. Effects to higher ecological organizations may be extrapolated from these results.

Risk to Receptors

a. Potential Risks from Exposure to Soil

No chemicals found in soil samples collected at the landfill have an EHQ greater than one using the LD 50 as the toxicity benchmark. If the NOAEL is used as the benchmark, both aluminum and copper have an EHQ greater than one. However, concentrations of aluminum and copper found in background soil samples result in EHQs of similar magnitude to those found at the landfill.

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b. Potential Risks from Exposure to Sediment

None of the chemicals detected in on-Site stream sediments exceed an EHQ of one when evaluated using the most conservative ER-L as the toxicity benchmark. The EHI exceeds one when either the ER-L or the ER-M is used as the toxicity benchmark. Once again, the EHI for background sediment is very similar in magnitude to the EHI for on-Site sediment. The sediment samples collected on-Site exhibited a smaller grain size and higher total organic carbon content than the off-Site samples, which would tend to magnify constituent concentrations in the on-Site samples.

c. Potential Risks from Exposure to Surface Water

None of the chemicals in surface water has an EHQ greater than one. The EHI for on-Site surface water is actually equivalent to the EHI for background surface water.

The aquatic habitat assessment results provide additional information in evaluating the health of the aquatic habitat and potential risks to receptors in surface water. As stated in the aquatic habitat assessment, all of the six benthic sample points (two background and four on-Site) have a similar benthic macroinvertebrate community structure and diversity. This structure shows an abundance of pollutant intolerant species.

d. Potential Risks from Exposure to Leachate

Chemicals are present either in the leachate lagoon or in leachate seeps at concentrations that

may pose a potential risk to aquatic organisms. Most notably, iron concentrations both in the lagoon and the seeps exceed water quality criteria. Other analytes detected in leachate that exceed water quality criteria include phenol, toluene, and total xylenes in the leachate lagoon, and cobalt in the leachate seeps. Although these chemicals represent a possible effect on aquatic receptors leachate is not an important aquatic habitat and is only expected to support limited aquatic life at the Site.

VII. DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The Feasibility Study ("FS") Report discusses the alternatives considered for the cleanup of the contaminants of concern identified during the RI for the Site and provides supporting information leading to alternative selection by US EPA. The FS initially proposed eight alternatives. These Alternatives were then evaluated in a two step process, first, initial screening and then detailed analysis. The initial screening process evaluates all the alternatives for 1) effectiveness in protecting human health and the environment, 2) implementability, which is the alternatives technical and administrative feasibility to be constructed, operated and maintained, and 3) Costs. Alternative 6 (Institutional Controls, Monitoring, Leachate Management System Operation, Landfill Cap Repairs, Low Permeability Crown on Eastern Landfill and Leachate Management System Expansion) and Alternative 8 (Institutional Controls, Monitoring, Leachate Management System Operation, Landfill Cap Repairs, and Hydraulic Ground Water Containment) were not carried forward to the detailed analysis in the FS, primarily because they did not provide any additional effectiveness in protecting human health or the environment and cost significantly more than other Alternatives which were carried forward. A more detailed description of Alternatives 6 & 8, and the discussion of why they were not carried forward to the detailed analysis can be found in Section 6 of the FS, a copy of which can be found in the Administrative Record in the Site repositories. A brief description of the Alternatives and the detailed analysis of each follows below.

BRIEF DESCRIPTION OF ALTERNATIVES:

A. Alternative No. 1 - No Further Action

Alternative No. 1 consists of performing no further action at the Site. The operation of the existing leachate management system and pumping of leachate to the Borough of Spring Publicly Owned Treatment Works ("POTW") for treatment will be discontinued. No further operation and maintenance activities will be performed at the Site. This "No Further Action" alternative is required to be evaluated by the National Oil and Hazardous Substances Pollution Contigency Plan ("NCP") and represents the baseline for comparison of the other alternatives.

B. Alternative No. 2 - Institutional Controls and Leachate Management System Operation

Alternative No. 2 consists of continuing the operation and maintenance of the existing leachate management system and pumping of the collected leachate to the local POTW for treatment and implementing institutional controls at the Site. In addition, Alternative No. 2 includes performing necessary repairs to the leachate management system. Each of these additional components is described below.

Institutional Controls

Title restrictions, restrictive covenants or other legal mechanisms, would be implemented to prohibit the future consumption of on-Site ground water down gradient from the landfills, to restrict future development at the Site and to limit future earth disturbing activities on the capped portions of the Site.

Leachate Management System Operation

Prior to repairing the leachate system, the leachate collection pipes will be inspected. The inspection of the collection pipes may include the use of a downhole video camera to assess the integrity of the piping, visual inspection about every 100 feet by excavating the pipe using a backhoe to determine as-built conditions and the presence of bacterial or sediment build-up and/or other appropriate means. The condition of the leachate system manholes, valves, collection lagoon liners, and leachate conveyance system would also be inspected to determine the need for repairs. The inspection of the leachate collection and management system would be conducted during remedial design.

Following any necessary repair, the leachate collection and management system will continue to be operated and maintained to ensure that the system remains effective in the future. Leachate will continue to be pumped to the local POTW in accordance with the existing Agreement with the Municipalities.

Alternative No. 2 Costs:	Capital	- $ 765,900
	O&M	- $ 74,100
	Present Worth	- $ 2,102,664

C. Alternative No. 3 - Institutional Controls, Monitoring, Leachate Management System Operation, and Leachate Collection System Expansion

Alternative No. 3 consists of all of the components of Alternative No. 2 plus the following additional components:
implementing ground water monitoring to provide an early warning precaution against off-Site impacts; and, expanding the existing leachate collection system.

Ground Water Monitoring

This additional remedial component includes ground water sampling and analyses at existing monitoring wells, residential wells, and a new sentinel monitoring well cluster, which will be installed west of the Site property line centrally located within the Cacoosing Creek tributary valley (See Figure 2.). This sentinel well cluster will provide a precautionary early warning system against any possible residential well impacts west of the Site. In addition to the sentinel well cluster, existing monitoring wells and residential wells will also be regularly monitored.

Ground water monitoring is an important component of this alternative as it provides an early warning system for potential upsets in the natural containment of landfill constituents in ground water. It is also an important component to help ensure that the residences west of the Site are properly protected and to assess compliance with chemical-specific applicable or relevant and appropriate requirements ("ARARs") west of the Site. All sample collection and analyses will be performed in accordance with US EPA accepted procedures. Analytical results will be validated as required and reported to US EPA annually as part of the Annual Report of Post-Closure Monitoring and Maintenance.

Leachate Collection System Expansion

Expanding the existing leachate collection system would include lengthening the existing collection system to surround more of the eastern landfill perimeter with the intent to collect additional leachate. In addition to the investigations and repairs associated with the leachate management system operation component, additional investigations would be performed during remedial design to assess expanding the leachate collection system. It is estimated that the

expansion could add up to approximately 700 feet of collection piping and two additional manholes/cleanouts. An additional 6,000 gallons per day ("gpd") of leachate are expected to be collected and ultimately discharged to the local POTW. This amount of additional leachate discharge combined with the existing average annual daily discharge rate (22,000 gpd) and anticipated seasonal variation is expected to be within the daily maximum (35,000 gpd) stated in the Agreement with the Municipalities.

Alternative No. 3 Costs:	Capital	-	$1,018,650
	O&M	-	$ 142,200
	Present Worth	-	$3,584,300

D. Alternative No. 4 - Institutional Controls, Monitoring, Leachate Management System Operation, and Landfill Cap Repairs (Cap Repair Alternatives 4A, 4B, 4C or 4D)

Alternative No. 4 consists of all of the components of Alternative No. 2 plus the following additional components:

ground water monitoring (which is described above under Alternative 3); and repair and maintenance of the existing landfill caps.

Alternative No. 4 Costs, not including cap repair:	Capital	-	$ 873,100
	O&M	-	$ 120,000
	Present Worth	-	$ 3,037,900

As part of Alternative No. 4, four cap repair alternatives (i.e., subalternatives of No. 4) have been evaluated that consider variations in final repaired cap thickness, final vegetative cover sequence, and future operation, inspection and maintenance requirements. These four cap repair alternatives are variations of Site-wide Remedial Alternative No. 4 and therefore represent Alternatives 4A, 4B, 4C, and 4D. A detailed description and evaluation of the four cap repair alternatives as well as the comparative analysis and cost estimates of the alternatives are presented below. The following discusses the landfill cap repair component of Site-wide Alternative No. 4 in a general sense and incorporates common items associated with each of the four cap repair alternatives as well as the range of attributes provided by the cap repair alternatives.

Landfill Cap Repairs

All of the cap repair alternatives include the following common features: re-establishing vegetation on bare areas of the cap; repairs to erosional areas and settlement cracks; repairs to the existing surface water management system, as needed; covering the thin lens of exposed refuse on the northern slope of the eastern portion of the eastern landfill; repairs to landfill slopes, as needed; and, on-going inspection and maintenance of the landfill cap, surface water management system, and passive landfill gas vents.

1. Cap Repair Alternative 4A

Final Repaired Cap Thickness: This cap repair alternative provides a minimum of a 1-foot cap thickness over both landfills in areas that are not currently covered by a large contiguous area of well-established vegetative cover. A cap thickness of less than 1 foot will be increased to at least 1 foot in these areas using cover soils similar in nature to the existing cover soils. The caps over the Area Behind Equipment Building and the Northern Disposal Area are included in this and all other cap repair alternatives (Set Figure 2.). Large contiguous areas that are currently well vegetated, are reducing erosion and are preventing direct contact with refuse

will not be disturbed, for the purpose of repairing the cap thickness, even if the cap thickness in these areas is less than 1 foot.

Final Vegetative Cover: Areas where the cap thickness is repaired in accordance to the above criterion will be vegetated with wildflower/grassland species in accordance with a meadow seed mixture, as defined by US EPA following consultation with PADEP. Within the eastern landfill, areas currently well covered with meadow plant species (wildflower/grasses/other herbaceous species) would be allowed to remain as they are even if the cap thickness in these areas is less than 1 foot. Ultimately, natural succession of the existing vegetation and seeded areas will be allowed to take place on both the eastern and western landfills, returning the area to its natural state.

Operation, Inspection and Maintenance: In general terms, operation and maintenance activities for the four cap repair alternatives will include the following: 1) operations - management of inspection and maintenance activities; 2) routine inspection - regular, pre-scheduled inspections that are typically annual; 3) additional inspections - area- or item-specific inspections following a particular event such as a large storm or repair; 4) routine maintenance - regular, pre-scheduled maintenance such as removing debris from surface water drainage channels and mowing of cover vegetation (if needed); and, 5) repair maintenance - performed as a result of an inspection identifying a problem. Repair maintenance could include repairs to the security fence, eroded areas, excessive wear to access roads, surface water drainage system washouts, etc.

Operation, inspection, and maintenance activities specific to Cap Repair Alternative 4A would include all five of the above items. Inspection and maintenance activities are particularly important for Cap Repair Alternative - 4A because of the lower final cap thickness that would be maintained and because the cover vegetation would be allowed to naturally succeed to the forest stage. During natural succession of meadow to forest, the intermediate stage (shrub) is expected to result in reduced visibility for inspection and access for maintenance. Any reduction in visibility or access can be effectively overcome as described below.

Inspection trails would be established at about 100-foot intervals using painted "blaze" on trees in maturing forested areas and cut and maintained access ways in shrub areas. A "brush hog" or other mechanical means can effectively cut and maintain access trails through the shrub areas. As these shrub areas mature into the forest stage, the inspection trails would be off-set from the maintained cut trails into blazed forest trails and the former maintained trails can be allowed to naturally succeed to the forest stage. This maintained system of inspection trails would allow the landfill cover inspector to retain spatial orientation at the Site so that complete and thorough coverage and inspection of the cap would be performed.

This system of annual inspection for Cap Repair Alternative 4A can be augmented by using annual flyovers with low altitude photography performed in the late fall/winter as an additional means to identify any cap repair maintenance needed, such as tree wind throw, eroded area, bare areas of the cap, and damage to surface water management systems. Additional inspections would be performed as needed based on the inspection observations and repair maintenance conducted.

Routine maintenance of the landfill cap will include maintaining the surface water drainageways, access roads, and inspection trails for the intended purpose. Surface water drainage systems and access roads will be kept clear of debris and woody vegetation. This routine maintenance will be performed annually and will include the use of herbicide application, cutting and digging to remove woody plants from these areas, as needed. Maintenance of the inspection trails will be performed by "re-blazing" and/or re-"brush-hogging" the trails.

While the maturing vegetation on the eastern and western landfill caps may present some unique challenges to the routine inspection and maintenance of the landfill caps, these challenges can be effectively met through the procedures described above. In fact, the maturing shrub areas and forests will effectively retard access and use of the area by trespassers and will provide an effective stabilizing vegetative cover to reduce erosion, i.e., will provide preventative maintenance.

4A Cap Repair Costs:	Capital	-	$1,128,690
	O&M	-	$ 104,000
	Present Worth	-	$3,004,862

Alternative No. 4 Costs, not including cap repair:

	Capital	-	$ 873,100
	O&M	-	$ 120,000
	Present Worth	-	$3,037,900

Total Alternative No. 4 Costs, including Cap Repair 4A

	Total Capital	-	$2,001,790
	Total O&M	-	$ 224,000
	Total Present Worth	-	$6,042,762

2. Cap Repair Alternative 4B

Final Repaired Cap Thickness: This cap repair alternative provides a minimum of a 1-foot cap thickness over the entire eastern landfill and over the non-forested portions of the western landfill. All large contiguous areas of the eastern landfill cap having a thickness of less than 1 foot will be increased to at least 1 foot including the Area Behind Equipment Building and the Northern Disposal Area (See Figure 2.). Forested/maturing shrub areas of the western landfill would be left as they are regardless of the cap thick. However, while conservative estimates indicate that portions of the cap in the forested portion of the western landfill may be less than 1 foot in thickness, greater thicknesses are actually expected and will be evaluated during remedial design.

Final Vegetative Cover: Ultimately, the forested/maturing shrub areas on the western landfill will be allowed to mature to the mature forest stage. The remainder of the vegetation on the western landfill, which consists of a meadow species on the crown, and the entire eastern landfill will be seeded, as necessary, and maintained as ameadow (wildflower/grass/other herbaceous species as described in 4A above).

Disturbances of the existing cover vegetation will occur as a result of cap thickness repair. In addition, the shrub and small tree vegetation on the eastern landfill will be removed by herbicide application and/or flush cutting and these areas will then be seeded with the meadow mixture.

The existing meadow vegetative cover on the eastern and western landfills and the areas seeded with the meadow mixture will be maintained as a meadow through a program of regular mowing of the cover vegetation and removal of hay. Hay removal may include mulching and spreading. The forested/maturing shrub areas on the western landfill will beallowed to naturally succeed to forest and more mature forest stages.

Operation, Inspection and Maintenance: Inspection of the existing and created meadow vegetative cover will be accomplished by an annual walkover during the spring of each year.

The mowing of the meadow will provide additional cover inspections during the summer period.

Inspection of the forested/maturing shrub areas of the western landfill will be accomplished in a manner similar to the procedures described for Cap Repair Alternative 4A. However, given that the majority of this area is already in the forest stage, less reduction of visibility and access is anticipated. The existing forested areas will be easily inspected and routes with good visibility into adjacent areas should be easily maintained. The maturing shrub areas will naturally succeed to the forest stage thus continually improving visibility and access.

Routine maintenance of the wildflower/grass meadow will be accomplished through annual mowing in mid to late-July. The mowing height will be about 6 inches or greater and the hay will be periodically removed. Hay removal could include mulching and spreading on the cap to retain the organic matter. The mowing contractor shall also be equipped with pin flags to locate potential problems which may have occurred on the cap such as erosion or signs of cap damage due to trespassing or other items. Mowing provides a unique opportunity to inspect a large portion of the landfill cap surface during the performance of routine maintenance.

No routine maintenance of the forested/maturing shrub areas on the western landfill are anticipated as these areas will be allowed to naturally succeed to more mature forest stages.

Repair maintenance of the landfill caps, surface water drainage channels, fencing, and access roads and other features will be performed on an as-needed basis as determined by the results of inspections.

Cap Repair 4B Costs:	Capital	-	$1,639,920
	O&M	-	$ 78,000
	Present Worth	-	$3,047,040

Alternative No. 4 Costs, not including cap repair:

	Capital	-	$ 873,100
	O&M	-	$ 120,000
	Present Worth	-	$3,037,900

Total Alternative No. 4 Costs, including Cap Repair 4B:

	Total Capital	-	$2,513,020
	Total O&M	-	$198,000
	Total Present Worth	-	$6,084,940

3. Cap Repair Alternative 4C

Final Repaired Cap Thickness: This cap repair alternative provides a minimum of a 2-foot cap thickness over the entire eastern landfill and the non-forested/maturing shrub portions of the western landfill. All large contiguous areas of the eastern landfill having a cap thickness of less than 2 feet will be increased to at least 2 feet, including the Arm Behind Equipment Building and the Northern Disposal Area. Areas of the western landfill having a cap thickness of less than 2 feet will be increased to at least 2 feet except in large contiguous areas of forest/maturing shrub vegetation. As previously stated, while conservative estimates indicate that portions of the forested cap in the western landfill may be less than 1 foot in thickness, greater thicknesses are actually expected and will be evaluated during remedial design.

Final Vegetative Cover: Ultimately, the forested/maturing shrub areas on the western landfill will be allowed to mature to the forest and more mature forest stage. The remainder of the

western landfill and the entire eastern landfill will be seeded, as necessary, and maintained as a meadow (wildflower/grass/other herbaceous species as described in 4A above).

The existing vegetation on the eastern landfill and non-forested/maturing shrub areas of the western landfill will be modified to provide a meadow consisting of wildflower, grasses, and other herbaceous species as follows: clear shrub and small trees via herbicide application and/or flush cutting; remove the existing cover vegetation as a result of cap thickness repair, and, improve areas not currently well covered by meadow vegetation.

In each of these areas, the soil cap surface will be seeded with the specified meadow mixture. Existing meadow cover vegetation (wildflower, grasses and other herbaceous species), if overlying large contiguous areas having a cap thickness of at least 2 feet, will be left undisturbed.

Large contiguous areas of forested/maturing shrub vegetation on the western landfill will be left undisturbed. These areas will be allowed to naturally succeed to more mature forest stages.

Operation, Inspection and Maintenance: Ultimately, two types of vegetative cover will be maintained: existing and created meadow cover consisting of wildflower/grasses and other herbaceous species; and, forested areas on the western landfill.

Inspection, operation and maintenance of the repaired landfill caps in these areas will be performed in a manner similar to that described for Cap Repair Alternative 4B. The meadow vegetative cover on the eastern and western landfills will be mowed and hay removed (or mulched and spread) on an annual basis. The forested and maturing shrub vegetation on the western landfill will be allowed to naturally succeed to more mature stages of vegetative growth and will therefore not require annual maintenance except for the maintenance of inspection trails and access roads in these areas.

Cap Repair 4C Costs:	Capital	-	$3,504,660
	O&M	-	$ 52,000
	Present Worth	-	$4,442,740

Alternative No. 4 Costs, not including cap repair:

Capital	-	$ 873,100
O&M	-	$ 120,000
Present Worth	-	$3,037,900

Total Alternative No. 4 Costs, including Cap Repair 4C:

Total Capital Costs	-	$3,377,760
Total O&M Costs	-	$ 172,000
Total Present Worth	-	$7,480,560

4. Cap Repair Alternative 4D

Final Repaired Cap Thickness: This cap repair alternative provides a minimum of a 2-foot cap thickness over both the entire eastern and western landfills including the Area Behind Equipment Building and the Northern Disposal Area. The cap thickness in all large contiguous areas of both landfills that are less than 2 feet will be increased to at least 2 feet. The forested and maturing shrub vegetation on the western landfill and brush and small trees on the eastern

landfill will be flush cut and maintained as a meadow (wildflowers/grass/other herbaceous species).

Final Vegetative Cover: Ultimately, the final cover vegetation will be modified to provide a meadow consisting of wildflower/grasses and other herbaceous species over both the entire eastern and western landfills. The cover vegetation on the eastern landfill and non-forested/maturing shrub vegetation on the western landfill will be modified as discussed for Alternative 4C. The forested/maturing shrub vegetation on the western landfill will be flush cut and seeded with the meadow mixture.

Inspection, Operation and Maintenance: Because the entire cap surfaces will consist of meadow vegetation, the inspection and maintenance activities to be performed are as described for the meadow areas in Alternative 4B. In summary, these include:

routine inspection:
- annual walkovers, and,
- annual mowing observations;
- additional inspections, as needed;

routine maintenance:
- annual mowing and hay removal and/or mulching/spreading,
- clearing surface water drainageways, and
- maintaining access roads; and,

repair maintenance as needed.

Cap Repair 4D Costs:	Capital	-	$4,493,340
	O&M	-	$ 39,000
	Present Worth	-	$5,196,900

Alternative No. 4 Costs, not including cap repair:

Capital	-	$ 873,100
O&M	-	$ 120,000
Present Worth	-	$3,037,900

Total Alternative No. 4 Costs, including Cap Repair 4D:

Total Capital Costs	-	$5,366,440
Total O&M Costs	-	$ 159,000
Total Present Worth	-	$8,234,800

E. Alternative No. 5 - Institutional Controls, Monitoring, Leachate Management System Operation, Landfill Cap Repairs (Cap Repair Alternatives 4A, 4B, 4C, and 4D), Leachate Collection System Expansion, and Regrading Crown of Eastern Landfill

Alternative No. 5 consists of all the components of Alternative No. 4 plus the following additional components:

expanding the existing leachate collection system; and, regrading the existing eastern landfill cap crown.

The crown of the eastern landfill would be regraded with the intent to further reduce infiltration by creating steeper slopes to enhance runoff. The crown on the eastern landfill has an average slope of about 4% and ranges from about 2% to 8%. These grades would be increased to about 8% using soils of similar geotechnical characteristics to obtain similar permeabilities. The newly constructed slopes would be vegetated with native grasses and wildflowers. Runoff from the regraded area would flow onto the surrounding cap outside of the crown and be collected and conveyed off of the landfill by the surface water management system.

Costs: Total Present Worth Range - $6,589,160 - $8,781,198 (depending on cap repair alternative)

F. Alternative No. 7 - Institutional Controls, Monitoring, Leachate Management System Operation, Landfill Cap Repairs (Cap Repair Alternatives 4A, 4B, 4C, and 4D), Leachate Collection System Expansion, and Limited Ground water Extraction and Treatment

Alternative No. 7 consists of all the components of Alternative No. 4 plus the following additional components:

expanding the existing leachate collection system; and, operation of ground water extraction wells at select locations with treatment of the extracted ground water.

Limited ground water extraction would be performed by installing three 6-inch extraction wells in the immediate vicinity of existing monitoring wells MP-18S and C-3S and C3-D designated EWMP-18S, EWC-3S, and EWC-3D, respectively (See Figure 11.). These locations exhibited the highest VOC concentrations detected in ground water samples collected during the remedial investigation. Based on the hydraulic parameters identified at these well locations during the remedial investigation the following pumping rates are believed to be able to be sustained at each well: EWMP-18S - 1 gpm; EWC-3S-4 gpm; and, EWC-3D -4 gpm.

Collected ground water is expected to need on-Site treatment prior to discharge to surface water or to the local POTW using the existing sewer tie-in. The combined flow of existing leachate (approximately 22,000 gpd annual average), leachate from expanding the collection system (estimated at 6,000 gpd), and the extracted ground water (approximately 13,000 gpd) would exceed the maximum allowable daily flow specified in the Agreement with the Municipalities (35,000 gpd). As a result, should the flows be combined with discharge to the local POTW, an amendment to the Agreement would be required.

Costs: Total Present Worth Range - $12,554,261 - $14,746,299 (depending on cap repair alternative)

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the remedial alternatives described above was evaluated using nine criteria. The resulting strengths and weaknesses of the alternatives were then weighed to identify the alternative providing the best balance among the nine criteria. These nine criteria are:

Threshold Criteria

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

- Compliance with ARARs: Whether or not a remedy will meet all applicable or relevant

and appropriate requirements ("ARARs") of Federal and State environmental statutes and/or whether there are grounds for invoking a waiver. Whether or not the remedy complies with advisories, criteria and/or guidance that may be relevant.

Primary Balancing Criteria

- ò Long-term effectiveness and permanence: The ability of the remedy to afford long-term, effective and permanent protection to human health and the environment, along with the degree of certainty that the alternative will prove successful.

- ò Reduction of toxicity, mobility or volume: The extent to which the alternative will reduce the toxicity, mobility, or volume of the contaminants causing the site risks.

- ò Short-term effectiveness: The time until protection is achieved and the short-term risk or impact to the community, on-Site workers and the environment that may be posed during the construction and implementation of the alternative.

- ò Implementability: The technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement that remedy.

- ò Cost: Includes estimated capital, operation and maintenance, and net present worth costs. The present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the current year. This analysis allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the basis year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life.

Modifying Criteria

- ò State Acceptance: Whether the Commonwealth concurs with, opposes, or has no comment on the Selected Remedy.

- ò Community Acceptance: Whether the public agrees with the Selected Remedy. This is assessed in detail in the ROD responsiveness summary (Appendix D of this ROD) which addresses public comments received on the Administrative Record and the Proposed Plan

A. Overall Protection of Human Health and the Environment

Alternative No. 1 is considered to be the least protective. The operation of the leachate management system would be discontinued, which might upset the existing equilibrium established between landfill constituents and natural attenuation mechanisms, i.e., decrease natural containment. As a result, constituent concentrations in ground water west of the Site may increase in the future.

Alternative Nos. 2, 3, 4, 5, and 7 provide for the protection of human health and the environment from the perspective of current and post-remedial risks. Indeed, each of these alternatives feature nearly equivalest post-remedial risks which are well within US EPA's acceptable range of 1 x 10 -4 to 1 x 10 -6. The maintenance of existing landfill caps and operation of the existing leachate management system should continue, as they have in the past, to control landfill constituent mobility such-that natural containment of landfill constituents is maintained in the future. Alternative Nos. 3, 4, 5, and 7 are somewhat more protective than Alternative No. 2 given the precautionary ground water monitoring provided. Future ground water

monitoring will provide protection of residential use of ground water west of the Site outside the point of compliance.

Furthermore, all of the alternatives, except Alternative No. 1, provide institutional controls which will prohibit future consumption of on-Site ground water down gradient ftom the landfills at the point of compliance.

The existing caps, which have existed ftom between 10 and over 20 years, and the existing leachate management system, which has been in operation for 10 years, are expected to continue to assist in providing protection of ground water west of the Site for residential use. The cap repair component provided in Alternative Nos. 4, 5, and 7 is expected to provide a higher level of assurance that future residential use of ground water west of the Site is protected because these alternatives provide long-term maintenance of the landfill caps. Because the existing caps are adequately reducing landfill constituent mobility, all of the cap repair alternatives will, at a minimum, maintain the same magnitude of mobility reduction and, as a result, all four cap repair alternatives are considered protective of human health and the environment. Increasing the cap thickness via Cap Repair Alternatives 4C and 4D does not actually appear to provide a higher level of protection. In addition, there are valid concerns that major disturbances of the caps and flush cutting of the forest/maturing shrub vegetation on the western landfill may result in sudden increases in infiltration that could potentially upset the ground water quality equilibrium. Similarly, expanding the leachate collection system or ground water extraction is not required for maintaining the current level of protection. However, cap repairs that include long-term maintenance and continuing the operation of the existing leachate collection system are believed necessary to provide maintenance of conditions at least equal to that of the existing landfill cap and, as a result, provide a high level of protectiveness and assurance that natural containment will be maintained in the future. As a result, Alternative Nos. 2 and 3 (without cap repairs) are rated slightly less for protectiveness than Alternative Nos. 4, 5, and 7 that contain cap repairs. Alternative Nos. 4 (including all cap repair alternatives), 5, and 7 are rated essentially equally.

B. Compliance with ARARs

All of the alternatives except for Alternative No. 1 are expected to comply with chemical-specific ARARs (MCLs and non zero MCLGs) for ground water west of the Site at the point of compliance. As discussed above, Alternative No. 1 does not include operation of the leachate management system and, as a result, ground water constituent concentrations west of the Site may eventually increase and exceed chemical-specific ARARs for ground water in the future.

Alternative Nos. 2 and 3 do not include the future maintenance of the exiting landfill cap and, as a result, conditions of the cap could theoretically deteriorate such that landfill constituent mobility increases and natural containment decreases to the point where chemical-specific ARARs for ground water are not met west of the Site. As a result, Alternative Nos. 1, 2, and 3 (without cap repairs) are rated less than Alternatives 4, 5, and 7 that have cap repairs. Furthermore, Alternative No. 2 is rated less than Alternative No. 3 because it does not provide a means for measuring compliance to ground water ARARs west of the Site.

Alternative Nos. 2, 3, 4, 5, and 7 contain institutional controls which will prohibit the future consumption of on-Site ground water down gradient of the landfills. As a result of these institutional controls, there is no complete exposure pathway for on-Site ground water.

All of the alternatives, except Alternative No. 1, are expected to achieve potential location-specific and action-specific ARARs.

The Pennsylvania Department of Environmental Protection (PADEP) identified 25 PA Code

Chapter 273 (1988), as an applicable, or relevant and appropriate requirement for the Site. Initially, US EPA did not consider Chapter 273 to be applicable, or relevant and appropriate as discussed in the April 25, 1997 Proposed Remedial Action Plan. After further consideration US EPA recognizes the Pennsylvania Municipal Waste Management Regulations, 25 PA Code Chapter 273 (1988) as an applicable requirement with regard to the alternatives including cap repairs because the closure of the landfills was not officially approved by PADEP. However, EPA believes that a waiver of these requirements, in accordance with 40 C.F.R. º 300.430(e)(9), is appropriate because the cap repair alternatives will otherwise achieve equivalent standards of performance in the protection of human health or the environment. Currently, soil, sediment, leachate, and air do not pose an unacceptable risk to human health, or the environment as a result of the current conditions of the landfill caps. For example, the remedial investigation determined the following:

1) Although there are variations in landfill cap thickness which will be addressed in all the cap repair portion of the Selected Remedy, the average current cap thicknesses of the western and eastern landfill are 24.7 and 18.7 inches, respectively;

2) The existing landfill Caps generally exhibit low permeabilities in the 10 -7 cm/sec to 10 -4 cm/sec range which effectively reduces infiltration and minimizes leachate generation. In addition, modeling conducted for the feasibility study and reviewed and approved by EPA, indicates that there would be no benefit in reduction of infiltration if two feet of similar types of soils were used as final cover for the caps, as opposed to one foot of final cover;

3) the landfill caps exhibit in place densities of 89% to 90% of the Standard Proctor maximum dry density indicating compaction occurred during construction;

4) the soils used to construct the caps are of the appropriate quality and character for landfill caps;

5) the landfill caps are, in general, well graded, covered with a good stand of vegetation and overall do not exhibit signs of excessive erosion; and

6) surface water management systems consisting of berms, benches, riprap lined channels and culverts have been constructed and generally are operating effectively.

7) the leachate management system effectively collects Site leachate.

All the cap repair alternatives will insure that the landfill caps will continue to be protective of human health and the environment in the future while effectively maintaining the natural containment of on-Site ground water. In addition, implementing the extensive grading and final cover requirements of the regulations found at 25 PA Code º 273.234 may pose a greater risk to human health or the environment because to comply with such requirements might jeopardize the natural containment of landfill constituents thereby creating greater risks to downgradient receptors.

As a practical matter, all of the cap repair alternatives will achieve, at a minimum, substantial compliance with 25 PA Code Chapter 75, the former landfill closure requirements. All alternatives would at least meet and would likely exceed the stated performance objectives of those closure requirements in that they will: 1) prevent direct contact with waste; 2) provide a stable, well-vegetated soil cover, 3) minimize excessive erosion; and 4) protect against environmental degradation (all of the cap repair alternatives provide a significant level of reduction of landfill constituent mobility).

In summary, Alternative Nos. 4, 5, and 7 provide an essentially equivalent level of ARAR compliance that is significantly greater than that provided by Alternative No. 1 and somewhat greater than that provided by Alternative Nos. 2, and 3.

C. Long-Term Effectiveness for Meeting Remedial Action Objectives and Permanence

Alternative Nos. 4 (including all cap repair alternatives), 5 and 7 provide the highest level of long-term effectiveness since they meet all the primary and secondary remedial action objectives equally. All of these alternatives include ground water monitoring and cap repair. Alternative No. 3 provides the next highest level of long-term effectiveness because it meets all of the primary objectives and also meets the secondary remedial action objective of ground water monitoring. Alternative No. 2 meets all of the primary objectives but none of the secondary objectives. Alternative No. 1 provides the lowest level of long-term effectiveness for meeting remedial action objectives.

The greatest concern for long-term adverse impacts would result from disturbances of the landfill caps associated with Cap Repair Alternative 4D, particularly on the western landfill. The intense construction effort would cause a long-term elimination of the maturing forest habitat on the western landfill. In addition, major disturbances of the cap surface soils and vegetation could cause a sudden increase in infiltration, possibly resulting in increased risk and non-compliance with ARARs west of the Site. These same disturbances also may cause conditions where increased erosion cannot be adequately controlled which might have long lasting effects on aquatic life.

None of the remedial alternatives considered provides a permanent remedy. All alternatives, except for Alternative No. 1, rely on waste containment, institutional controls, natural attenuation, and long-term monitoring and maintenance to provide the necessary level of protection of human health and the environment. This is almost always the case when evaluating remedial alternatives for closed municipal solid waste landfills.

D. Reduction of Toxicity, Mobility and Volume

Alternative No. 7 provides the most reduction of toxicity and volume through treatment as a result of the limited collection and treatment of ground water and expanded collection and treatment of leachate. Alternative Nos. 3 and 5 provide the next highest reduction of toxicity and volume through treatment as a result of expanded leachate collection. Any additional reduction of toxicity and volume afforded by Afternative Nos. 3, 5 and 7 may not be appreciable and is not required to provide a high degree of long-term protection of human health and the environment. The next highest degree of reduction of toxicity and volume is provided by Alternative Nos. 2 and 4 as a result of continuing to operate the existing leachate management system. On-going natural attenuation mechanisms that reduce toxicity and volume of constituents are essentially equivalent for each of the alternatives.

Alternatives that include cap repairs (Alternative Nos. 4, 5, and 7) will result in a higher level of reduction of constituent mobility than alternatives without cap repairs (Alternative Nos. 1, 2, and 3). HELP model analyses have estimated that Cap Repair Alternatives 4B, 4C, and 4D provide an essentially equivalent level of reduction of constituent mobility in that they reduce infiltration by about 97% to 99%. Cap Repair Alternatives 4C and 4D should provide a slightly higher reduction of constituent mobility due to the slightly higher reduction in infiltration (98 to 99%). Further reduction of constituent mobility is not required to provide long-term protection of human health and the environment.

None of the cap repair alternatives address the reduction in toxicity or volume of leachate constituents.

E. Short-Term Effectiveness

All of the remedial alternatives, except for Alternative No. 7, are expected to be able to be designed and constructed within 12 months. The alternatives are expected to have varying degrees of adverse short-term impacts primarily as a result of the level of construction planned for a given alternative, disturbances to the existing cap, impacts to terrestrial wildlife habitat, and the potential for soil erosion to adjacent aquatic habitats. Accordingly, Cap Repair Alternative 4A is rated best in that it is expected to have the lowest level of adverse short-term impact. The remaining cap repair alternatives in order of increasing adverse short-term impacts are 4B, 4C, and 4D. Cap Repair Alternative 4D has a much higher level of adverse short-term impacts.

All of the alternatives are expected to have varying degrees of adverse short-term impacts primarily as a result of the level of construction required for a given alternative. Alternative No.7 and Cap Repair Alternatives 4C and 4D are expected to result in the most adverse short-term impacts and Alternative No. 1 the least. Most of the short-term impacts to human health, the environment, or community concerns are not expected to be major or long-lasting.

F. Implementability

Similar to the criteria of short-term effectiveness, the implementability of the remedial alternatives varies primarily as a result of the level of construction required. Alternative No. 7 is expected to be most difficult to implement and Alternative No. 1 is essentially already implemented. The components most difficult to implement are included with Alternative Nos. 3, 5, and 7 (potential modifications to the leachate agreement with the Municipalities) and Alternative No. 7 (design and construction of a ground water treatment plant and obtaining permit equivalencies for treated ground water discharge). Cap Repair Alternative 4B is the easiest to implement followed by Cap Repair Alternative 4C. Cap Repair Alternatives 4A and 4D are expected to be the most difficult to implement, but for different reasons. Cap Repair Allternative 4A includes conducting inspections and maintenance on the eastern landfill as vegetation succeeds from the currently mostly meadow stage through shrub to forest stages. While a comprehensive inspection and maintenance program can be utilized to adequately conduct landfill inspections in these areas, implementing this inspection and maintenance program will be more difficult for Cap Repair Alternative 4A than for the other alternatives. Cap Repair Alternative 4D is considered to be the most difficult to implement due to the higher level of construction complexity and the need to adequately prevent a sudden increase in infiltration and to control erosion to surrounding aquatic habitats.

G. Cost

Alternative No. 1 (No Further Action) has the lowest overall cost. The remaining alternatives in increasing overall cost are Alternative Nos. 2, 3, 4, 5, and 7. A summary of thC estimated cost for each alternative can be found in Table 13 and Table 14.

H. State Acceptance

PADEP has assisted EPA in the review of reports and Site evaluations for the Berks Landfill Site. Although PADEP agrees with the approach of the Selected Remedy, it has not concurred with this Record of Decision.

I. Community Acceptance

Pursuant to CERCLA º 113(k)(2)(B)(I)-(v), US EPA released for public comment the final

RI/FS reports and the Proposed Remedial Action Plan setting forth US EPA's preferred alternative for the Berks Landfill Site on April 25, 1997. US EPA made these documents available to the public in the Administrative Record located at the US EPA Docket Room in Region III's Philadelphia office, and at the Sinking Spring Public Library, Sinking Spring, Pennsylvania. The notice of availability of these documents was published in the Reading Eagle and the Merchandiser on April 25, 1997 and May 14, 1997, respectively.

A public comment period on the documents was held from April 25, 1997 to May 26, 1997. In May, 1997 US EPA issued a Fact Sheet announcing the availability of the Proposed Remedial Action plan and public meeting. The May 1997 Fact Sheet discussed US EPA's Preferred Alternative, as well as other alternatives evaluated by US EPA and solicited comments from all interested parties. In addition, US EPA conducted a public on May 14, 1997. At this meeting, representatives from US EPA answered questions about conditions at the Site and the remedial alternatives under consideration.

The responses to all comments received during the public comment periods are included in the Responsiveness Summary, which is Appendix D of this Record of Decision ("ROD").

In summary, US EPA believes the selected remedy provides the best balance of trade-offs among the alternatives evaluated with respect to the nine criteria above.

IX. THE SELECTED REMEDY; DESCRIPTION AND PERFORMANCE STANDARD(S) FOR EACH COMPONENT OF THE REMEDY

A. General Description of the Selected Remedy

US EPA carefully considered state and community acceptance of the remedy prior to reaching the final decision regarding the remedy.

The Agency's selected remedy is set forth below. Based on current information, this alternative provided the best balance among the alternatives with respect to the nine criteria US EPA uses to evaluate each alternative. The selected remedy consists of the following components:

US EPA's Selected Remedy for addressing contaminated ground water at the Berks Landfill Superfund Site is Alternative No. 4 - Institutional Controls, Monitoring, Leachate Management System and Operation, and Landfill Cap Repair Alternative 4B, which includes:

- Institutional Controls
  Title restrictions, restrictive covenants, etc. to prevent future consumption of on-Site ground water, restrict future development at the Site and limit future earth moving activities at the Site;
- Long-term Monitoring, including
  Installation of a sentinel monitoring well cluster,
  Sampling of Residential wells,
  Monitoring of on-Site wells, Combustible landfill gases and Aquatic habitat,
- Leachate Management System Repair and Operation & Maintenance
- Cap Repair and Maintenance, to include,
  Minimum 1 foot final cover thickness on Eastern Landfill and non-forested portions of the Western Landfill; Eastern Landfill and non-forested portions of Western Landfill will be maintained as wildflower/grass

meadow (mowed once per year); Forested portions of Western Landfill will remain and be maintained.

Estimated Capital Costs: $2,513,020
Estimated Annual O&M Costs: $198,000
Estimated 30 Year Total Present Worth Costs: $6,084,940

Each component of the Selected Remedy and its Performance Standards and Costs are described below.

B. Description and Performance Standard(s) of Each Component of the Selected Remedy

1. Institutional Controls to limit options for future Site use.

1.a. Description

Institutional controls will be used to identify the Site as property underlain by contaminated groundwater, and to prevent the consumption of contaminated ground water; to restrict future development at the Site and to limit future earth disturbing activities on the capped portions of the Site.

1.b. Performance Standards

1.b.1 No newly commenced or expanded ground water pumping in the aquifer shall be implemented which will adversely affect the natural hydraulic containment and plume migration.

1.b.2. Drinking water supply wells shall not be installed in the area of the contaminated ground water plume.

1.b.3. No new development at or near the Site shall adversely affect the natural hydraulic containment and plume migration.

1.b.4 Except as necessary to implement other portions of the selected remedy, no earth moving activities shall be carried out on the capped portions of the western or eastern landfill, the northern disposal area and the area behind the equipment building locations.

1.b.5. Title restrictions along with other appropriate means shall be used to implement the requirements of 1.b.1., 1.b.2., 1.b.3., and 1.b.4., immediately above.

1.A.6. Title restrictions will be appropriately recorded with the Berks County Recorder of Deeds.

2. Long-term Monitoring

2.a. Description

This portion of the remedy calls for a long-term sampling plan including sampling and analyses at existing monitoring wells, residential wells, and new sentinel monitoring wells, to be installed in a manner which will provide an early warning of potential upsets in the natural hydraulic containment of the ground water plume, and to monitor on-Site contaminant levels. In addition the long-term sampling plan will include

surface water, sediment and benthic macroinvertebrate survey sampling of the upgradient and downgradient drainage system to monitor effects the Site may have on the drainage system.

2.b. Performance Standards

2.b.1. A long-term ground water monitoring program shall be implemented to evaluate the effectiveness of the natural hydraulic containment mechanisms in maintaining Site contaminant levels below MCLs and MCLGs at the point of compliance and to monitor on-Site contaminant levels over time.

2.b.2. The plan for the long-term ground water monitoring program shall be included in an operation and maintenance plan for the Site. This plan shall include the sampling of a sufficient number of sentinel wells, residential wells and existing monitoring wells to monitor the effectiveness of the natural hydraulic containment mechanisms in maintaining Site related contaminant levels below MCLs and MCLGs at the point of compliance and to monitor on-Site contaminant levels over time. As part of the remedial design, US EPA, in consultation with PADEP, will determine the number and location of wells necessary to verify the performance of the remedial action.

2.b.3. The installation of additional sentinel wells shall be required. The exact design, number and location of these sentinel wells shall be determined by US EPA during the remedial design, in consultation with the PADEP.

2.b.4. Sentinel wells and residential wells shall be sampled quarterly for Target Compound List ("TCL") VOCs and semi-annually for Target Analyte List ("TAL") metals for the first year of sampling. The sentinel wells and residential wells shall be sampled no less than semi-annually for TCL VOCs and annually for TAL metals for the second through fifth year of sampling. Based on the findings of the first five years of sampling, the appropriate sampling frequency for subsequent years will be determined by US EPA in consultation with the PADEP.

2.b.5. On-Site monitoring wells shall be sampled annually for TCL VOCs and TAL metals for the first five years of sampling. Based on the findings of the first five years of sampling, the appropriate sampling frequency for subsequent years will be determined by US EPA, in consultation with the PADEP.

2.b.6. At least two rounds of surface water, sediment and benthic macroinvertebrate sampling of the upgradient and downgradient surface water drainageways and the tributary of the Cacoosing Creek shall be required. The first round shall be conducted no less than six months after cap repairs are completed. The second round shall be completed prior to the initial five-year review for the Site and the data included in the initial five-year review for the Site. The surface water, sediment and benthic macroinvertebrate sampling conducted as part of the Remedial Investigation shall be used as a baseline for this required sampling, however, the exact sampling methods, parameters, sampling locations and analytical methods will be determined by US EPA, in consultation with PADEP, during the remedial design. US EPA, in consultation with PADEP, will determine if additional surface water, sediment and benthic macroinvertebrate sampling is necessary based on the findings of the first two rounds of samples collected.

2.b.7. Sampling and operation and maintenance shall continue until such time as US EPA, in consultation with PADEP, determines that MCLs or MCLGs for each contaminant of concern have been achieved to the extent technically practicable

throughout the entire area of ground water contamination.

3. Leachate Management System Operation & Maintenance

3.a. Description

This portion of the remedy calls for the inspection, repair and continued operation and maintenance of the existing leachate collection system at the Site.

3.b. Performance Standards

3.b.1. An initial inspection of the existing leachate management system, including but not limited to, collection and conveyance piping, manholes, valves, lagoons and pumps shall be conducted. The appropriate inspection mcthod(s) will be determined by US EPA in consultation with the PADEP during the Remedial Design.

3.b.2. Any deficiencies of the existing leachate management system identified under 3-b.1 shall be repaired. Repairs may include, but shall not be limited to, hydrocleaning, or replacing any collection system piping compromised by blockage, clogging, or structural failure, replacing manholes, manhole covers, valves and/or conveyance piping, repairing or replacing the collection lagoon liners and repairing/replacing the pumping system. US EPA, in consultation with PADEP, will determine the type of final repairs necessary to correct deficiencies identified under 3.b.1.

3.b.3. A plan for the long-term operation and maintenance of the leachate management system shall be included in an operation and maintenance plan for the Site. This plan shall include routine inspections of the system of a sufficient frequency to monitor and maintain the effectiveness of leachate management system over time. US EPA, in consultation with PADEP, will determine the type and frequency of inspections necessary to verify the performance of the system.

4. Landfill Cap Repairs

4.a. Description

This portion of the selected remedy calls for the repair of the existing landfill soil caps in order to establish and maintain a minimum of one foot of soil cover, a stable, maintainable well vegetated final cover, prevent direct contact with refuse and minimize excessive erosion and seepage to protect the final cover over the eastern landfill, western landfill, northern disposal area and the area behind the equipment building.

4.b. Performance Standards

4.b.1. A comprehensive inspection of the western landfill, eastern landfill, northern disposal area and the area behind the equipment building cap conditions including, but not limited to, cap thickness, vegetative cover, erosional areas and settlement cracks, landfill slopes, surface water management systems and passive gas vents shall be performed as part of the remedial design. The appropriate inspection method(s) will be determined by US EPA in consultation with the PADEP during the remedial design.

4.b.2. All large contiguous areas of the non-forested portion of the western landfill, the eastern landfill, the northern disposal area and the area behind the equipment building identified during 4.b.1 as having less than one foot in final cover thickness will be increased to a minimum of one foot of final cover material of a type similar to the

existing cover material. The definition of a large contiguous area will be determined by US EPA, in consultation with PADEP during the remedial design. The final cover material shall prevent vectors, odors, blowing litter and other nuisances. The final cover shall cover solid waste without change in its properties and without regard to weather. The final cover shall be noncombustible. The final cover shall be capable of supporting the germination of propagation of the vegetative cover under 4.b.3.

4.b.3. All areas where existing cover is disturbed for repairs in accordance with 4.b.2., 4.b.4., 4.b.6., 4.b.7., 4.b.8. and 4.b.9. will be reseeded with the following wildflower/grassland meadow seed mixture:

Big bluestem (Andropogon gerardii)	2.5 lbs/acre
Switchgrass (Panicum virgatum)	1 lb/acre
Indiangrass (Sorghastrum nutans)	2 lbs/acre
Little bluestem (Andropogon scopadus)	1 lb/acre
Sideoats grama (Bouteloua curtipendula)	1 lb/acre
New England aster (Aster novae-angliae)	2 oz/acre
Gray-headed coneflower (Ratibida pinnata)	3 oz/acre
Round-headed bushclover (Lespedeza capitata)	3 oz/acre
Black-eyed Susan (Rudbeckia hirta)	6 oz/acre

Revegetation shall provide for an effective and permanent cover. Disturbed and bare areas shall be seeded and planted when weather and planting season permit, however, the seeding and planting of disturbed areas shall be performed by the first normal period of favorable planting after final grading. The performance standard for successful revegetation shall be the percent of ground cover of the vegetation which exists on the Site. A minimum of 70% groundcover of the disturbed areas with the above permanent ground cover shall be required. No more than 1% of the total disturbed area shall have less than 30% ground cover. No single or contiguous disturbed area exceeding 3,000 square feet shall have less than 30% groundcover.

4.b.4. Existing shrub and small tree vegetation in areas identified in 4.b.1. with existing cap thickness greater than one foot and not disturbed for any repair under 4.b.2., 4.b.6., 4.b.7, 4.b.8. or 4.b.9. on the eastern landfill, northern disposal area and area behind the equipment building will be removed by herbicide application and/or flush cutting and then these areas will be seeded in accordance with 4.b.3.

4.b.5. The forested/maturing shrub tree areas of the western landfill shall be allowed to naturally succeed to the mature forest stage. The existing meadow area on the crown of the western landfill shall be addressed according to 4.b.4. and 4.b.6.

4.b.6. All bare areas with cover thickness greater than one foot shall be evaluated and corrective measures taken, including but not limited to, surface water management system repairs to prevent erosion; fertilizer and/or topsoil may be applied to rectify low fertility; and passive gas venting can be used to establish and maintain an effective well vegetated final cover. These areas shall be seeded in accordance with 4.b.3.

4.b.7. All existing cap areas identified during 4.b.1 with side slopes greater than 33% shall be repaired. No repaired area shall have a final side slope greater than 33%. The grade of final side slopes shall ensure permanent slope stability; control erosion due to rapid water velocity and other factors; and allow compaction, seeding and revegetation of cover material place on the slopes. The grade of the final surface of the cap areas shall not be less than 3%. For final slopes greater than 15% the necessity of horizontal terraces shall be determined by US EPA in consultation with PADEP during the

remedial design. If it is determined that existing horizontal terraces need repair or new horizontal terraces are necessary, the final design characteristics of the terraces shall be determined by US EPA in consultation PADEP. No slopes shall have a grade exceeding 33% including slopes between benched terraces.

4.b.8. The existing thin lens (approx. 20 foot by 50 foot) of exposed refuse on the northeastern portion of the eastern landfill and any other areas of exposed refuse identified under 4.b.1 shall be repaired in accordance with 4.b.2., 4.b.3, 4.b.7. and 4.b.9.

4.b.9. Soil erosion and sedimentation shall be prevented to the maximum extent possible. The need for stabilization and reseeding under Section 4.b.3 will be determined by US EPA in consultation with PADEP.

4.b.10. Surface water management shall comply with the requirements of The Dam Safety and Waterway Management Act, 25 PA Code °° 105.1 - 105.3, 105.12, and 105.19.

4.b.11. Routine sampling of combustible gas levels shall be required. US EPA in consultation with PADEP will determine the frequency, location, sampling and analytical methods for the combustible gas sampling during the remedial design. A plan for the routine monitoring of combustible gas levels shall be included in the operation and maintenance plan for the Site.

4.b.11. All cap repair activities shall avoid, minimize and mitigate impacts on floodplains and wetlands. The performance standard will be compliance with Executive Order No. 11988 and 40 CFR Part 6, Appendix A (regarding avoidance, minimization and mitigation of impacts on floodplains), and Executive Order No. 11990 and 40 CFR Part 6, Appendix A (regarding avoidance, minimization and mitigation of impacts on wetlands).

4.b.13. A plan for the long-term operation and maintenance of the forested/maturing shrub portion of the western landfill shall be included in an operation and maintenance plan for the Site. This plan shall include routine inspections of the forested/maturing shrub portion of a sufficient frequency to monitor and maintain the effectiveness of the final cap over time. US EPA, in consultation with PADEP, will determine the type and frequency of inspections and maintenance necessary to verify and maintain the performance of the cap.

4.b.14. A plan for the long-term operation and maintenance of the non-forested portion of the western landfill, the eastern landfill, the northern disposal area and the area behind the equipment building shall be included in an operation and maintenance plan for the Site. This plan shall include routine inspections of the system of a sufficient frequency to monitor and maintain the effectiveness of the final cap over time. US EPA, in consultation with PADEP, will determine the type and frequency of inspections and maintenance necessary to verify and maintain the performance of the cap.

Worker Safety

During all Site work, Occupational Safety and Health Administration ("OSHA") standards set forth at 29 C.F.R, Parts 1910, 1926 and 1904 governing worker safety during hazardous waste operations, shall be complied with.

Five-Year Reviews

Long-term monitoring, operation and maintenance of the leachate management system and operation and maintenance of the landfill caps shall continue for an estimated 30 years or such other time period as US EPA, in consultation with PADEP, 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 the initiation of the remedial action in accordance with the US EPA guidance document, Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 23, 1991). Five-year statutory reviews under Section 121 (c) of CERCLA will be required, as long as hazardous substances remain on-Site and prevent unlimited use and unrestricted access to the Site. Five-year reviews shall be conducted after the remedy is implemented to assure that the remedy continues to protect human health and the environment. A Five-year Review Work Plan shall be required and shall be approved by US EPA in consultation with the PADEP.

X. STATUTORY DETERMINATIONS

US EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. Section 121 of CERCLA also requires that the selected remedial action comply with ARARs, be cost effective, and utilize permanent treatment technologies to the maximum extent practicable. The following sections discuss how the selected remedy for the Berks Landfill Site meets these statutory requirements.

A. Protection of Human Health and the Environment

Based on the baseline Human Health Risk Assessment for the Berks Landfill Site, measures should be considered to reduce potential risk from VOCs and metals in the ground water beneath the Site. These contaminants in on-Site groundwater were selected because potential health hazards for some exposure scenarios exceeded the US EPA target range of 1.0 x 10 -4 (or 1 in 10,000), and 1. 0 x 10 -6 (or 1 in 1,000,000) for lifetime cancer risk or a non-cancer Hazard Index of one (1). The results of the Ecological Risk Assessment show that the Site does not pose an unacceptable risk to ecological receptors.

The institutional controls called for in the selected remedy will prevent future human exposure to on-Site ground water contaminants. US EPA is using its discretion based on Site-specific conditions to establish the point of compliance for ground water at the Site as the western, eastern and southern Site property boundaries and Wheatfield Road to the north. This point of compliance for ground water will be protective of human health and the environment.

Natural containment through institutional controls, natural attenuation and existing Site-specific hydrogeologic conditions in conjunction with long-term monitoring is protective of human health and the environment.

The long-term monitoring called for in the selected remedy will act as an early warning in the event that on-Site contaminants move beyond the point of compliance.

The cap repairs called for in the selected remedy in conjunction with the repair and continued operation and maintenance of the existing leachate management system will assist in maintaining the natural containment of on-Site ground water contaminants. The cap repair, and operation and maintenance portion of the selected remedy will insure that the caps will prevent direct contact with waste; provide a stable, maintainable, well vegetated soil cover; and minimize erosion and seeps in the future.

Implementation of the selected remedy will not pose any unacceptable short term risks or cross media impacts to the Site, or the community.

B. Compliance with and Attainment of Applicable or Relevant and Appropriate

Requirements ("ARARs")

The selected remedy will comply with all applicable or relevant and appropriate chemical-specific, location-specific and action-specific ARARs. Those ARARs are:

1. Chemical Specific ARARs

PADEP has identified the Land Recycling and Environmental Remediation Standards Act, 95 Pa. Laws 2 ("Act II"), as an ARAR for this remedy; however, US EPA has determined that Act II does not, on the facts and circumstances of this remedy, impose any requirements more stringent than the federal standards. Accordingly, groundwater cleanup Maximum Contaminant Levels and non-zero Maximum Contaminant Level Goals are set forth in accordance with Section 300g-1 of the Safe Drinking Water Act, 42 U.S.C. Section 1412, and its implementing regulations at 40 C.F.R. Part 141 as relevant and appropriate to the Selected Remedy at the point of compliance.

Compliance with groundwater concentration limitations at the point of compliance required by Section 121(d)(2)(A)(I) and (ii) of CERCLA and 40 C.F.R. Section 300.430(e)(2)(I)(B). Those limitations are established at 40 C.F.R. Sections 141.11-16, 141.50-51 and 141.60-63.

2. Location Specific ARARs

The Pennsylvania Erosion Control Regulations, 25 PA Code °° 102.1 - 102.5, 102.11 - 102.13, and 102.21 - 102.24, regulate erosion and sedimentation control. These regulation are applicable to the grading and excavation activities associated with the selected remedy.

The Storm Water Management Act of October 4, 1978, P.L. No. 167, as amended 32 P.S. Section 680.13. is applicable with respect to control of storm water runoff during construction,

The Dam Safety and Waterway Management Act, 25 PA Code °° 105.1 - 105.3, 105.12, and 105.19 are location-specific regulations for the surface water management system as it is considered waters of the Commonwealth.

3. Action Specific ARARs

Pennsylvania Municipal Waste Management Regulation, 25 PA Code Chapter 273 apply to the selected remedy. However, EPA is waiving these requirements because the remedial action selected in this Record of Decision will attain an equivalent standard of performance in the protection of human health and the environment through the cap repairs, continued leachate management system operation and long-term monitoring.

With respect of the discharge of water from the leachate collection system into a publicly owned treatment works, Federal Water Pollution Control Act, 33 U.S.C. º 1317; 40 C.F.R. °° 403.5 and 403.17; and 25 PA Code °° 97.1, 97.14-15 and 97.91-95.

Fugitive dust emissions generated during remedial activities will be controlled in order to comply with fugitive dust regulations in the federally-approved State Implementation Plan ("SIP") for the Commonwealth of Pennsylvania, 25 PA Code °° 123.1 - 123.2. and the National Ambient Air Quality Standards for Particulate Matter in 40 C.F.R. °° 50.6 and PA Code °° 131.2 and 131.3

25 PA Code °° 123.31 and 123.41 which prohibits malodors detectable beyond the Berks Landfill property line is applicable to the selected remedial alternative.

25 Pa. Code Chapter 107 is applicable to the drilling of any new wells at the Site. These regulations are established pursuant to the Water Well Drillers License Act, 32 P.S. º 645.1 et seq.

4. To Be Considered ("TBC") Standards

OWSER Directive #9355.7-04, Land Use in the CERCLA Remediation Selection Process, is a "to be considered" (TBC) requirement.

Sediment and erosion controls and temporary covers will be installed to protect exposed soil from the effects of weather in accordance with PADEP, Bureau of Soil and Water Conservation's Erosion and Sediment Pollution Control Manual which is a "to be considered" (TBC) requirement.

40 C.F.R. º 6.302 Subpart C (a) and (b) addressing wetlands and floodplains are "to be considered" requirements with regard to the cap repair portion of the selected remedy.

Any on-Site landscaping will be in accordance with Office of the Federal Executive; Guidance for Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds, 60 Fed. Reg. 40837 (August 10, 1995) which is a "to be considered" (TBC) requirement.

C. Cost-Effectiveness

The selected remedy is cost-effective in providing overall protection in proportion to cost, and meets all other requirements of CERCLA. Section 300.430(f)(ii)(D) of the NCP requires US EPA to evaluate cost-effectiveness by comparing all the alternatives which meet the threshold criteria - protection of human health and the environment and compliance with ARARS - against three additional balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment, and short-term effectiveness. The selected remedy meets these criteria and provides for overall effectiveness in proportion to its cost. The combined estimated present worth cost for the selected remedy presented in this Record of Decision is $6,084,940.

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

None of the remedial alternatives considered provides a permanent remedy. All alternatives rely on waste containment, institutional controls, natural attenuation, and long-term monitoring and maintenance to provide the necessary level of protection of human health and the environment. This is almost always the case when evaluating remedial alternatives for closed municipal solid waste landfills. US EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be, utilized while providing the best balance among the other evaluation criteria. Of those alternatives evaluated that are protective of human health-and the environment and meet ARARs, the selected remedy provides the best balance of tradeoffs in terms of long-term and short-term effectiveness and permanence, cost, implementability, reduction in toxicity, mobility, or volume through treatment, State and community acceptance, and preference for treatment as a principal element.

E. Preference for Treatment as a Principal Element

The selected remedy addresses the primary threat of future ingestion and inhalation of on-Site contaminated ground water through the use of institutional controls while natural processes such as dilution, dispersion, sorption and volatilization of contaminants are contributing to the

natural treatment and reduction of contaminant concentrations in the ground water at the point of compliance. To the extent that Site related contaminants are naturally treated and reduced at the point of compliance the selected remedy satisfies, in part, the statutory preference for treatment as a principal element.

As discussed above, an intrusive diabase mass is the most important geologic feature at the Site. This diabase mass, at the surface, encircles the Site except for possibly a small area to the southwest, and is present beneath the Site in a bowl-like configuration. The large diabase mass acts as a low permeability hydraulic barrier, deflecting ground water flow to the west, to its eventual discharge point, in the north west corner of the Site (See Figures 4. & 5.). Ground water discharges into the tributary of the Cacoosing Creek in this area. Water quality and aquatic organism sampling conducted in the tributary of the Cacoosing Creek and in the on-Site drainage ways shows that ground water discharging to the Cacoosing Creek tributary is not causing an increased risk to human health, or environmental receptors. It is believed that natural processes such as dilution, dispersion, sorption and volatilization of contaminants are contributing to the natural treatment and reduction of contaminant concentrations in the ground water. These natural contaminant reducing processes when combined with the unique diabase mass which forces ground water to discharge to the Cacoosing Creek tributary provide natural containment of the Site-related contaminants and does not allow them to move off-Site beyond the point of compliance.

XI. DOCUMEMATION OF CHANGES FROM PROPOSED PLAN

A. 25 PA Code Chapter 273(1988)

The Pennsylvania Department of Environmental Protection (PADEP) identified 25 PA Code Chapter 273 (1988), as an applicable, or relevant and appropriate requirement for the Site. Initially, US EPA did not consider Chapter 273 to be applicable, or relevant and appropriate as discussed in the April 25, 1997 Proposed Remedial Action Plan. After further consideration US EPA recognizes the Pennsylvania Municipal Waste Management Regulations, 25 PA Code Chapter 273 (1988) to be an applicable requirement because the closure of the landfills was not officially approved by PADEP. However, EPA believes that a waiver of these requirements, in accordance with 40 C.F.R. º 300.430(e)(9), is appropriate because the proposed remedy will otherwise achieve an equivalent standard of performance in the protection of human health or the environment as discussed above in Section VII.B.

B. Air Monitoring

EPA received public comments on the April 25, 1997 Proposed Remedial Action Plan regarding the effectiveness of the current landfill gas venting system as well as concerns regarding strong methane odors from the Site. EPA carefully considered the comments and has added air monitoring to the Long-term monitoring component of the selected remedy. Routine sampling of combustible gas levels shall be required. US EPA in consultation with PADEP will determine the frequency, location, sampling and analytical methods for the combustible gas sampling during the remedial design. A plan for the routine monitoring of combustible gas levels shall be included in the operation and maintenance plan for the Site.

Appendix A

Figures
Appendix B

Tables

TABLE 1.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/kg)	Arithmetic Mean 5 (mg/kg)
Butylbenzylphthalate	1/3	ND - 0.044	0.15
Chrysene	1/3	ND - 0.047	0.15
Fluoranthene	1/3	ND - 0.068	0.15
Pyrene	1/3	ND - 0.041	145
Aluminum	3/3	19,200 - 26,600	23,933
Arsenic	3/3	4.2 - 4.5	2.18
Barium	3/3	95.4 - 151	120
Beryllium	2/3	ND - 1.5	1.2
Calcium	3/3	2,720 - 5,740	4,030
Chromium	2/3	ND - 91.8	48.1
Cobalt	3/3	16.1 - 34.8	21.8
Copper	3/3	31.8 - 408	167
Iron	3/3	26,100 - 65,900	45,200
Lead	3/3	31.2 - 37.4	22
Magnesium	3/3	2,200 - 3,550	3,083
Manganese	3/3	712 - 1,350	537
Nickel	3/3	11.2 - 37.3	23.6
Potassium	3/3	619 - 3,130	1,552
Vanadium	3/3	67.6 - 152	96.9
Zinc	3/3	95.9 - 151	116

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in surface soil samples S1-BG, S2-BG, and S3-BG.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media subgroup. Data qualified with an N, B,JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 2.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations (mg/kg) 4	Arithmetic Mean (mg/kg) 5
2-Butanone	4/19	ND - 0.014	0.007
4-Methyl-2-Pentanone	1/19	ND - 0.004	0.006
Acetone	1/3	ND - 0.11	0.041
Chlorobenzene	1/18	ND - 0.002	0.006
Chloroform	1/19	ND - 0.006	0.006
Ethylbenzene	3/19	ND - 0.037	0.008
Toluene	3/19	ND - 0.18	0.015
Total Xylenes	4/18	ND - 0.073	0.01
1,4-Dichlorobenzene	1/19	ND - 0.12	0.2
2-Methylnaphthalene	2/19	ND - 0.12	0.191
Acenaphthene	2/19	ND - 0.38	0.202
Anthracene	2/19	ND - 0.655	0.217
Benzo(a)Anthracene	2/19	ND - 1.85	0.285
Benzo(a)Pyrene	2/19	ND - 1.21	0.249
Benzo(b)Fluoranthene	1/18	ND - 0.15	0.199
Benzo(g,h,i)Perylene	1/19	ND - 0.63	0.224
Benzo(k)Fluoranthene	1/18	ND - 0.068	0.194
Butylbenzylphthalate	2/19	ND - 0.063	0.192
Carbazole	1/19	ND - 0.37	0.21
Chrysene	2/19	ND - 1.5	0.267
Di-n-Octyl Phthalate	1/19	ND - 0.054	0.2
Dibenz(a,h)Anthracene	1/19	ND - 0.32	0.208
Dibenzofuran	2/19	ND - 0.26	0.196
Fluoranthene	7/19	ND - 3.15	0.326
Fluorene	2/19	ND - 0.46	0.206
Indeno(1,2,3-cd)Pyrene	1/19	ND - 0.58	0.221
Naphthalene	2/19	ND - 0.4	0.208
Pentachlorophenol	1/19	ND - 0.11	0.483
Phenanthrene	4/19	ND - 2.9	0.333
Phenol	1/19	ND - 0.12	0.202
Pyrene	5/19	ND - 2.7	0.312
Aroclor-1248	1/6	ND - 0.27	0.04

TABLE 2. Cont.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/kg)	Arithmetic Mean 5 (mg/kg)
Aluminum	19/19	5,430 - 33,400	20,731
Antimony	2/14	ND - 4.3	6.47
Arsenic	14/14	1.6 - 30.9	6.32
Barium	19/19	38.9 - 933	125
Beryllium	14/19	ND - 2	1.09
Cadmium	5/18	ND - 9.1	2.2
Calcium	19/19	2,040 - 20,600	6,896
Chromium	19/19	18.1 - 1,180	151
Cobalt	19/19	10.9 - 55.4	19.8
Copper	19/19	10.4 - 247	47.7
Iron	19/19	21,800 - 200,000	43,621
Lead	19/19	5.3 - 176.7	14.4
Magnesium	19/19	2,800 - 37,500	10,964
Manganese	19/19	293 - 6,030	798
Mercury	7/19	ND - 0.26	0.08
Nickel	19/19	21.5 - 771	96
Potassium	11/11	266.5 - 2,140	1,058
Selenium	2/19	ND - 66.2	4.31
Silver	1/19	ND - 0.67	1.15
Sodium	4/4	376 - 2,310	1,350
Vanadium	19/19	25.7 - 137	65.9
Zinc	19/19	57.1 - 332	103

Notes:

The determination of frequency of detactions and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1900).

1 Based on chemical concentrations in surface soil samples S1-EL, S1-WL, S2-EL, S2-WL, S3-EL, S3-WL, S4-EL, S4-WL, S5-EL, S5-WL, S6-EL, S6-WL, S7-EL, S7-WL, S8-EL, S8-WL, S9-EL, S10-EL, and S11-EL.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:

Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 3.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/l)	Arithmetic Mean 5 (mg/l)
Acetone	1/3	ND - 0.016	0.009
Benzene	2/6	ND - 0.008	0.006
Chlorobenzene	3/6	ND - 0.0145	0.006
Chloroethane	1/6	ND - 0.0155	0.007
Ethylbenzene	2/6	ND - 0.087	0.019
Toluene	3/6	ND - 0.005	0.004
Total Xylenes	2/6	ND - 0.15	0.035
1,4-Dichlorobenzene	1/2	ND - 0.0085	0.007
2-Methylnaphthalene	2/2	0.002 - 0.002	0.002
4-Chloro-3-Methylphenol	1/2	ND - 0.002	0.004
4-Methylphenol	1/2	ND - 0.001	0.003
Naphthalene	2/2	0.011 - 0.013	0.012
bis(2-Ethylhexyl)Phthalate	1/2	ND - 0.001	0.003
Aluminum	2/2	0.41 - 4.04	2.23
Arsenic	2/2	0.0091 - 0.0166	0.006
Barium	2/2	0.266 - 0.453	0.36
Cadmium	2/2	0.0022 - 0.0034	0.001
Calcium	2/2	46 - 121	83.5
Chromium	2/2	0.0128 - 0.0249	0.009
Cobalt	1/1	0.0313 - 0.0313	0.031
Copper	2/2	0.0042 - 0.0202	0.012
Iron	2/2	10.5 - 24.7	17.6
Lead	2/2	0.0156 - 0.0174	0.017
Magnesium	2/2	23.2 - 153	88.1
Manganese	2/2	0.88 - 2.26	1.57
Nickel	1/1	0.0997 - 0.0997	0.1
Potassium	2/2	49 - 345	197
Sodium	2/2	132 - 954	543
Vanadium	2/2	0.0079 - 0.0203	0.014
Zinc	2/2	.0974 - 0.213	0.131

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data usability in Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in leachate seep water samples L1-EL, L1-WL, L2-EL, L2-WL, L3-EL, L3-WL.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualiftd with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 4.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/l)	Arithmetic Mean 5 (mg/l)
Badum	2/2	0.0224 - 0.0235	0.023
Calcium	3/3	29.2-35.9	32.4
Copper	1/3	ND - 0.0042	0.01
Iron	2/2	0.203 - 0.461	0.332
Magnesium	3/3	11 - 12.6	11.7
Manganese	2/2	0.0235 - 0.0673	0.045
Potassium	2/3	ND - 1.8	1.94
Selenium	1/3	ND - 0.0032	0.003
Sodium	3/3	6.21 - 7.53	3.46

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1900).

1 Based on chemical concentrations in surface water samples SW-1, SW-3, and SW-4.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media subgroup. Data qualified with an N, B, JN or R we not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value:
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 5.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/l)	Arithmetic Mean 5 (mg/l)
Aluminum	3/3	0.156 - 0.238	0.2
Barium	7/7	0.0114 - 0.0354	0.027
Calcium	8/8	27.4 - 50.7	40
Cyanide	1/8	ND - 0.0519	0.011
Iron	5/5	0.222 - 0.675	0.441
Magnesium	8/8	11.3 - 15.9	13.5
Manganese	8/8	0.0104 - 0.276	0.104
Potassium	8/8	1.11 - 4.09	2.27
Sodium	8/8	6.68 - 19.6	7.16
Vanadium	3/8	ND - 0.0048	0.017

Notes:
The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in surface water samples SW-6, SW-7, SW-8, SW-9, SW-10, SW-11, SW-12, and SW-13.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered d detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier One-half the reported value, is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 6.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/kg)	Arithmetic Mean 5 (mg/kg)
Benzo(a)Anthracene	1/4	ND - 0.17	0.211
Benzo(a)Pyrene	1/4	ND - 0.11	0.196
Benzo(b)Fluoranthene	1/3	ND - 0.061	0.16
Benzo(k)Fluoranthene	1/3	ND - 0.079	0.166
Chrysene	1/4	ND - 0.13	0.201
Fluoranthene	1/4	ND - 0.26	0.234
Indeno(1,2,3-cd)Pyrene	1/4	ND - 0.088	0.191
Phenanthrene	1/4	ND - 0.087	0.191
Pyrene	1/4	ND - 0.19	0.216
Aluminum	4/4	10,600 - 24,200	14,300
Arsenic	4/4	3.2 - 10.7	5.28
Barium	4/4	56.8 - 102	75.7
Beryllium	2/4	ND - 1.5	1.03
Calcium	4/4	4,330 - 7.040	5,525
Chromium	4/4	16.5 - 23.6	19.8
Cobalt	4/4	18 - 21.6	19.5
Copper	4/4	18.5 - 69.6	46.1
Iron	4/4	25,000 - 36,000	31,175
Lead	4/4	8.6 - 31.4	17.1
Magnesium	4/4	1,760 - 4,250	2,733
Manganese	4/4	601 - 1,650	915
Nickel	3/4	ND - 17.5	14.0
Potassium	1/4	ND - 1,430	873
Sodium	1/1	904 - 904	904
Vanadium	4/4	62.6 - 134	108
Zinc	4/4	61.8 - 90.5	74.7

Notes:
The determination of frequency or detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability in Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in sediment samples SED-1, SED-2, SED-3, and SED-4.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent a detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 7.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/kg)	Arithmetic Mean 5 (mg/kg) TABLE 4.
Benzo(a)Anthracene	4/10	ND - 0.1	0.173
Benzo(b)Fluoranthene	1/5	ND - 0.067	0.204
Chrysene	4/10	ND - 0.089	0.172
Fluoranthene	6/10	ND - 0.18	0.162
Phenanthrene	3/10	ND - 0.13	0.194
Pyrene	5/10	ND - 0.11	0.162
Aluminum	10/10	7,200 - 17,300	11,061
Arsenic	10/10	1.55 - 4.4	2.64
Barium	10/10	42.3 - 115	73.3
Beryllium	5/10	ND - 1.3	0.91
Cadmium	3/10	ND - 4.7	1.82
Calcium	10/10	3,350 - 12,400	6,505
Chromium	10/10	9.1 - 35	20
Cobalt	10/10	11.2 - 30.7	16.6
Copper	10/10	15.4 - 67.9	38.9
Iron	10/10	16,500 - 36,300	27,290
Lead	10/10	5.9 - 19.7	9.72
Magnesium	10/10	,020 - 6,920	4,299
Manganese	10/10	758 - 1,309	931.2
Mercury	2/9	ND - 0.24	0.1
Nickel	10/10	11.3 - 34.5	16.6
Potassium	5/10	ND - 1,250	778
Vanadium	10/10	41.9 - 138	87.2
Zinc	10/10	50.4 - 110	72.6

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in sediment samples SED-5, SED-6, SED-7, SED-8, SED-9, SED-10, and SED-11.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:

Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 8.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/l)	Arithmetic Mean 5 (mg/l)
1, 1 -Dichloroethane	1/2	ND - 0.004	0.008
1, 1 -Dichloroethene	1/2	ND - 0.012	0.011
2-Butanone	1/2	0.16 - 0.19	0.175
4-Methyl-2-Pentanone	1/2	ND - 0.028	0.02
Acetone	1/1	0.1 - 0.1	0.1
Benzene	2/2	0.014 - 0.021	0.018
Chlorobenzene	2/2	0.003 - 0.01	0.007
Ethylbenzene	2/2	0.054 - 0.079	0.067
Tetrachloroethene	2/2	0.003 - 0.0085	0.006
Toluene	2/2	0.24 - 0.37	0.305
Total 1,2-Dichloroethene	2/2	0.045 - 0.075	0.06
Total Xylenes	2/2	0.15 - 0.24	0.195
Trichloroethene	2/2	0.006 - 0.0165	0.011
Vinyl Chloride	2/2	0.007 - 0.011	0.009
1,2-Dichlorobenzene	1/2	ND - 0.003	0.004
1,4-Dichlorobenzene	2/2	0.003 - 0.0075	0.006
2,4-Dimethylphenol	1/2	ND - 0.001	0.003
2-Methylphenol	2/2	0.002 - 0.002	0.002
4-Methylphenol	2/2	0.001 - 0.17	0.091
Diethylphthalate	1/1	0.001 - 0.001	0.001
Isophorone	1/2	ND - 0.0015	0.006
Naphthalene	1/2	ND - 0.003	0.004
Phenol	1/2	ND - 0.03	0.018
Barium	2/2	0.384 - 0.623	0.503
Calcium	2/2	124 - 173	149
Chromium	1/2	ND - 0.0138	0.009
Cobalt	1/1	.0118 - 0.0118	0.012
Iron	2/2	9.61 - 35.4	22.5
Magnesium	2/2	63.2 - 86.5	74.9
Manganese	2/2	4.45 - 5.83	5.14
Nickel	1/1	0.0311 - 0.0311	0.031
Potassium	2/2	28.3 - 38.5	33.4
Sodium	2/2	201 - 275	238

Notes:

The determination of frequency of detections are the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in lagoon water samples L1-MH1 and L2-MH1.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media subgroup. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:

Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 9.

SUMMARY OF DETECTED CHEMICALS IN BACKGROUND SURFACE SOIL SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations (mg/l)4	Arithmetic Mean (mg/l)5
1,2-Dichloroethane	1/19	ND - 0.0005	0.00216
Bromomethane	1/19	ND - 0.014	0.003
Chloromethane	1/19	ND - 0.02	0.003
Aluminum	7/8	ND - 58.3	25.783
Arsenic	5/10	ND - 0.008	0.006
Barium	7/9	ND - 0.173	0.091
Beryllium	3/10	ND - 0.006	0.003
Cadmium	2/10	ND - 0.013	0.004
Calcium	10/10	20.2 - 62.7	37.65
Chromium	4/10	ND - 0.098	0.025
Cobalt	6/10	ND - 0.028	0.024
Copper	8/9	ND - 0.272	0.094
Cyanide	1/3	ND - 0.045	0.018
Iron	7/8	ND - 66.4	32.114
Lead	7/9	ND - 0.017	0.007
Magnesium	10/10	4.29 - 22.6	12.599
Manganese	7/10	ND - 1.24	0.499
Nickel	2/9	ND - 0.076	0.025
Potassium	8/10	ND - 4.09	1.99
Sodium	10/10	5.41 - 12.3	7.914
Vanadium	9/10	ND - 0.156	0.07
Zinc	7/8	ND - 0.136	0.073

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability In Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in Monitoring Wells G-2, G-3, G-7, G-8, and G-10; Residential Wells CASS, REIFSNYDER, and HEINZ.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic mean where:
Field duplicate and primary sample results are averaged for a sample value
The highest value of either the primary of reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for data containing 'U' in its qualifier
One-half the reported value is used for data qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 10.

SUMMARY OF DETECTED CHEMICALS IN ONSITE GROUNDWATER SAMPLES
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 1	Frequency Of Detection 2	Range Of Detected Concentrations 3 (mg/l)	Arithmetic Mean 4 (mg/l)
1,1,1-Trichloroethane	1/43	ND - 0.006	0.010
1,1,2-Trichloroethane	1/43	ND - 0.001	0.009
1,1-Dichloroethane	17/43	ND - 0.009	0.010
1,1-Dichloroethene	2/43	ND - 0.014	0.010
1,2-Dichloroethane	3/43	ND - 0.002	0.010
1,2-Dichloropropane	2/43	ND - 0.002	0.010
2-Butanone	2/38	ND - 0.039	0.012
Acetone	3/37	ND - 0.019	0.011
Benzene	10/43	ND - 0.013	0.010
Carbon Disulfide	1/43	ND - 0.003	0.010
Chlorobenzene	14/43	ND - 0.022	0.011
Chloroethane	6/42	ND - 0.027	0.010
Chloromethane	1/43	ND - 0.006	0.010
Ethylbenzene	2/43	ND - 0.023	0.011
Tetrachloroethene	1/43	ND - 0.001	0.009
Total 1,2-Dichloroethene	14/38	ND - 3.7	0.208
Total Xylenes	2/43	ND - 0.11	0.015
Trichloroethene	11/43	ND - 3.1	0.140
Vinyl Chloride	11/43	ND - 0.37	0.021
cis-1,2-Dichloroethene	6/7	ND - 0.007	0.002
1,2-Dichlorobenzene	2/41	ND - 0.002	0.004
1,3-Dichlorobenzene	1/41	ND - 0.009	0.005
1,4-Dichlorobenzene	13/39	ND - 0.010	0.005
2,4-Dimethylphenol	1/38	ND - 0.004	0.005
3-Nitroanline	1/37	ND - 0.001	0.012
4-Methylphenol	1/38	ND - 0.001	0.005
4-Nitroaniline	1/37	ND - 0.007	0.012
Butylbenzylphthalate	3/37	ND - 0.002	0.005
Di-n-Octyl Phthalate	1/37	ND - 0.004	0.005
Di-n-butylphthalate	1/24	ND - 0.001	0.005
Diethylphthalate	1/24	ND - 0.022	0.006
Hexachloroethane	2/37	ND - 0.006	0.005
Isophorone	2/37	ND - 0.002	0.005
N-Nitroso-di-n-propylamine	1/37	ND - 0.001	0.005
Naphthalene	4/39	ND - 0.005	0.005
bis(2-Ethylhexyl)Phthalate	4/12	ND - 0.095	0.005

TABLE 10.

SUMMARY OF DETECTED CHEMICALS IN ONSITE GROUNDWATER SAMPLES
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 1	Frequency Of Detection 2	Range Of Detected Concentrations 3 (mg/l)	Arithmetic Mean 4 (mg/l)
Aluminum	17/17	0.618 - 147	20.121
Arsenic	19/38	ND - 0.028	0.007
Barium	36/37	ND - 1.37	0.220
Beryllium	7/38	ND - 0.006	0.002
Cadmium	6/29	ND - 0.014	0.003
Calcium	39/39	13.4 - 476.5	164.699
Chromium	10/39	ND - 0.085	0.012
Cobalt	15/39	ND - 0.034	0.022
Copper	27/34	ND - 0.248	0.033
Iron	34/34	0.126 - 119	14.837
Lead	18/35	ND - 0.233	0.013
Magnesium	39/39	4.97 - 153	49.941
Manganese	38/38	0.016 - 27.6	3.302
Mercury	1/35	ND - 0.00025	0.0001
Nickel	13/37	ND - 0.104	0.025
Potassium	33/39	ND - 32.6	6.207
Selenium	1/11	ND - 0.004	0.003
Silver	1/35	ND - 0.003	0.005
Sodium	39/39	3.45 - 429	47.591
Vanadium	14/39	ND - 0.111	0.026
Zinc	23/23	0.016 - 0.919	0.133

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989s) and Guidance for Data Usability in Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in Monitoring Wells C-1, C-2, C-3, C-4, C-5, C-6, C-7, G-1, G,5, G-6, G-11, G-12, G-13, GR-18, GR-19, MD-2, MP-3, MP-6, MP-11, M-15, M-16, M-17, MP-18, and MP-19; Residential Wells NEIN, and Auction House.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for date containing 'U' in its qualifier
One-half the reported value is used for date qualified as K or L
The full reported value is used for data qualified as A or J

TABLE 11.

SUMMARY OF DETECTED CHEMICALS IN OFFSITE RESIDENTIAL GROUNDWATER SAMPLES 1
BERKS LANDFILL
BERKS COUNTY, PENNSYLVANIA

Constituents Detected 2	Frequency Of Detection 3	Range Of Detected Concentrations 4 (mg/l)	Arithmetic Mean 5 (mg/l)
1,1,2-Trichloroethane	1/32	ND - 0.0006	0.001
1,2-Dichloroethane	2/32	ND - 0.002	0.001
Chloroform	1/32	ND - 0.0006	0.001
Toluene	1/32	ND - 0.0009	0.001
Arsenic	1/3	ND - 0.006	0.005
Barium	2/2	0.0233 - 0.028	0.026
Calcium	3/3	51.7 - 70.7	64.2
Copper	1/2	ND - 0.0311	0.0218
Magnesium	3/3	0.857 - 2.47	1.92
Nickel	1/3	ND - 0.0418	0.027
Potassium	1/3	ND - 0.466	1.82
Sodium	3/3	27.9 - 37.9	28.9
Zinc	1/1	0.01 - 0.01	0.01

Notes:

The determination of frequency of detections and the calculation of mean concentrations are performed in accordance with the procedures outlined in Risk Assessment Guidance For Superfund (RAGS), Volume 1 (USEPA, 1989a) and Guidance for Data Usability in Risk Assessment, Interim Final (USEPA, 1990).

1 Based on chemical concentrations in Monitoring Wels Bechtald, Berkel, Botch/Roberts, Breitegam, Buller, Cremer, and Faust.

2 Constituent is listed if it was detected at a frequency of at least once in the environmental media. Only constituents qualified with an A, J, K, or L are considered detected.

3 Frequency of Detection is the number of times a constituent is detected over the number of times a constituent was analyzed in each media. Data qualified with an N, B, JN or R are not counted in the determination of frequency of detection.

4 ND = Not detected.

5 Mean is the Arithmetic Mean where:
Field duplicate and primary sample results are averaged for a given sample value
The highest value of either the primary or reanalysis is used for a given sample
One-half the SQL or CRDL is used as the result for date containing 'U' in its qualifier
One-half the reported value is used for date qualified as K or L
The full reported value is used for data qualified as A or J

Table 12.

Summary of Cumulative Risks Posed by Exposure Route

	Cancer Risk	Hazard Index
Background	3 x 10 -4	6.00
Off-Site Residential	2 x 10 -4	<1
On Site Trespasser	1 X 10 -6	<1
On Site Worker	6 x 10 -7	<1
Future On-Site Residential	1 x 10 -3	15.00

Table 13.

Summary of
Remedial Alternative Cost Estimates
Berks Landfill

Alternative No	Capital Cost (1)	Annual Operations and Maintenance Cost (2)	Present*** Worth (3)
1	$ -	$ -	$ -
2	$ 765,900	$ 74,100	$ 2,102,664
3	$ 1,018,650	$ 142,200	$ 3,584,300
4(4)	$ 2,001,790 to $ 5,336,440	$ 159,000 to $ 224,000	$ 6,042,762 to $ 8,234,800
5(4)	$ 2,147,340 to $ 5,511,990	$ 181,200 to $ 246,200	$ 6,589,160 to $ 8,781,198
7(4)	$ 3,300,090 to $ 6,664,740	$ 447,980 to $ 512,980	$ 12,554,261 to $ 14,746,299

(1) The Capital Cost includes a 20% Design/Administrative Cost and a 30% Construction Contingency.
(2) The Annual Operations and Maintenance (O&M) Costs include a 30% Contingency.
(3) The Present Worth is based upon a 3% rate of inflation and a 6% discount rate, for a 30 year O&M period.
(4) Because these alternatives contain cap repairs, the costs vary in accordance with the individual cap repair alternative. Therefore, the costs in this table are expressed as a range that includes the cap repairs with the least and highest cost as defined in Attachment C. The range in costs between cap repair alternatives are capital $1,128,702 to $4,314,840; annual O&M $39,000 to $104,000; and present worth $3,004,862 to $5,018,400.

Table 14.

Alternative Cost Summary
Cap Repair Alternatives
Berks Landfill

ALTERNATIVE NUMBER	ESTIMATED COST OF REMEDIAL ALTERNATIVE LESS CAP REPAIR COMPONENT			ESTIMATED COST OF CAP REPAIR COMPONENT			TOTAL ESTIMATED COST FOR REMEDIAL ALTERNATIVE		
	Capital O&M	Annual Present Worth	Total	Capital O&M	Annual Present Worth	Total	Capital O&M	Annual Present Worth	Total
4A	$873,100	$120,000	$3,037,900	$1,128,690	$104,000	$3,004,862	$2,001,790	$224,000	$6,042,762
4B	$873,100	$120,000	$3,037,900	$1,639,920	$78,000	$3,047,040	$2,513,020	$198,000	$6,084,940
4C	$873,100	$120,000	$3,037,900	$3,504,660	$52,000	$4,442,740	$4,377,760	$172,000	$7,480,560
4D	$873,100	$120,000	$3,037,900	$4,493,340	$39,000	$5,196,900	$5,366,440	$159,000	$8,234,800

Appendix C

Toxicological Profiles

Vinyl Chloride is a gas used to manufacture polyvinyl chloride (PVC) which is contained in many plastic and vinyl products. It is recognized by the EPA as a class A carcinogen. Chronic exposure to vinyl chloride has been shown to cause angiosarcoma of the liver, a form of cancer. Increased risk of cancer of the brain, lungs, other organs as well as possible miscarriages have also been associated with inhalation of vinyl chloride. In humans, acute inhalation exposure to 0.8 to 2.0% vinyl chloride has been associated with central nervous system depression resembling mild alcohol intoxication.

Arsenic is a naturally occurring metal that is present in the environment as a constituent of many organic and inorganic compounds. Arsenic is a known human carcinogen implicated in skin cancer in humans. Inhalation of arsenic by workers is known to cause lung cancer. Arsenic compounds cause chromosome damage in animals, and humans exposed to arsenic compounds have an increased incidence of chromosomal aberrations. Arsenic compounds are reported to be teratogenic, fetoxic, and embryotoxic in some animal species. Dermatitis and associated lesions are attributable to arsenic coming into contact with the skin, with acute dermatitis being more common than chronic. Chronic industrial exposures may be characterized by hyperkeratosis, and an accompanying hyperhidrosis (excessive sweating usually of the palms and soles of the feet).

Manganese is a steel-gray, hard, brittle metal that is naturally-occurring in the earth's crust. Manganese is used in the iron and steel industry, and in the manufacture of dry cell batteries, paints, dyes, matches and fireworks. Although manganese has a relatively low order of toxicity, chronic exposure can cause degenerative changes in the central nervous system. Symptoms of manganese toxicity include apathy, anorexia, headache, weakness of the legs, irritability, mental confusion, and aggressiveness. As manganese exposure continues, the symptoms of toxicity become indistinguishable from classical Parkinson's disease.

Beryllium is a grey, light weight, naturally occurring metal that possesses a high tensile strength. Because of its physical properties beryllium is used extensively in manufacturing electrical components, chemicals, ceramics, and x-ray tubes. Soluble beryllium salts as may be found in ground water are primary irritants; that is, these compounds can cause contact dermatitis to areas of exposed skin. Beryllium exposure may also cause inflammation of the conjunctiva of the eyes. Additionally, chronic exposure to beryllium via the inhalation route, which occurs also exclusively in an occupational setting, has been associated with respiratory distress, weakness, fatigue, joint pain, weight loss, and liver dysfunction. Because there is evidence that exposure to beryllium may cause cancer in some strains of laboratory animals, this metal has been classified by the US EPA as a Group B - Probable Human Carcinogen. It is important to note, however, that there is no conclusive evidence that exposure to beryllium has ever caused cancer in humans.

APPENDIX D

RESPONSIVENESS SUMMARY
FOR THE
PROPOSED REMEDIAL ACTION PLAN
AT THE
BERKS LANDFILL SUPERFUND SITE
SPRING TOWNSHIP, BERKS COUNTY, PENNSYLVANIA

Public Comment Period
April 25, 1997, through May 26, 1997

Berks Landfill Superfund Site

Responsiveness Summary
for the
Proposed Remedial Action Plan

TABLE OF CONTENTS

Responsiveness Summary
Berks Landfill Superfund Site
Spring Township, Berks County, Pennsylvania

This Responsiveness Summary is divided into the following sections:

Overview: This section discusses the U.S. Environmental Protection Agency's (US EPA) preferred alternative for remedial action.

Background: This section provides a brief history of community interest and concerns raised during remedial planning at the Berks Landfill Site.

Part I: This section provides a summary of commentors' major issues and concerns, and US EPA's responses to those issues and concerns. "Commentors" may includelocal homeowners, businesses, the municipality, and potentially responsible parties (PRPs).

Part II: This section provides a comprehensive response to all significant comments and is comprised primarily of the specific legal and technical questions raised during the public comment period. If necessary, this section will provide technical detail to answers from Part I.

Any points of conflict or ambiguity between information provided in Parts I and II of this Responsiveness Summary will be resolved in favor of the detailed technical and legal presentation contained in Part II.

Overview

On April 25, 1997, US EPA announced the opening of the public comment period and published the Proposed Remedial Action Plan (Proposed Plan) for the Berks Landfill Superfand Site (the Site), located in Spring Township, Berks County, Pennsylvania. The Proposed Plan details US EPA's preferred clean-up alternative for the Berks Landfill Site. US EPA screened several possible alternatives to clean-up the Site contamination, giving consideration to the following nine evaluation criteria:

Threshold Criteria
- Overall protection of human health and the environment
- Compliance with Federal, state, and local environmental statutes

Balancing Criteria
- Long-term effectiveness and permanence
- Reduction of mobility, toxicity, or volume of contaminants
- Short-term effectiveness
- Ability to implement
- Cost

Modifying Criteria
- State acceptance
- Community acceptance

US EPA carefully considered state and community acceptance of the clean-up alternative before reaching the final decision regarding the clean-up plan. The Record of Decision (ROD) details US EPA's final clean-up decision.

US EPA's preferred clean-up alternative is outlined below. Based on current information, this alternative provides the best balance among the alternatives with respect to the nine evaluation criteria US EPA used to evaluate each alternative. The selected alternative, Alternative 4: Institutional Controls, Monitoring, Leachate Management System Operation, and Landfill Cap Repair Alternative 4B, consists of the following components:

1.) Institutional Controls, including title restrictions, restrictive covenants, etc. to prevent future consumption of on-site ground water, restrict future development at the Site and limit future earth moving activities at the Site;

2.) Long-term Monitoring, including installation of a sentinel monitoring well cluster, sampling of residential wells, on-site monitoring wells, aquatic habitat and combustible gases;

3.) Leachate Management System Operation & Maintenance, and,

4.) Cap Repair and Maintenance, to include, a minimum one foot in final cover thickness on the eastern landfill and non forested portions of the western landfill. The eastern landfill and non-forested portions of Western Landfill will be maintained as wildflower/grass meadow (mowed once per year). Forested portions of western landfill will remain and be maintained.

Background

Community interest and concern about the Berks Landfill Site has been steady throughout US EPA's involvement. US EPA held a public availability session on January 29, 1990 at the Wilson Southern Jr. High School to introduce US EPA staff, review the Superfund process and update the community on upcoming Site activities. US EPA issued a Fact Sheet in August 1990 discussing the Superfund process and removal actions planned by US EPA to address conditions at the Site which US EPA felt posed an immediate risk to human health while Site-wide long-term remedial actions were contemplated.

In January 1991 US EPA issued a Fact Sheet discussing the removal actions taken at the Site and upcoming remedial actions to be taken to identify the nature and extent of contaminants at the Site.

On August 28, 1991 US EPA completed a Community Relations Plan for the Site. The Plan highlighted issues, concerns and interests of the community located near the Site which were raised during community interviews.

In July, 1992 US EPA issued a Fact Sheet announcing the approval of the Remedial Investigation/Feasibility Study Work Plan. The July 1992 Fact Sheet briefly outlined the work to be performed during the RI/FS and gave a general time line for completion of the work. The July 1992 Fact Sheet also announced a public meeting which was held on July 27, 1992 at the Southern Junior High School. Questions regarding the RI/FS work plan and a draft Community Relations Plan were discussed at the meeting.

In July 1996 US EPA issued a Fact Sheet to keep the community informed of Site related activities. The Fact Sheet briefly explained the findings of the RI, the Superfund Process, and the nature and extent of Site contamination.

Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") º 113(k)(2)(b)(i)-(v), US EPA released for public comment the final RI/FS reports and the Proposed Remedial Action Plan setting forth US EPA's preferred alternative for the

Berks Landfill Site on April 25, 1997. US EPA made these documents available to the public in the Administrative Record located at the US EPA Docket Room in Region III's Philadelphia office, and at the Sinking Spring Public Library, Sinking Spring, Pennsylvania. The notice of availability of these documents was published in the Reading Eagle and the Merchandiser on April 25, 1997 and May 14, 1997, respectively.

A public comment period on the documents was held from April 25, 1997 to May 26, 1997. In May, 1997 US EPA issued a Fact Sheet announcing the availability of the Proposed Remedial Action plan and public meeting. The May 1997 Fact Sheet discussed US EPA's Preferred Alternative, as well as other alternatives evaluated by US EPA and solicited comments from all interested parties. In addition, US EPA conducted a public meeting on May 14, 1997. At this meeting, US EPA representatives answered questions about conditions at the Site and the remedial alternatives under consideration.

Part I: Summary of Commentors' Major Issues and Concerns

This section provides a summary of commentors' major issues and concerns and US EPA's responses to those issues and concerns. "Commentors" may include local homeowners, businesses, the municipality, and PRPs. The major issues and concerns about the proposed clean-up plan for the Berks Landfill Site received during the public meeting on May 14, 1997, and during the public comment period are grouped into the following categories:

A. Sampling
B. Leachate
C. Land Use Issues
D. Landfill Capping
E. The Cleanup
F. The PRPs and Their Role
G. Site Contamination
H. Surface and Ground Water
I. The Site
J. The Soil

A. Sampling

1. How often will EPA test residential wells?

EPA Response: US EPA understands and shares citizens concerns regarding regular monitoring of residential wells to insure that human health and the environment continues to be protected in the future. As a result, residential wells will be sampled quarterly for Target Compound List ("TCL") Volatile Organic Compounds ("VOCs") and semi-annually for Target Analyte List ("TAL") metals for the first year of sampling. The Residential wells will be sampled no less than semi-annually for TCL VOCs and annually for TAL metals for the second through fifth year of sampling. Based on the findings of the first five years of sampling, the appropriate sampling frequency for subsequent years will be determined by US EPA in consultation with the PADEP.

2. How many residential wells did EPA test?

EPA Response: As part of the Remedial Investigation for the Berks Landfill Superfund Site, US EPA required the testing of a total of eleven residential wells. However, as a result of the information collected during the Remedial Investigation three residential wells were determined to be background wells because they were found to be hydrogeologically isolated from the Site. Therefore, a total of eight downgradient residential wells were sampled on five different occasions as part of the Remedial Investigation.

3. Do sampling results vary from day to day?

EPA Response: There may be natural fluctuations in the levels of contaminants in wells, although levels do not tend to fluctuate from day to day. Over time there may be minor fluctuations resulting from seasonal conditions.

4. Will EPA accept well sampling results from a private lab?

EPA Response: Yes, US EPA will consider sampling results submitted by residents. However, if a resident has a sample tested independently, US EPA at its discretion will typically take an additional sample to verify the results. If the resident wishes, the sample would be split between the resident's chosen lab and US EPA's chosen lab for analysis to ensure that the sample was taken at the same time and from the same location. The results would then be compared.

5. Why are the wells on the western landfill not being tested? When were these wells last sampled?

EPA Response: As part of the Remedial Investigation US EPA required all on-Site monitoring wells to be tested, including the wells on the western landfill. US EPA last required wells on the western landfill be sampled during the remedial investigation activities in approximately 1993. As part of the Selected Remedy set forth in the Record of Decision, on-Site monitoring wells are required to be sampled annually for the first five years of sampling. Based on the findings of the first five years of sampling, the appropriate frequency of subsequent sampling will be determined by US EPA, in consultation with PADEP.

6. What materials were found in the wells upgradient of the Site?

EPA Response: Arsenic, manganese, and beryllium were found in upgradient background wells as well as low concentrations of 1,2-dichloroethane, chloromethane, and bromomethane. EPA has determined that arsenic, manganese and beryllium are the result of naturally occurring geologic conditions on and near the Site since similar concentrations were found upgradient and downgradient from the Site. EPA has determined that the VOCs are not Site related since the same compounds were not found in wells sampled on and downgradient of the Site.

7. How far below the surface were ground water samples taken?

EPA Response: The depth of the ground water samples taken during the Remedial Investigation varied depending upon the location of the well being sampled. The deepest wells sampled were between 200 and 250 feet deep. Near the Cacoossing Creek tributary, the wells were very shallow since the ground water was so near the surface.

8. Would it be more cost-effective to connect residents to the public water supply than to continue testing residential wells?

EPA Response: US EPA has determined that there is no risk to human health and the environment outside the point of compliance, which is the western, eastern and southern Site property boundaries and Wheatfield Road to the north, due to ground water contamination. Therefore, US EPA does not have the authority under CERCLA to take an action such as connecting residents to the public water supply since no risk to human health and the environment has been demonstrated. However, US EPA will require that sufficient monitoring be done to insure that human health and the environment continue to be protected in the future.

B. Leachate

1. Why has EPA not proposed to remove the leachate collection lagoons?

EPA Response: The leachate management system currently collects and discharges Site leachate to the Spring Township publicly owned treatment works. Additionally, US EPA has determined that the leachate collection lagoons pose no risk to human health or the environment. Therefore, US EPA does not have the authority under CERCLA to take an action such as removing the leachate collection lagoons. The Selected Remedy calls for the repair and continued operation and maintenance of the leachate collection system so that the current Site conditions will be maintained in the future.

2. Are the leachate collection lagoons in a floodplain and is that allowable?

EPA Response: The leachate collection lagoons are at least partially in a floodplain. Although there are certain restrictions for placing lagoons in a floodplain, it is allowable. The Selected Remedy will comply with all applicable or relevant and appropriate requirements for the leachate collection system.

3. Could EPA use the money allocated for the landfill caps to cover the lagoons?

EPA Rcsponse: US EPA has determined that the leachate collection lagoons pose no risk to human health or the environment. Therefore, US EPA does not have the authority under CERCLA to take an action such as removing the leachate collection lagoons. However, the leachate management system currently collects and discharges Site leachate to the Spring Township publicly owned treatment works. The Selected Remedy calls for the repair, and continued operation and maintenance of the leachate collection system so that the current Site conditions will be maintained in the future.

4. Is leachate flowing from the landfill into the stream?

EPA Response: US EPA has not detected any leachate flowing from the landfill into the on-Site drainageways or into the Cacoosing Creek tributary.

5. Could there be a naturally-occurring fracture completely through the underlying rock that would allow leachate to enter the ground water?

EPA Responses: While drilling on-Site monitoring wells, fractures were encountered in the first several feet of the diabase mass. However, fewer and fewer fractures, were encountered the farther the wells were advanced into the diabase due to the extreme natural density of the diabase. Therefore, since the diabase mass is typically several hundred feet thick in the Site area it is highly unlikely that naturally occurring fractures could exist completely through the diabase mass.

C. Land Use Issues

1. A resident requested information concerning the actions EPA proposes to take regarding use of the Nein property. Will the PRPs purchase the property? If so, will the PRPs turn the property over to the township?

EPA Response: The Selected Remedy requires institutional controls which will be used to identify the Site as property underlain by contaminated groundwater; to prevent the consumption of contaminated ground water; to restrict future development at the Site; and to limit future earth disturbing activities on the capped portions of the Site. The Nein property would be affected by these institutional controls. It is US EPA's understanding that certain PRPs are

investigating the purchase of the Nein property. Regardless of the final disposition of the Nein property, the Selected Remedy must be implemented and maintained to protect human health and the environment. US EPA will continue to routinely update interested parties as implementation of the Selected Remedy progresses.

2. What are EPA's intentions with respect to the landfill property and those properties adjacent to the western landfill?

EPA Response: The Selected Remedy requires institutional controls which will be used to identify the Site as property underlain by contaminated groundwater; to prevent the consumption of contaminated ground water; to restrict future development at the Site; and to limit future earth disturbing activities on the capped portions of the Site.

D. Landfill Capping

1. A resident inquired about a possible crack in the cap covering the Stabatrol area.

EPA Response: As part of the Remedial Investigation of the Site required by US EPA, detailed investigations of the existing landfill cap conditions were required. A study of settlement cracks was carried out as part of the Remedial Investigation. US EPA is not aware of cracks in the cap in the Stabatrol area. Based on the evaluation of the settlement crack survey data, some landfill settlement is occurrmig, as would be expected. The type of settlement is typical of conditions at clay capped landfills where invariably some differential settlement of refuse occur's causing tension cracks in the clay to form.

2. Why is-EPA permitting the use of a one-foot thick cap while PADEP regulations state that there must be at least a two-foot thick cap?

EPA Response: The Pennsylvania Department of Environmental Protection (PADEP) identified 25 PA Code Chapter 273 (1988), one component of which requires a minimum of two feet of final cover thickness, as an applicable, or relevant and appropriate requirement for the Site. Initially, US EPA did not consider Chapter 273 to be applicable, or relevant and appropriate as discussed in the April 25, 1997 Proposed Remedial Action Plan. After further consideration US EPA recognizes the Pennsylvania Municipal Waste Management Regulations, 25 PA Code Chapter 273 (1988) to be an applicable requirement because the closure of the landfills was not officially approved by PADEP. However, EPA believes that a waiver of these requirements, in accordance with 40 C.F.R. § 300.430(e)(9), is appropriate because the cap repair alternatives will otherwise achieve an equivalent standard of performance in the protection of human health or the environment. Currently, soil, sediment, leachate, and air do not pose an unacceptable risk to - human health, or the environment as a result of the current conditions of the landfill caps. For - example the remedial investigation determined the following:

1) Although there are variations in landfill cap thickness which will be addressed in all the cap repair portion of the Selected Remedy, the average current cap thicknesses of the western and eastern landfill are 24.7 and 18.7 inches, respectively;

2) The existing landfill caps generally exhibit low permeabilities in the 10' cm/sec to 10' cm/sec range which effectively reduces infiltration and minimizes leachate generation. In addition, modeling conducted for the Feasibility Study and reviewed and approved by EPA, indicates that there would be no benefit in reduction of infiltration if two feet of similar types of soils were used as final cover for the caps, as opposed to one foot of final cover,

3) the landfill caps exhibit in place densities of 89% to W/o of the Standard Proctor maximum dry density indicating that compaction occurred during construction;

4) the soils used to construct the caps are of the appropriate quality and character for landfill caps;

5) The landfill caps are, in general, well graded, covered with a good stand of vegetation and overall do not exhibit signs of excessive erosion; and

6) surface water management systems consisting of berms, benches, riprap lined channels and culverts have been constructed and generally are operating effectively.

All the cap repair alternatives will insure that the landfill caps will continue to be protective of human health and the environment in the future while effectively maintaining the natural containment of on-Site ground water. In addition, implementing the extensive grading and final cover requirements of the regulations found at 25 PA Code º 273.234 may pose a greater risk to human health or the environment because complying with such requirements might jeopardize the natural containment of landfill constituents and thereby create greater risks due to the migration of contaminants to downgradient receptors.

3. How can EPA supersede PADEP's regulations for a two-foot cap?

EPA Response: See answer to D.2. above.

4. A citizen noted that EPA's regulations and guidelines for landfill capping also require two feet of cap cover.

EPA Response: See answer to D.2. above

E. The Cleanup

1. How long will it take to complete the cleanup?

EPA Response: The Feasibility Study estimates that the Selected Remedy can be designed and implemented in twelve to eighteen months.

2. What happens if site conditions change between now and when the cleanup is completed?

EPA Response: Long-term monitoring, operation and maintenance of the leachate management system and operation and maintenance of the landfill caps shall continue for an estimated 30 years or such other time period as US EPA, in consultation with PADEP, 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 the initiation of the remedial action in accordance with the US EPA guidance document, Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 23,1991). Five-year statutory reviews under Section 121(c) of CERCLA will be required as long as hazardous substances remain on-Site and prevent unlimited use and unrestricted access to the Site. Five-year reviews shall be conducted after the remedy is implemented to assure that the remedy continues to protect human health and the environment. If US EPA, in consultation with PADEP, determines that the Selected Remedy is no longer protective of human health and the environment US EPA will take the appropriate actions to ensure that conditions at the Site are protective. Further, US EPA retains its emergency removalauthority which it can invoke if an emergency situation arises.

3. Can EPA guarantee that the contaminants will remain under control in the future?

EPA Response: See Response to E.2. above.

4. What happens if Site conditions change after EPA has completed the cleanup and left the area?

EPA Response: See Response to E.2. above.

F. The PRPs and Their Role

1. A resident requested the names of the potentially responsible parties ("PRPs').

EPA Response: A list of the PRPs was not available at the public meeting. However, the names of the PRPs for the Berks Landfill Superfund Site are available upon request.

2. Do the PRPs have a choice concerning whether or not they want to participate in the cleanup?

EPA Response: US EPA sends each PRP a General Notice letter notifying them of their potential liability for response actions at the Site. US EPA then issues a Special Notice letter to PRPs following signing of the Selected Remedy inviting the PRPs to implement the design and construction of the Selected Remedy. However, PRPs do not have to enter into a consensual agreement with US EPA. US EPA has other enforcement authority to address situations where PRPs do not agree to implement the Selected Remedy. Specifically, US EPA can issue a Unilateral Administrative Order to PRPs requiring them to implement the design and construction of the Selected Remedy, or US EPA can conduct the implementation of the design and construction of the Selected Remedy using funds from the Superfund Trust Fund and then seek reimbursement of the costs of implementing the remedy from the PRPs through litigation.

3. Do the PRPs have an input in the clean-up decision?

EPA Response: As members of the public, the PRPs may comment on the Proposed Plan during the public comment period and at the public meeting. US EPA will take into account all comments received during the public comment period and from the public meeting, including those of the PRPs. However, US EPA, in consultation with PADEP, makes the final decision regarding the Selected Remedy.

4. A resident asked how the costs of the cleanup are distributed among the PRPs.

EPA Response: The Superfund statute establishes that all liable parties under Superfund are jointly and severally liable. In other words, each liable party is equally liable and each is liable for the entire clean up costs at the Site. However, all the PRPs or a group of PRPs may decide among themselves how to distribute the costs or work at the Site, although each PRP remains jointly and severally liable.

G. Site Contamination

1. One resident asked if beryllium was naturally occurring at the Site.

EPA Response: Yes. US EPA has determined that the beryllium encountered in well sampling at the Site is naturally occurring. Similar levels of beryllium were detected in off-Site wells, both upgradient and downgradient of the Site.

2. How does EPA determine the difference between naturally-occurring contaminants, such as beryllium, manganese, and arsenic, and those that are the result of the landfill?

EPA Response: When similar levels of a compound are detected in off-Site wells, both upgradient and downgradient of a Site the compounds can be considered naturally occurring. If the levels of these contaminants were elevated in the downgradient wells, those results could indicate the increased levels of the compounds were the result of contamination emanating from the Site.

3. Is it possible that someone dumped contaminants on-Site without anyone's knowledge?

EPA Response: It is likely that contaminants were dumped at the Site without the knowledge of PADEP and US EPA during its period of operation. However, US EPA believes that the findings of the Remedial Investigation sufficiently describe the nature and extent of contamination at the Site to allow US EPA to select the remedy set forth in the Record of Decision.

4. What would EPA have done if contaminants that posed a risk to human health or the environment were found in off-site residential wells?

EPA Response: If EPA had found contaminants in off-site residential wells that posed a risk to human health or the environment, US EPA would have taken actions to protect human health and the environment such as the installation of carbon filtration units or the provision of bottled water, etc while alternatives for a permanent remedy were evaluated.

5. If EPA found any contaminants in off-site residential wells, did they come from the Site?

EPA Response: EPA has not found any Site related contaminants in off-Site residential wells.

6. If EPA discovered new information at the present time about the Site contamination, would EPA change the Proposed Plan?

EPA Response: Five-year statutory reviews under Section 121(c) of CERCLA will be required, as long as hazardous substances remain on-Site and prevent unlimited use and unrestricted access to the Site. Five-year reviews shall be conducted after the remedy is implemented to assure that the remedy continues to protect human health and the environment. If US EPA, in consultation with PADEP, determines that the Selected Remedy is no longer protective of human health and the environment US EPA will take the appropriate actions to ensure that conditions at the Site are protective.

H. Surface and Ground Water

1. Are there underground rivers below the Site?

EPA Response: No. Ground water is defined as fresh water found underground that fills in gaps between soil, sand, and gravel, and often is a major source of drinking water. Generally, ground water does not flow in an underground river. Ground water flows small through spaces between sand grains, or bedrock. When the bedrock fractures, water flows through these cracks. The amount of water flowing through cracks depends upon how many cracks are present and the size of these cracks.

2. One resident suggested that EPA had not proposed an alternative to address the water that runs over the surface of the landfill after a rainfall.

EPA Response: The cap repair portion of the Selected Remedy includes provisions to ensure that the surface water management system works properly. The Selected Remedy will ensure that surface water is directed off the landfill properly.

3. One resident informed EPA that there were deformed fish in the pond at the end of Wheatfield and Chapel Hill Roads. The resident requested that EPA examine the fish and determine what contaminants in the pond are causing the deformities.

EPA Response US EPA does not believe that Site-related contaminants are causing risks to surface water or sediment off-Site as evidenced by the results of the Remedial Investigation and Baseline Risk Assessment. However, US EPA takes this report of deformed fish seriously and has referred the information to PADEP for further investigation.

I. The Site

1. How did EPA determine the boundaries of the Site?

EPA Response: The Berks Landfill Superfund Site consists of two closed municipal refuse landfills and associated features located south of Wheatfield Road and the areal extent of contamination which includes the ground water plume. The Site boundaries as shown on figures in the Remedial Investigation reflect only the property boundaries on which the two landfills and associated features are located.

2. One resident commented that he was disturbed that so many EPA personnel had been on the job in just a few years, and that there had not been one constant person involved with the Site. He also commented that he had offered information about the Site to EPA personnel involved with the Site cleanup, but no one ever responded to his offers.

EPA Response: While there has been turn over of US EPA Remedial Project Managers since the Site was listed on the National Priorities List, sufficient information was gathered during the Remedial Investigation to determine the nature and extent of contamination at the Site and to allow the US EPA to evaluate alternatives to address risks posed by the Site in the Feasibility Study. The Selected Remedy set forth in the Record of Decision is protective of human health and the environment and provides the best balance among the alternatives with respect to the nine criteria US EPA uses to evaluate each alternative. US EPA encourages interested parties to provide US EPA with any information they feel is relevant to the Berks Landfill Superfund Site. US EPA will evaluate any information regarding the Site which is provided by concerned parties.

J. The Soil

1. One resident commented that her backyard is under water several times during the year and had requested several times that EPA test her soil. Since the soil has never been tested, she is afraid to put a garden there.

EPA Response: While US EPA understands citizens concerns regarding off-Site contamination emanating from the Site, the Remedial Investigation and Baseline Risk Assessment which were required by US EPA did not identify increased risks to human health or the environment from contaminants in surface water Or sediment in the Cacoosing Creek tributary downgradient of the Site. Therefore, since it is highly unlikely that Site-related contaminants arc present in the soils adjacent to the tributary US EPA determined that it was not necessary to conduct off-Site soil sampling.

2. One citizen questioned the results of the permeability tests on the soil and sediments in the landfills.

EPA Response: The landfill cap investigation portion of the Remedial Investigation required by US EPA included sampling to determine the permeability of the existing landfill caps. The sampling conducted during the Remedial Investigation was conducted under US EPA oversite.

The results of the Remedial Investigation sampling shows that the existing landfill caps generally exhibit low permeabilities in the 10 -7 cm/sec to 10 -8 cm/sec range which effectively reduces infiltration and minimizes leachate generation. In addition, modeling conducted for the feasibility study and reviewed and approved by EPA indicates that there would be no benefit in reduction of infiltration if two feet of similar types of low permeability soils were used as final cover for the caps, as opposed to one foot of final cover.

Part II: Comprehensive, Technical, and Legal Responses to Comments

This section provides technical detail in response to comments or questions on the Berks Landfill Site. EPA received these comments or questions by mail during the public comment period. These comments or questions may have been covered in a more general fashion in Part I of this Responsiveness Summary. The following specific comments are addressed:

A. Comments of the Pennsylvania Department of Environmental Protection ("PADEP")
B. Comments of Ms. Vivian Faust on behalf of CCWBC
C. Comments of Resident
D. Comments of Golder Associates, Inc. on behalf of the members of the Berks Landfill PRP Group
E. Comments of Kittredge, Donley, Elson, Fullem & Embrick, LLP on behalf of the group of defendants in litigation initiated by the members of the Berks Landfill PRP Group

A. Comments of PADEP

In a five-page document dated May 19,1997, PADEP submitted comments on the Berks Landfill Site Proposed Plan.

1. PADEP received the Proposed Plan on April 28, 1997, while the public comment period began on April 25, 1997. In addition, PADEP was not given a review period as provided for in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Section 300.515(h)(3), under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA").

EPA Response: Section 300.515(h)(3) of the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") states: "The lead agency shall provide the support agency an opportunity to review and comment on the RI/FS, proposed plan, ROD, and remedial design and any proposed determinations on potential ARARs and TBCs. The support agency shall have a minimum of 10 working days and a maximum of 15 working days to provide comments to the lead agency on the RI/FS, ROD, ARAR/TBC determinations and remedial design. The support agency shall have a minimum of five working days and a maximum of 10 working days to comment on the proposed plan." US EPA, as the lead agency, as stated in PADEP comment No. 1 provided PADEP, the support agency, with the Proposed Plan on April 28, 1997. The comment period on the Proposed Plan was open until May 26, 1997. PADEP therefore was given 20 working days to comment on the Proposed Plan. PADEP provided US EPA comments on the proposed plan in a letter dated May 19, 1997, 15 working days after receipt of the proposed plan.

2. PADEP did not receive for review a draft copy of the Final Risk Assessment Report.

EPA Response: US EPA believes that PADEP received a copy of the July 1, 1996 Final Risk Assessment Report for the Berks Landfill Site prepared by Golder Associates Inc. As can be shown from Proof of Delivery documentation provided by Federal Express to Golder Associates, Inc., D. Hammock and J. Straub of PADEP signed for delivery of the July 1, 1996 Final Baseline Risk Assessment Report on July 3, 1996 at PADEPs Reading field office and 1 Ararat Blvd. Regional office, respectively. Subsequently on October 31, 1996, US EPA provided comments to Golder Associates, Inc. on the July 1, 1996 Final Risk Assessment which are reflected in the November 6, 1996 Addendum to the Final Baseline Risk Assessment submitted by Golder Associates, Inc. The November 6, 1996 Addendum was signed for by representatives of PADEP on November 8, 1996 at both the Reading field office and 1 Ararat Blvd. Regional office. US EPA received no comments from PADEP on either the July 1, 1996 Final Baseline Risk Assessment Report or November 6, 1996 Addendum.

3. PADEP's Municipal Waste Guidance #21 states that landfill areas not closed according the Chapter 75 or in accordance with an approved closure plan before April 9, 1988, must be closed in accordance with the new municipal waste regulations, 25 PA Code Chapters 271-285. Therefore, areas of the Site which do not have two-foot soil covers, or where refuse is intermixed with soil cover, are not in compliance with Chapter 75.

EPA Response: The Pennsylvania Department of Environmental Protection (PADEP) identified 25 PA Code Chapter 273 (1988), one component of which requires a minimum of two feet of final cover thickness, as an applicable, or relevant and appropriate requirement for the Site. Initially, US EPA did not consider Chapter 273 to be applicable, or relevant and appropriate as discussed in the April 25, 1997 Proposed Remedial Action Plan. After further consideration US EPA recognizes the Pennsylvania Municipal Waste Management Regulations, 25 PA Code Chapter 273 (1988) to be an applicable requirement because the closure of the landfills was not officially approved by PADEP. However, EPA believes that a waiver of these requirements, in accordance with 40 C.F.R. º 300.430(e)(9), is appropriate because the cap repair alternatives will otherwise achieve an equivalent standard of performance in the protection of human health or the environment. Currently, soil, sediment, leachate, and air do not pose an unacceptable risk to human health, or the environment as a result of the current conditions of the landfill caps. For example the Remedial Investigation detemiined the following:

1) although there are variations in landfill cap thickness which will be addressed in the cap repair portion of the Selected Remedy, the average current cap thicknesses of the western and eastern landfill are 24.7 and 18.7 inches, respectively;

2) the existing landfill caps generally exhibit low permeabilities in the 10 -7 cm/sec to 10 -8 cm/sec-range which effectively reduces infiltration and minimizes leachate generation. In addition, modeling conducted for the Feasibility Study and reviewed and approved by EPA, indicates that there would be no benefit in reduction of i infiltration if two feet of similar types of soils were used as final cover for the caps, as opposed to one foot of final cover;

3) the landfill caps exhibit in place densities of 89% to 90% of the Standard Proctor maximum dry density indicating compaction occurred during construction;

4) the soils used to construct the caps are of the appropriate quality and character for landfill caps;

5) the landfill caps are, in general, well graded, covered with a good stand of vegetation and overall do not exhibit signs of excessive erosion; and

6) surface water management systems consisting of berms, benches, riprap lined channels

and culverts have been constructed and generally are operating effectively.

All the cap repair alternatives will insure that the landfill caps will continue to be protective of human health and the environment in the future while effectively maintaining the natural containment of on-Site ground water. In addition, implementing the extensive grading and final cover requirements of the regulations found at 25 PA Code º 273.234 may pose a greater risk to human health or the environment because complying with such requirements might jeopardize the natural containment of landfill constituents and thereby create greater risks to downgradient receptors.

4. Constructing a lower permeability cap on the eastern landfill would lessen the current risk of exposure to leachate seeps on the eastern landfill.

EPA Response: The July 1, 1997 Baseline Risk Assessment for the Berks Landfill Superfund Site did not identify increased risks to human health and the environment as a result of leachate seeps on the eastern landfill. US EPA believes that the Selected Remedy set forth in the Record of Decision will be protective of human health and the environment. In addition, see answer to PADEP Comment No. 3 above.

5. PADEP's Municipal Waste Guidance #21 states that landfill areas closed before April 9, 1988, do not have to be reaffected and meet current regulations unless one or more of the following problems are present: (a)final cover; (b)leachate seeps; (c) ground water degradation; (d)landfill gas problems; or (e)erosion and sedimentation problems. The Site does not meet final cover requirements because extensive leachate seeps are present, volatile organic compounds (VOCs) are present in the ground water in both the shallow and deep aquifers indicating ground water degradation, strong methane odors are present around the eastern landfill, and the Remedial Investigation Report did not include an evaluation of the current gas venting system.

EPA Response: In response to this comment, the Selected Remedy, as set forth in the Record of Decision, does require monitoring of landfill gases. In addition, see response to PADEP Comment No. 3 above.

6. The purpose of maintaining vegetation is to prevent the natural succession of this vegetation from disrupting the soil cover and/or the cap. The proposed clean-up alternative does not adequately address present or future site conditions relative to vegetation on the landfills.

EPA Response: US EPA believes the Selected Remedy adequately addresses maintenance of vegetation on the forested/maturing shrub tree portion of the western landfill and the non-forested portions of the western landfill, eastern landfill, northern disposal area and area behind the equipment building. See Section IX.B.4.b.13. and Section IX.B.4.b.14. of the Record of Decision.

7. The Proposed Plan states that the northern slope of the landfill behind the auction house is no more than a "thin lens of exposed refuse." In reality, it is a 20 to 25 foot vertical wall of exposed refuse that will require extensive leveling.

EPA Response: As set forth in Section IX.B.4.b.8. of the Record of Decision, the approximate 20 foot by 50 foot thin lense of exposed refuse shall be repaired.

8. PADEP also provided a list of applicable or relevant and appropriate requirements (ARARs) and requirements to be considered (TBCs) which were not included in the Proposed Plan.

a. Land Recycling and Environmental Remediation Standards Act of May 19, 1995, P.L.4, No. 1995-2, 35 P.S. Section 6026.101 et. seq. (Act 2). Chapter 3, Sections 301, 302, and 303. Chapter 1, Section 106(A) states "the remediation standards established under this act shall be considered as applicable, relevant and appropriate requirements for this Commonwealth under the Comprehensive Environmental, Response, Compensation, and Liability Act of 1980 (Public Law 96-510, 94 Stat. 2767) and the Hazardous Site Cleanup Act."

b. 25 PA Code Chapter 250, Revision R (Administration of the Land Recycling Program). The Maximum Contaminant Level and/or Health Advisory Limit for VOC contaminants in the shallow and deep aquifers are chemical ARARs.

c. The Solid Waste Management Act of July 7, 1980, P.L. 380, No. 97, as amended, 35 P.S. Sections 6018.101 et.seq.

d. Municipal Waste Management Regulations (Article VIII, Chapters 271 - 285).
Chapter 273, Landfills
Section 273.151: Soil erosion and sedimentation control plan
Section 273.234: Final cover and grading, Table 1 (page 273 - 48 of Section 273.256)
Sections 273.235 - 273.236: Revegetation
Sections 273.241 - 273.245: Water quality protection
Sections 273.271 - 273.277: Leachate treatment
Sections 273.281 - 273.288: Water quality monitoring
Sections 273.292 - 273.293: Gas management
Sections 273.321 - 273.322: Closure

e. Bureau of Waste Management Municipal Waste Guidance #21, "Closure of Municipal Waste Landfill", July 11, 1989.

f. The Air Pollution Control Act of January 8, 1960, P.L. 2119, 35 P.S. Sections 4001, et.seq.

g. Air Resources Regulations (Article III, Chapters 121 - 143)
Chapter 131: Ambient Air Quality Standards
Chapter 139: Sampling and Testing
Section 139.11: General requirements for stationary sources
Section 139.14: Emissions of VOCs

h. Guidance Manual, "Air Quality Permitting Criteria for Remediation Project Involving Air Strippers and Soil Decontamination Units"

I. "Air Quality Criteria Including Best Available Technology Criteria for Municipal Waste Landfills"

j. The Clean Streams Law of June 22, 1937, P.L. 1987, as amended, P.S. Sections 691.1 et. seq.

k. Water Quality Regulations, Chapters 97 and 101
Chapter 97: Industrial Wastes
Section 97.1: General Provisions
Sections 97.14 and 97.15: Standards
Sections 97.91 - 97.95: Standards for discharge of industrial flows to POTWs

Chapter 101: Special Water Pollution
Section 101.2: Incidents causing or threatening pollution
Section 101.3: Activities utilizing polluting substances
Section 101.4: Impoundment
Section 101.5: Algicides, herbicides, and fish control chemicals

l. "Acceptable Risk/Human Health Environmental Protective Levels for Ground Water Protection and Remediation"

m. "Technical Guidance for NPDES Permitting Landfill Leachate Discharges"

n. "Toxics Management Strategy"

o. "Soil Erosion and Sedimentation Control Manual"

p. The Storm Water Management Act of October 4, 1978, P.L. 1840, 32 P.S. Sections 645.1 et.seq.

q. Chapter 105: Dam Safety and Waterway Management
Section 105.17: Wetlands
Section 105.18: Activities in wetlands
Section 105.20: Wetland replacement criteria

r. The Water Well Drillers License Act of May 29, 1956, P.L. 1840, 32 P.S. Sections 645.1 et. seq.

s. Chapter 107: Requirements for Water Well Drillers

t. The Pennsylvania Safe Drinking Water Act of May 1, 1984, P.L. 206, 35 P.S. Sections 721 et. seq.

u. Chapter 109: Water Supply and Community Health Regulations
Sections 109.201 - 109.203

v. Pennsylvania Department of Transportation Act of June 1, 1945 (P.L. 1242, No. 421) (36 P.S. Sections 670 - 411, 670 - 420, 670 - 421, and 670 - 702)

w. Pennsylvania Hazardous Transportation Regulations, Pa. Code Titles 13 and 15

EPA Response: US EPA evaluated all potential applicable or relevant and appropriate requirements identified by PADEP and believes that the Selected Remedy will comply with all necessary applicable or relevant and appropriate requirements and TBCs as set forth in Section X.B. of the Record of Decision.

B. Comments of Ms. Vivian Faust on behalf of CCWBC

In a three-page letter dated May 22, 1997, Ms. Vivian Faust provided a written copy of the statement she read during the May 14, 1997, public meeting on behalf of CCWBC.

1. How could the different Remedial Project Managers know what was happening with the Site if no notes or minutes were taken during meetings with the PRPs?

EPA Reponse: While there has been turnover of US EPA Remedial Project Managers since the Site was listed on the National Priorities List, US EPA performed adequate oversight and sufficient

information gathering during the Remedial Investigation to determine the nature and extent of contamination at the Site and to allow the US EPA to evaluate alternatives to address risks posed by the Site in the Feasibility Study. The Selected Remedy set forth in the Record of Decision is protective of human health and the environment and provides the best balance among the alternatives with respect to the nine criteria US EPA uses to evaluate each alternative.

2. EPA claimed that the stream acts as a barrier to contaminants moving offsite. If this is correct, why did sampling results indicate vinyl chloride in the Nein well across the stream?

EPA Response: As discussed in the Proposed Plan and the Record of Decision, the diabase rock mass, which encompasses the Site, acts as a major hydraulic barrier that controls groundwater flow at the Site and prevents downward migration of groundwater from the overlying units. The diabase effectively acts as a confining unit or barrier beneath the Site and causes the shallow phreatic and deeper semi-confined groundwater systems to merge and discharge to the Cacoosing Creek tributary system (drainageways and tributary) at the northwestern portion of the Site and west of the Site boundary. The Nein well is a shallow hand dug well in the shallow aquifer immediately north of the eastern landfill on-Site which explains why vinyl chloride was detected in the well. Because the diabase mass pinches to the surface northwest of the Site it acts as a barrier to the migration of contaminants off-Site to the west.

3. EPA claimed that the rock layer underlying the Site would prevent contaminants from moving off-Site. However, EPA's own tests indicated fractures in that layer. Since EPA conducted the studies, there have been many earthquakes which CCWBC believes have enlarged these fractures. CCWBC requested that EPA take these fractures into account when deciding on the clean-up alternative.

EPA Response: While drilling on-Site monitoring wells, fractures were encountered in the first several feet of the diabase mass. However, fewer and fewer fractures were encountered the farther the wells were advanced into the diabase due to the extreme natural density of the diabase. Therefore, since the diabase mass is typically several hundred feet thick in the Site area it is highly unlikely that naturally occurring fractures could exist completely through the diabase mass. US EPA believes that it is highly unlikely that earthquakes in the Site area have affected the hydrogeologic conditions at the Site.

4. When making a final clean-up decision, CCWBC requested that EPA take into account the unstabilized sludges, referred to as the Stabatrol area.

EPA Response: US EPA believes that the Remedial Investigation gathered sufficient information to determine the nature and extent of all contamination at the Site and to allow the US EPA to evaluate alternatives to address risks posed by the Site in a Feasibility Study. US EPA believes that the Selected Remedy addresses all risks to human health and the environment identified in the Baseline Risk Assessment for the Berks Landfill Site. EPA believes the Selected Remedy is protective of human health and the environment.

5. CCWBC commented that a former PADEP hydrogeologist told the group that ground water flows at the Site are unpredictable due to the Site's geologic and hydrogeologic conditions. CCWBC requested that EPA clarify why the group was told that the eastern portion of the Site is the most contaminated if ground water flows to the west.

EPA Response: US EPA believes that site specific hydrogeologic conditions were thoroughly delineated in the Remedial Investigation for the Berks Landfill Superfund Site. The Remedial investigation, Proposed Plan and Record of Decision all state that the area of most highly contaminated groundwater on-Site is directly beneath the Eastern Landfill. As discussed above,

an intrusive diabase mass is the most important geologic feature at the Site. This diabase mass, at the surface, encircles the Site except for possibly a small area to the southwest, and is present beneath the Site in a bowl-like configuration. The large diabase mass acts as a low permeability hydraulic barrier, deflecting ground water flow to the west, to its eventual discharge point, in the north and north west portions of the Site. Shallow ground water discharges into the tributary of the Cacoosing Creek in this area. Water quality and aquatic organism sampling conducted in the tributary of the Cacoosing Creek and in the on-Site drainage ways shows that ground water discharging to the Cacoosing Creek tributary is not causing an increased risk to human health or environmental receptors. It is believed that natural processes such as dilution, dispersion, sorption and volatilization of contaminants are contributing to the natural treatment and reduction of contaminant concentrations in the ground water. These natural contaminant reducing processes when combined with the unique diabase mass which forces ground water to discharge to the Cacoosing Creek tributary provide natural containment of the Site-related contaminants and does not allow them to move off-Site.

6. CCVBC also requested the following information about the cluster wells:
    a. How many extra wells will be added?
    b. How often will they be tested?
    c. Will there be replacement wells closer to the decommissioned wells?
    d. Will the stream also be tested and how often?
    e. CCWBC requested that EPA continue testing residential wells since pollution may surface a mile from the source.

EPA Response: US EPA understands and shares citizens concerns regarding regular monitoring of sentinel and residential wells to insure that human health and the environment continues to be protected in the future. As set forth in the Record of Decision, the installation of additional sentinel wells shall be required. The exact number and location of these sentinel wells shall be determined by US EPA during the remedial design, in consultation with the PADEP. The Record of Decision also requires that a plan for a long-term ground water monitoring program shall be included in an operation and maintenance plan for the Site. This plan shall include the sampling of a sufficient number of sentinel wells, residential wells and existing monitoring wells to monitor the effectiveness of the natural hydraulic containment mechanisms in maintaining Site related contaminant levels below MCLs and MCLGs at the point of compliance and to monitor on-Site contaminant levels over time. US EPA, in consultation with PADEP, will determine the number and location of wells necessary to verify the performance of the remedial action. Sentinel and residential wells will be sampled quarterly for Target Compound List ("TCL") Volatile Organic Compounds ("VOCs") and semi-annually for Target Analyte List ("TAL") metals for the first year of sampling. The Sentinel and Residential wells will be sampled no less than semi-annually for TCL VOCs and annually for TAL metals for the second through fifth year of sampling. Based on the findings of the first five years of sampling, the appropriate sampling frequency for subsequent years will be determined by US EPA, in consultation with the PADEP. On-Site monitoring wells shall be sampled annually for TCL VOCs and TAL metals for the first five years of sampling. Based on the findings of the first five years of sampling, the appropriate sampling frequency for subsequent years will be determined by US EPA, in consultation with the PADEP. At least, two rounds of surface water, sediment and benthic macroinvertebrate sampling of the upgradient and downgradient surface water drainageways and the tributary of the Cacoosing Creek shall be required. US EPA in consultation with PADEP will determine if additional surface water, sediment and benthic macroinvertebrate sampling is necessary based on the findings of the first two rounds of samples collected.

7. Can the open leachate collection lagoons be eliminated? If not all of them can be eliminated, can some of the lagoons be eliminated?

EPA Response: The Baseline Risk Assessment required by US EPA determined that the leachate

collection lagoons pose no risk to human health or the environment. Therefore, US EPA does not have the authority under CERCLA to take an action such as removing the leachate collection lagoons. However, the leachate management system currently collects and discharges Site leachate to the Spring Township publicly owned treatment works. The Selected Remedy calls for the repair and continued operation and maintenance of the leachate collection system so that the current Site conditions will be maintained in the future.

8. EPA found that the soil permeability was not as expected. The leachate reaction on the limestone can cause further problems as the limestone deteriorates.

EPA Response: The landfill cap investigation portion of the Remedial Investigation required by US EPA included sampling to determine the permeability of the existing landfill caps. The sampling conducted during the Remedial Investigation was conducted under US EPA oversite. The results of the Remedial Investigation sampling show that the existing landfill caps generally exhibit low permeabilities in the 10 -7 cm/sec to 10 -8 cm/sec range which effectively reduces infiltration and minimizes leachate generation. In addition as discussed above, the leachate management system currently collects and discharges Site leachate to the Spring Township publicly owned treatment works. The Selected Remedy calls for the repair, and continued operation and maintenance of the leachate collection system so that the current Site conditions will be maintained in the future.

9. Why were replacement wells placed so far from the decommissioned wells?

EPA Response: During the Remedial Investigation it was determined that the condition of certain existing monitoring wells were such that they were unsalvageable for future use. Therefore, these wells were decommissioned and replacement wells were installed. The replacement wells were located by US EPA, in consultation with PADEP, in such a way to allow US EPA to determine the nature and extent of contamination at the Berks Landfill Site.

10. CCWBC requested that additional cluster wells be placed around the perimeter of the landfill in all directions due to the unpredictable ground water flows.

EPA Response: US EPA understands and shares citizens concerns regarding regular monitoring of sentinel and residential wells to insure that human health and the environment continues to be protected in the future. As set forth in the Record of Decision, the installation of additional sentinel wells shall be required. The exact number and location of these sentinel wells shall be determined by US EPA during the remedial design, in consultation with the PADEP.

11. CCWBC requested that EPA take action to eliminate the foul odors which come from the landfill. These odors are particularly offensive during damp periods, in the early morning, and on cloudy days.

FPA Response: US EPA believes that the Selected Remedy, specifically the cap repair portion of the Selected Remedy set forth in the Record of Decision, will help to reduce the odors emanating from the Site.

C. Comments of Resident

In a three-page handwritten letter dated May 23, 1997, a resident submitted comments on EPA's proposed clean-up alternative.

1. The old landfill outside the fence on the west side contains many contaminants, possibly more than the eastern portion on which EPA is concentrating. The western landfill needs to have enough new soil placed over the top to allow proper surface

water drainage. Although this resident discussed this issue with PADEP and agreed that the soilplacement would be appropriate, the soil never was placed over the landfill.

EPA Response: The Selected Remedy as set forth in the Record of Decision requires that all large contiguous areas of the non-forested portion of the western landfill, the eastern landfill, the northern disposal area and the area behind the equipment building identified as having less than one foot in final cover thickness will be increased to a minimum of one foot of final cover material of a type similar to the existing cover material. Also, Section IX.B.4.b.7 of the Selected Remedy set forth in the Record of Decision requires that the landfills meet certain grading requirements.

2. The west side of the western landfill has no leachate collection system. The resident and PADEP also discussed the implementation of a leachate collection system in this area, although the system never was implemented.

EPA Response: The Baseline Risk Assessment required by US EPA determined that leachate seeps pose no risk to human health or the environment. Therefore, US EPA does not have the authority under CERCLA to take an action such as expanding the existing leachate collection system. However, the leachate management system currently collects and discharges Site leachate to the Spring Township publicly owned treatment works. The Selected Remedy calls for the repair, and continued operation and maintenance of the leachate collection system so that the current Site conditions will be maintained in the future.

3. Brush and wildflowers covering the western landfill do not constitute a healthy or proper final capping for any landfill.

EPA Response: US EPA, in consultation with the US Fish and Wildlife Service and PADEP, has determined that the meadow seed mixture proposed in the proposed plan and required by the Record of Decision for non-forested portion of the western landfill, eastern landfill, northern disposal area and the area behind the equipment building is an appropriate final vegetative cover for the landfills and that this seed mixture will provide beneficial wildlife habitat on the landfills in the future.

4. Sediment control has been neglected. Gravel build-up has changed the flow of the stream resulting in problems for many properties downstream. The gravel needs to be cleaned out.

EPA Response: The Baseline Risk Assessment required by US EPA determined that sediment in the Cacoosing Creek tributary pose no risk to human health or the environment. Therefore, US EPA does not have the authority under CERCLA to take an action such as excavating sediment from the tributary. However, the Selected Remedy set forth in the Record of Decision requires that soil erosion and sedimentation be prevented to the maximum extent possible.

5. All leachate collection lagoons should be removed and the leachate collection system should be updated. The leachate should be collected in steel or fiberglass tanks.

EPA Respose: The Baseline Risk Assessment required by US EPA determined that the leachate collection lagoons pose no risk human health or the environment. Therefore, US EPA does not have the authority under CERCLA to take an action such as removing the leachate collection lagoons. However, the leachate management system currently collects and discharges Site leachate to the Spring Township publicly owned treatment works. The Selected Remedy calls for the repair, and continued operation and maintenance of the leachate collection system so that the current Site conditions will be maintained in the future.

D. Comments of Golder Associates, Inc. on behalf of the members of the Berks Landfill PRP Group

In a two-page document dated May 23, 1997, Mr. Randolph S. White of Golder Associates, on behalf of the members of the Berks Landfill PRP Group, submitted comments on the Berks Landfill Proposed Plan. The Berks Landfill PRP Group concurred with the conclusions EPA made in the Proposed Plan, as well as with EPA's preferred clean-up alternative for the Site. The comment letter also stated that the Proposed Plan appropriately recognized the unique hydrogeologic conditions, natural ground water containment processes, and the protectiveness of the existing landfill cap.

1. The PRP Group requested that EPA ensure that the ROD is sufficiently flexible to allow consideration of alternative operation and maintenance procedures if alternative methods are identified during the remedial design.

EPA Response: EPA believes that the Selected Remedy set forth in the Record of Decision allows for sufficient flexibility in all long-term operation and maintenance plans required. US EPA, in consultation with PADEP, will determine the final requirements of all long term operation and maintenance plans.

2. The PRP Group requested that EPA ensure that the ROD is flexible enough to allow for the following:
   a. the selection of appropriate monitoring points (including the appropriate location of the sentinel well cluster)
   b. the frequency of and parameters for monitoring, and
   c. annual reviews to allow adjustments in the monitoring program as the data is collected.

EPA Response: US EPA believes that the Selected Remedy set forth in the Record of Decision addresses each of the concerns raised. See Sections IX.B.2.b. and IX.B.4.b.

4. Continuing to monitor all the residential wells which have been sampled previously is not necessary because some are hydrogeologically isolated from the Site or are upgradient or far downgradient of the Site. Monitoring on-site wells (except those in the far western; downgradient portion of the Site) is not necessary if compliance wells also are monitored.

EPA Response: US EPA believes that the Selected Remedy set forth in the Record of Decision addresses the concern raised. See Sections IX.B.2.b.

5. The PRP Group questions the need for future aquatic monitoring. However, if EPA requires aquatic monitoring, the PRP Group suggests that the ROD be flexible enough to allow for the development of the aquatic monitoring program during the remedial design.

EPA Response: US EPA believes that the Selected Remedy set forth in the Record of Decision addresses the concern raised. See Sections IX.B.2.b.

E. Comments of Kittredge, Donley, Elson, Fullem & Embrick, LLP on behalf of the group of defendants in litigation initiated by the members of the Berks Landfill PRP Group

In a two-page letter dated May 29,1997, Kittredge, Donley, Elson, Fullem & Embrick, LLP

commented on the Proposed Plan on behalf of the Berks Landfill PRP Group. Although EPA received this letter after the comment period closed, EPA will respond to the issues brought forth as follows:

1. The group of defendants believes that the information obtained during the remedial investigation and feasibility study activities confirm that no landfill cap repairs are necessary. Alternative No. 4, excluding any cap repairs, is fully protective of human health and the environment and is a common-sense, effective, and cost-effective alternative. The lack of identifiable risks from the Site in its present condition; the existing, unique hydrogeologic conditions at the Site; the existence of natural ground water containment and attenuation processes; and sufficiency of the existing landfill cap, all strongly support the choice of Alternative No. 4 without the landfill cap repairs.

EPA Response: The cap repairs called for in the selected remedy in conjunction with the repair and continued operation and maintenance of the existing leachate management system will assist in maintaining the natural containment of on-Site ground water contaminants. The cap repair, and operation and maintenance portion of the selected remedy will insure that the caps will prevent direct contact with waste; provide a stable, maintainable, well vegetated soil cover; and minimize erosion and seeps in the future. The cap repair portion of the selected remedy will also insure that the landfill caps will continue to be protective of human health and the environment in the future while effectively maintaining the natural containment of on-Site ground water.