133971

1992

RECORD OF DECISION
STRASBURG LANDFILL SITE

DECLARATION

SITE NAME AND LOCATION

Strasburg Landfill Site
Newlin Township, Chester County, Pennsylvania

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit 3 for the Strasburg Landfill Site, in Newlin Township, Pennsylvania, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for this Site.

The Pennsylvania Department of Environmental Resources (PADER) concurs with the selected remedy. The information supporting this remedial action decision is contained in the Administrative Record for this site.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDY

This Operable Unit is the third of four operable units for the site. Operable Unit 1 involves the collection and treatment of leachate from the eastern portion of the landfill. Operable Unit 2, which is currently at the design stage, will involve the construction of a security fence around the perimeter of the landfill portion of the Site. This third operable unit will address all principal threats posed by contamination from the Site in all media except groundwater. Within this remedial action the landfill will be recapped, a landfill gas venting system will be installed, and the leachate discharging from the landfill will be collected and treated. These actions, combined with those contemplated within Operable Unit 4, which will address the groundwater contamination, will address all of the principal threats posed by conditions at this Site.

This Remedial Action (for Operable Unit 3) will need long-term operation and maintenance, which includes management, to remain effective. Operation and maintenance will be needed to ensure that the new landfill cap is maintained and that the leachate continues to be collected and treated in compliance with applicable regulations.

The selected remedy includes the following major components:

- Removal of the existing (damaged) landfill cover
- Installation of a landfill cap over the existing 22 acre landfill
- Installation of a landfill gas venting system
- Revegetation of the landfill cap
- Installation of a sub-surface leachate collection system
- Construction of a leachate treatment system
- Operation and Maintenance

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and it satisfies the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume as their principal element.

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

Edwin B. Erickson
Regional Administrator
Region III

3/31/92
Date

Decision Summary for the Record of Decision for Operable Unit 3

1. Site Name, Location, and Description

The Strasburg Landfill Site is a portion of land, including a 22-acre inactive facility, located within a 220-acre tract of land south and slightly east of Strasburg Road in both Newlin and West Bradford Townships, Chester County, Pennsylvania. The coordinates of the Site are North 39° 56′ 35" latitude and West 75° 46′18" longitude. The entrance to the landfill is on Strasburg Road and is controlled by a locked gate. The gate, however, is across the road entrance only and access, at this time, to the Site is essentially unrestricted (Fig 1). A previous Record of Decision (ROD), designated "Operable Unit 2" or "OU2," was signed on June 28, 1991. That ROD calls for the installation of a perimeter fence around the landfill portion of the Site.

The topography of the area is characterized by a combination of steep and gentle hills. All the land in the area is sloped towards, and drains to, the Brandywine Creek that forms the southern and western boundaries of the Site area.

The highest elevation of hills south of the Site area in Newlin Township approaches 550 feet above mean sea level (MSL). The landfill itself resembles a steep hill. The peak elevation of the landfill, from ground control survey, is 474 feet above MSL. The south and east sides of the landfill have a much steeper slope than the north and western sides. The slope along the eastern side is approximately 60 degrees in some locations. Surface drainage from the Site flows to the south and southwest toward the Brandywine Creek and to the east and southeast toward Briar Run that flows into the Brandywine.

The elevation of the Brandywine Creek floodplain to the south is approximately 250 feet above MSL. There are no wetlands either on the landfill, or within 300 feet of the landfill in any direction (Fig 2). The nearest wetland is the Briar Run watershed which is approximately 600 feet east and southeast of the landfill.

Land use in the area is primarily suburban residential, with some residual agricultural areas. There are 201 single family residences within a one mile radius of the Site. All the drinking water to these residences is supplied from groundwater. Most of the homes are served by private home wells. There is a private water company, approximately one mile east and slightly

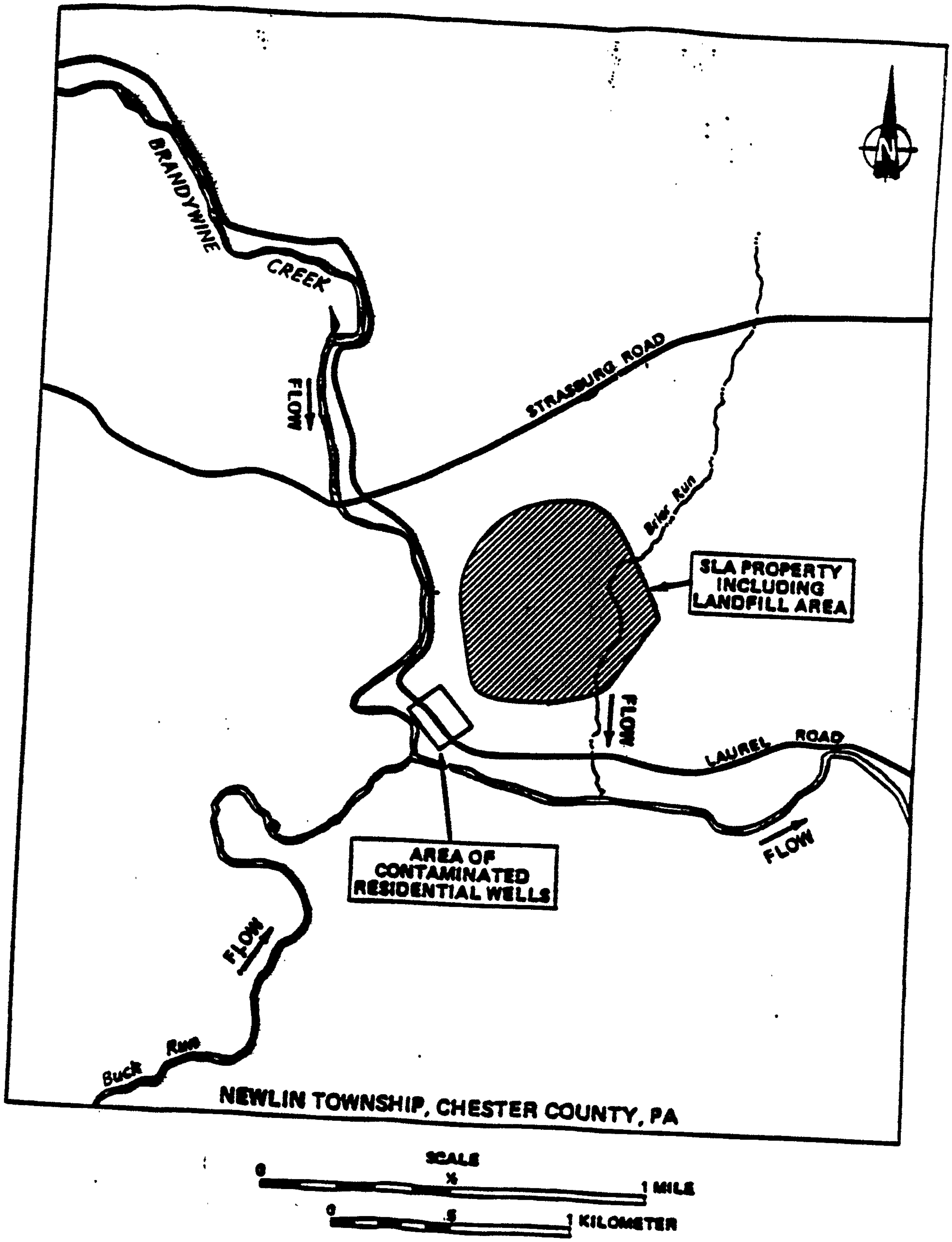

Figure 1 SITE LOCATION MAP

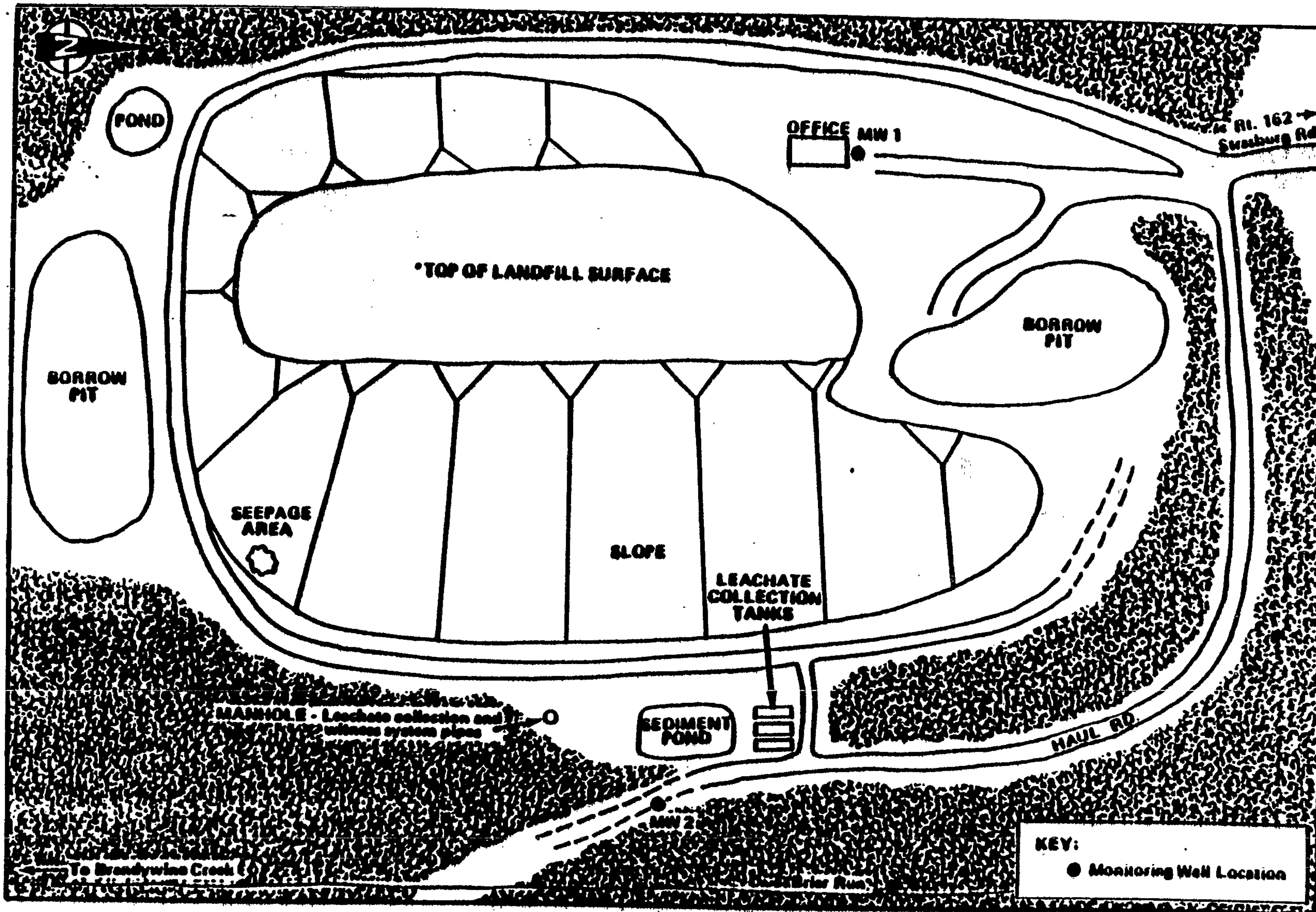

Figure 2 SCHEMATIC SITE MAP OF STRASBURG LANDFILL

north of the landfill, that provides drinking water from deep wells to several residences radiating away from the site area.

According to the State closure plan, the landfill was supposed to be closed by covering the fill material with two feet of soil, a polyvinyl chloride (PVC) cover, and an additional two feet of soil and vegetation. Later discussion in this decision document will show that this type of landfill closure did not occur. Grasses and various wild vegetation are growing on approximately 60 - 70% of the landfill cap. The remaining areas are barren because of one or more of the following reasons: poor quality of the soils, the steepness of the slopes, no maintenance of the existing cover, exposure of the PVC cover, and leachate seeps. Typically, leachate seeps form and stain the vegetation; as the leachate persists, the vegetation dies off, leaving barren strips on the landfill. Next, erosion sets in, and strips off all but the largest rocks in these areas. Leachate seeps will not be contained by the implementation of the access restrictions imposed by OU2; these seeps may freely flow through the fence on the surface as well as into the groundwater.

2. Site History and Enforcement Activities

According to EPA's records, prior to 1973, some of the property was used for farming and a large portion of the property was undeveloped.

A partnership, Strasburg Associates Inc. (SAI), was formed in September 1973 and purchased the property in December 1973. In August 1975, Strasburg Associates received a Pennsylvania Department of Environmental Resources (PADER) permit to accept municipal wastes at the 22-acre facility. The opening was delayed until February 1979 because of local concerns over the use of residentially zoned roads, the proposed sale of the landfill to Strasburg Landfill Associates (SLA) and permitting of a proposed 200 acre expansion.

In May 1978, SLA was formed through a joint venture agreement. In August 1978, SLA acquired the landfill. In October 1978, SLA applied to PADER for a proposed 200-acre landfill expansion. On October 11, 1978, SLA entered into a lease agreement with SA, a joint venture composed of SAI and Strasburg Associates II, (another limited partnership), to operate the landfill.

In February 1979, the 22-acre landfill was opened. In the spring of 1979, new PADER permits were granted to SLA to receive certain industrial and heavy metal wastes. By July 1979, the landfill was accepting sewage treatment plant sludge and manufacturing wastes, including "off-spec" and scrap PVC. By December 1979, more than 1,000 cubic yards of PVC wastes, 2,052 cubic yards of industrial wastes and sludges, and 35,000 gallons of heavy metal sludge had been accepted at the landfill.

In December 1979, PADER charged the landfill operators with excessive siltation of Briar Run. At that time PADER prohibited the disposal of certain industrial wastes because the waste characteristics did not match those on the approved waste disposal application module. Also, PADER prohibited SA from accepting additional PVC waste for disposal. In August 1980, PADER permanently prohibited the landfill from receiving industrial wastes. Between January and June 1981, PADER cited SA for operational problems (dust control, daily cover, and litter control) at the landfill.

PADER conducted periodic inspections, both announced and unannounced, during the landfill operation. During an unannounced inspection in April 1983, PADER found four major operating violations: improper run-off control; slopes in excess of allowed limits; failure to cover compacted waste; and inadequate sedimentation and erosion control. PADER issued SA a notice of violation and required that the violations be corrected within 30 days. The violations were not corrected within the specified time. In May 1983, PADER suspended the landfill operating permit and ordered the landfill closed. SLA closed the landfill in May 1983, by providing a final soil cover, a PVC cover, and stabilized the site with an additional layer of soil, The operators also planted vegetation, and installed a leachate storage tank system. PADER also issued an order requiring the removal of collected leachate for off-site treatment and disposal.

As part of the closure plan, the landfill was supposed to be regraded, covered with 2 feet of soil, and topped with a PVC cover. Another 2 feet of soil was supposed to be placed on the PVC cover and vegetation planted. After the vegetation took root, the cap was to be maintained by mowing. This did not occur. The landfill PVC liner is not covered with two feet of soil; and, in numerous locations, the liner is exposed to the surface. The leachate collection and storage system was also installed as part of the closure plan. It is not clear how well this system was installed. EPA has had to perform additional work to channel some of the landfill leachate into the treatment system constructed as part of OU1, as discussed below.

In August 1983, volatile organic contaminants (see Tables 1 and 2) were detected in an on-site monitoring well, M-2, and in the landfill witness system drain pipe. In September 1983, volatile organic contaminants (see Table 1) were detected in Briar Run east of the landfill. PADER required SA and SLA to conduct a periodic monitoring program and a hydrogeologic study. In October 1983, volatile organic contaminants, in excess of drinking water standards, (see Table 3) were detected in an off-site residential drinking water well southwest of the landfill.

In February 1984, SLA installed four monitoring wells (M-2A, M-2B, M-2C, and M-5) and began a sampling and analysis program (see Table 2). SLA submitted the hydrogeologic investigation to PADER in July 1984.

In July 1984, the hydrogeologic/engineering report evaluating the extent of groundwater contamination was completed. The six corrective measures delineated in the report included:

- o Extending the PVC liner;
- o Installing new leachate collector drains;
- o Installing a 15 mil PVC membrane cap;
- o Regrading soil to attain 2-1/2:1 or 3:1 final outslopes;
- o Revegetating the sides and the top of the landfill; and
- o Regrading soil to divert surface water away from the fill.

Implementation of these measures was never completed. Additionally, the eastern side of the landfill is very steep (estimated 60% slope) in areas, and erosion is occurring such that the original PVC liner is exposed and torn in numerous locations. Vegetation is non-existent or extremely sparse over approximately 1/3 of the landfill. Approximately eight distinct leachate seeps were evident in 1989 on the eastern and southern portions of the landfill. Over the next two year period, the number of distinct surficial leachate seeps has increased to approximately 20 seeps, including a number of seeps on the western slopes of the landfill. Because of the lack of cap maintenance and the toxic effect of the leachate seeps on the present vegetation, erosion has begun to rapidly accelerate the demise of the already poor landfill cap.

PADER has conducted periodic monitoring of residential drinking water wells, on-site monitoring wells, sediment pond outfall, leachate seeps, and Briar Run from September 1983 to the present (see Appendix A of the Remedial Investigation [RI]): Summary of PADER Residential Well Sampling). The monitoring program results showed two residential wells southwest of the landfill contaminated with volatile organics. In August 1983, PADER analyses of water from well M2 and of leachate from the witness drain revealed organic and inorganic contamination (see Table 1). In September 1983, analyses of water samples collected from well M2, the witness drain, and Briar Run (see Table 2) revealed significant levels of organic chemicals.

A Hazard Ranking System (HRS) scoring package was prepared by EPA for the Strasburg Landfill site in April 1987, receiving a score of 30.71. The site was proposed for inclusion on the National Priorities List (NPL) in Update Number 7, released in June 1988. The Strasburg Landfill was added to the NPL in March 1989.

As a result of the leachate running off of the landfill, and flowing directly into Briar Run, and the failure of the operator to take any corrective actions, PADER initiated an action to collect this leachate and haul it, for treatment, to a nearby municipal sewage treatment plant. Prior to the installation of the leachate collection system and treatment system, surface water runoff and leachate from the landfill were directed into the unlined sediment ponds located southwest and east of the landfill.

Since the installation of the leachate collection and treatment system, flow through the system has increased slightly and (fall 1991 flow meter gauge) averages approximately 5 gallons per minute.

Despite the warning signs of the hazardous nature of this Site and the clear evidence that this Site was a landfill, EPA has seen direct evidence of many different groups of people utilizing the property, and specifically the landfill for various recreational activities. These include the following:

- o people using horses whose tracks are seen adjacent to, and on the lower slopes of the landfill. Local residents indicate that there is both random horseback riding and organized fox hunts involving large numbers of riders and accompanying hounds;

- o hikers, who occasionally build campfires on the slopes and top of the landfill;

- o vandals, who have attempted to dismantle parts of the leachate treatment system;

- o joggers; and most particularly;

- o riders of motorcycles and "all terrain vehicles" (ATVs) whose tire tracks are wearing grooves into the sides of the landfill.

It is expected that some of the contact between the site users and the surficial landfill seeps will be eliminated by the construction of the (OU2) security fence. EPA has also spoken to people who recreate on the site and they have indicated that, on occasion, leachate seep material has splashed up on their clothing and, furthermore, that the leachate has splashed into their mouths. EPA's concern for both the health of local people and the continuing deteriorating condition of the existing cap and emergence of new leachate seeps leads EPA to propose the series of actions outlined in this ROD to minimize or eliminate the potential exposures to contaminants on the site. Also, EPA is aware that the security fence will not totally eliminate people coming into contact with the surficial leachate streams, as these streams could flow, virtually unrestricted, though the fence.

Table 1

SUMMARY OF ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM WELL M2 AND WITNESS DRAIN PIPE, PADER, AUGUST 1, 1983 (µg/l)

Compound	Witness Drain Pipe	Well M2
Chloroethane	27	7
Chloroethene	126	8
1,2-Dichloroethene	11	-
1,1-Dichloroethene	109	16
1,2-Dichloroethene	140	3
1,1-Dichloroethene	-	10
1,1,1-Trichloroethane	6	47
Trichloroethene	9	3
Tetrachloroethane	-	14
Chloromethane	2	2
Dichloromethane	86	3
Dichlorofluoromethane	-	Trace
Trichlorofluoromethane	Trace	9
Benzene	34	2
Toluene	76	Trace
Ethyl benzene	12	-
Chlorobenzene	4	-

Table 2

SUMMARY OF ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM WELL M2, THE WITNESS DRAIN PIPE, AND BRIAR RUN, PADER, SEPTEMBER 6, 1983
(µg/l)

Compound	Well M2	Witness Drain Pipe	Briar Run
Chloroethane	8.7	6.7	-
Chloroethene	18	Estimate 180	2.2
1,2-Dichloroethene	1.2	13	-
1,1-Dichloroethene	22	Estimate 150	1.5
1,2-Dichloroethene	9	100	1.7
1,1-Dichloroethene	8.4	2.1	-
1,1,1-Trichloroethane	65	16	1.5
Trichloroethene	4.1	2.4	Trace
Tetrachloroethane	18	5.8	Trace
Chloromethane	-	-	-
Dichloromethane	4.6	34	-
Dichlorofluoromethane	Trace	-	-
Trichlorofluoromethane	3.7	-	-
Benzene	6.2	47	1.0
Toluene	1.0	97	1.0
Ethyl benzene	-	19	-
Chlorobenzene	-	3.8	-

Table 3

ANALYTICAL RESULTS OF THE SAMPLES COLLECTED FROM AN OFF-SITE RESIDENTIAL WELL PADER, OCTOBER 14, 1983 (µg/l)

Compound	Residential Well
Chloroethane	-
Chloroethene	0.9
1,2-Dichloroethene	-
1,1-Dichloroethene	7.8
1,2-Dichloroethene	3.4
1,1-Dichloroethene	-
1,1,1-Trichloroethane	3.3
Trichloroethene	5.8
Tetrachloroethane	9
Chloromethane	-
Dichloromethane	8.5
Dichlorofluoromethane	Trace
Trichlorofluoromethane	-
Benzene	-
Toluene	-
Ethyl benzene	-
Chlorobenzene	-

A number of Potentially Responsible Parties (PRPs) have been notified with regard to remedial actions undertaken at the Site. A Unilateral Administrative Order was issued to three PRPs for the implementation of OU 1, discussed below.

3. Highlights of Community Participation

The current Proposed Plan for Operable Unit Three (OU3) for the Strasburg Landfill site was released for public comment on **December 24, 1991.** A Remedial Investigation (RI) and Feasibility Study (FS), summarized in the Proposed Plan, were also made available for public comment. These two documents and the Proposed Plan, along with other site related documents, were made available to the public in both the administrative record and an information repository maintained at the EPA Docket Room in Region III and at the **Bayard Taylor Memorial Library** located in Kennett Square, PA. The notice of availability for these two documents was published in the Daily Local News on December 24, 1991.

In accordance with CERCLA Sections 113 (k)(2)(B)(i-v) and 117, a public comment period was held from December 24, 1991 to January 23, 1992; at the request of one of the commenters, this period was extended to February 6, 1992. In addition, a public meeting was held on **January 8, 1992 at the West Bradford Township Building.** At this meeting, representatives from EPA and PADER answered questions about problems at the Site and the remedial alternatives under consideration. A response to the comments received during the public comment period is included in the Responsiveness Summary, which is part of this ROD.

This decision document presents the selected remedial action for OU3 for the Strasburg Landfill Site, in Newlin and West Bradford Townships, Pennsylvania, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. The decision for this Site is based on the administrative record.

4. <u>Scope and Role of Operable Unit (OU 3) or Response Action Within Site Strategy</u>

As with many Superfund sites, the problems at the Strasburg Landfill Site are complex. As a result, EPA has organized the remedial work into four separate planned actions.

This ROD which is the third planned remedial action (OU 3) at the site, addresses the following contaminated media: the surface of the landfill; nearby surface streams; air in and around the landfill; the surficial aquifer; and to a limited extent, the groundwater. The first ROD (OU 1) addressed contaminated residential wells and leachate releases into surface water ways and groundwater near the landfill. Under this first action, leachate is now collected, treated, and discharged on site. OU 1 has been fully implemented. The second ROD (OU 2) addresses site access and security. Under this subsequent action, the landfill portion of the site is to be enclosed with a security fence and additional warning signs will be placed in the area. A future ROD (OU 4) will specifically address groundwater in the area of the site. The scope of this future remedial action (OU 4) will be based on the success of the remedy selected for this (OU3) operable unit.

This remedial action addresses low level wastes emanating from the landfill both onto the surface, and into the groundwater and surface streams near the Strasburg landfill, The principal threat is the leachate emanating from this landfill. This remedy will look to minimize or eliminate the exposure pathways of people coming into contact with these substances, for example, inhaling the hazardous vapors either on the landfill or by showering using contaminated groundwater; by ingesting the contaminated groundwater, or by having these leachate materials splashed up on them. It should be noted that this action may not fully address all of the contamination evidenced in the groundwater. Monitoring and modelling will be used in developing the scope of Operable Unit 4, which is planned to address groundwater contamination.

A Remedial Investigation (RI) and Feasibility Study (FS) which were performed for this OU are contained in the public record as support for this Record of Decision. The RI/FS for this third planned action were finalized in September, 1991. Since the fourth operable unit will be based on (partly) groundwater modelling, based on several years of data collected after OU 3 is completed, the ROD for this future unit (OU 4) is not expected for a minimum period of two years after the completion of this (OU 3) operable unit. Naturally, unforeseen situations may arise which would modify this comment.

5. <u>Summary of Site Characteristics</u>

During sampling by PADER in October 1983, volatile organic compounds were detected in off-site residential drinking water wells. Based on their findings, PADER implemented a periodic monitoring program of the residential drinking water wells.

In August 1986, EPA prepared an HRS package to determine the Strasburg Landfill Site's eligibility for proposal to the NPL. The Strasburg Landfill was proposed to the NPL on Update #7, in May 1988. Since that time and continuing through to the time of this decision summary, EPA continues to conduct a PRP search.

From the evidence gathered to date, it is clear that the Strasburg landfill received massive quantities of both municipal and industrial wastes. The industrial wastes disposed of at this Site came from both direct deposits and also indirectly, through the actions of municipalities that brought sludges, containing wastes from industrial contributors, to the Site. Because of the lack of records regarding the operation of the landfill, the specific ratio, or volume from any one source is impossible to determine, but measurements show that the total volume of the landfill is more than 3 million cubic yards. Specific contaminants, which have been determined as leaving the landfill site, and placing the nearby residents and visitors to the site at risk, are listed in Tables 1 through 7 in this decision document.

<u>Nature and Extent of Contamination</u>

This sub-section focuses on the contaminants that may pose hazards, through ingestion, inhalation and direct contact, to the public due to the release of hazardous substances from the landfill. The Strasburg Landfill received both municipal and industrial wastes during its operation. The landfill served as a significant disposal site for municipalities in southeastern Pennsylvania as well as a disposal site for industrial contributors from this same area as well as from Delaware. It is estimated that the total volume of the landfill is at least 3,000,000 cubic yards of combined wastes and fill. The proportion of industrial waste to municipal waste has not been determined. Responses from industrial contributors to inquiries from EPA as to the substances deposited in the landfill characterize, at least a portion of the waste, as hazardous, as defined in 40 CFR § 261 Subpart C and 25 PA Code Part 261, Subpart C. These wastes, defined as "characteristic" under the Resource Conservation and Recovery Act (RCRA), were disposed of at the landfill after the effective date of RCRA. In addition some of the wastes deposited at the landfill contained constituents of hazardous wastes as contained in 40 CFR § 261 Subpart D and 25 PA Code Part 261, Subpart D.

During several planned inspections of the landfill cap, it was observed that the plastic liner, which was supposed to be buried under two feet of soil, was exposed to the surface. The number of locations where the liner was exposed exceeded 25 locations and, based on further examination, it is estimated that a significant portion of the landfill has only a few inches of soil cover. In addition, leachate streams flow from a number of areas on the landfill which have been improperly capped or where the landfill cap has been somehow compromised. Initial over-flights of the Site showed approximately 15 leachate seeps on the eastern and southern slopes of the landfill. In the last twelve months, EPA has identified at least six additional seeps on the southern and western portions of the landfill. It is not clear if these are new seeps or if they had been overlooked during the over-flight investigation. Leachate, as used in this document, refers to the liquid and semi-liquid substances, particularly hazardous chemicals, that seep from the contents of the landfill, either onto other ground surface areas, ground (called "discharge to groundwater") or surface waters.

In order to minimize cap erosion and stabilize landfill deposits, side slopes for a landfill should be not less than 2% and not greater than 15%. This is specified in 25 PA Code 264.301(5). The eastern slopes of the Strasburg Landfill have grades of approximately 50 - 60%. Because of the steepness of these slopes, soil cover has slid away from the liner exposing large amounts of the liner to the surface.

As part of the landfill closure (according to the closure plan), the cell structure of the landfill was to be vented to allow for the escape of built-up landfill gases (so they do not rupture the sides or top of the landfill). Vent pipes were to be placed at reasonable distances to allow the gases to escape, and the landfill liner was supposed to be covered with clean soil. Soil depth on top of the liner was specified to be a depth of two feet, and, as a final measure, the surface soils were to be seeded to promote the growth of vegetation to prevent soil erosion. In the situation at the Strasburg Landfill, as described above, the depth of soil cap is totally inadequate, with much of the liner exposed and torn. In addition, the type of soil used for final cover was inappropriate. Much of the liner cover material is best described as weathered bedrock, which is a poor soil base for subsequent vegetation. More importantly, this weathered bedrock contains numerous medium sized jagged rocks, many over 8 inches in diameter, which, when dropped from the tailgate of a dump truck, can puncture the fragile plastic liner. The effect is that the liner more closely resembles (in effect) an inverted colander, allowing rain water to flow freely into the landfill and leachate to flow freely out of it.

There is much evidence that the existing cap of the landfill has been compromised. There are large areas on the eastern slope of the landfill where all of the soils have eroded exposing large areas of the liner. Furthermore, EPA now finds over twenty distinct leachate seeps covering the eastern, southern, and western slopes of the landfill. Most leachate seep material that rises to the landfill surface, flows to the eastern and southern direction toward a small trout stream called Briar Run. From roughly the area where the seeps would enter Briar Run, this stream flows approximately one quarter mile before it joins the Brandywine Creek, which is classified as a scenic stream and is also used as a drinking water intake less than two miles farther downstream. The neighborhood around the landfill is relatively stable in terms of development; however, similar areas, in locales as close as four miles away are experiencing a considerable amount of development of single family housing. It is expected that this type of development will, in a reasonably short time, occur in this area. At the time the site was first visited by EPA, private surveyors, apparently contracted by the owners, were on the property working on a plan to develop part of the property for executive homes. While this action immediately ceased, additional development in the area may bring more people, particularly children, into contact with the landfill.

Leachate Seeps

There are a number of leachate seeps evident on all but the small northern slope of the landfill. The largest and most notable leachate streams are located on the eastern and southeastern portions of the landfill. Data are available on landfill leachate collected from a manhole near the sediment pond and a seep located between the sediment pond and Briar Run Creek. Recent analytical results for samples of these materials are given in Table 4. These materials are presumably derived from the same general source as the liquid from the other seeps at the southeast corner of the landfill and may exhibit similar contamination patterns.

The liquid discharging from some of the southeast seeps flow overland and eventually discharge directly to Briar Run or flow in a northeasterly direction to be collected and treated in the leachate collection system (OU 1), or to a drainage ditch that empties into the sedimentation pond immediately east of the landfill. During heavy rains, the sedimentation pond (prior to the implementation of OU 1) would overflow and discharge, via a riser and a conduit, running eastward from the pond, through the woods and into Briar Run, which in turn flows into Brandywine Creek. Liquid discharged from some of the southeast seeps may migrate to groundwater via infiltration at various points along the overland flow pathway. Groundwater movement in the area is mainly via fractures in the Peters Creek Schist Formation.

Potential pathways of exposure to the leachate seep material include the following:

- o Ingestion of domestic well water which could be contaminated with leachate flowing through fractures in the bedrock.
- o Direct contact (including dermal and oral exposure) with the seep material by members of the general population (adults and children) who might enter the site for miscellaneous recreational purposes; for example, children playing in the area;
- o Inhalation of volatile organics, emitted from the leachate and soils along the overland flow pathway, by representatives of the general population that may come into close proximity to the seeps or their overland flow pathways; and
- o Dermal, oral, and inhalation exposure to contaminants that might reach Briar Run or the Brandywine Creek. This is a concern for members of the general population using the Brandywine for recreational purposes such as canoeing, tubing, swimming, bathing, wading, fishing, or as a drinking water source.

The leachate has also infiltrated the ground and reached (discharged into) the groundwater that is used as a water supply source by 203 residences in the vicinity of the landfill.

Table 4

SUMMARY OF ANALYTICAL RESULTS FOR SEEP AND LANDFILL LEACHATE SAMPLES (ug/L)

Compound	Seep East of Sediment Pond	Landfill Leachate
Vinyl Chloride	10	20
1,1-Dichloroethane	30	--
trans-1,2-Dichloroethylene	1.0	--
1,2-Dichloroethane	4.3	--
1,2-Dichloropropane	2.9	--
Trichloroethylene	3.4	--
Benzene	2.2	10
Toluene	8.4	280
Chlorobenzene	26	15
Xylenes	2.0	Est. 950
cis-1,2-Dichloroethylene	35.0	13
1,4-Dichlorobenzene	7.8	Est. 50
1,2-Dichlorobenzene	1.0	--
Chloroethane	--	12
Ethylbenzene	--	130

Source: PADER, March 9, 1988.

Table 5

LIST OF CONTAMINANTS FOUND IN RESIDENTIAL DRINKING WATER WELLS (ug/L)

Compound	Maximum Detected Contaminant Concentration Levels	Maximum Allowable Contaminant Levels (MCLs)
Benzene	3.4	5
Chlorobenzene	1.4	100
Chloroform	1.7	-
1,1-Dichloroethane	16.0	-
1,2-Dichloroethane	1.3	5
cis-1,2-Dichloroethylene	413.9	7
1,2-Dichloropropane	1.2	5
1,1,1-Trichloroethane	2.5	200
Trichloroethylene	35.8	5
1,1,2,2-Tetrachloroethylene	3.5	5
Vinyl chloride	2.5	2

Source: PADER 1987-1988.

6. <u>Summary of Site Risks</u>

The contaminants in the landfill leachate and seeps (Table 4) and in the residential water supplies of the affected homes (Table 5) consist of a variety of hazardous volatile organic compounds. This section provides a summary of the potential risks to human health from these contaminants in the absence of any remedial action.

It should again be noted, that, although EPA has evaluated the risks posed by the site contaminants, the stability and integrity of the existing cap is a significant concern to be addressed by this remedial action. Further degradation of the cap may lead to increased leachate production, greater number of seeps and more potential exposure risks. Additionally, the security of the existing collection and treatment system is impacted by trespassers and vandals. Failure of this system could cause large releases of contaminated water directly to Briar Run and then to the Brandywine Creek. Large bushes have also taken root on the cap and the penetration of their roots can be expected to further compromise the landfill's PVC liner.

HUMAN HEALTH RISKS

The Strasburg Landfill is a former 22-acre landfill located on an open 220 acre tract of land. The only access restriction is a locked gate across the main access road. When Operable Unit 2 is installed, the 22 acre landfill will be enclosed in a security fence. This access restriction will minimize exposure to the landfill leachate seeps; however, the fence will not serve as a barrier and seep material will (can) flow freely through it. Nor will the fence restrict access of Site visitors beyond the landfill area.

The exposure pathways that appear to have the greatest potential to produce adverse human health effects at Strasburg Landfill are:

- Ingestion of contaminated drinking water from the surficial aquifer (all of the 200+ residents in the vicinity of the landfill rely on groundwater for the source of their drinking and bathing water)

- Inhalation of hazardous vapors by bathing or showering with contaminated groundwater. Migration of volatile contaminants via soil gas to the air in the vicinity of the landfill, where they could be inhaled by site visitors;(it is estimated that on a daily basis, approximately 40 people visit the site area for recreational purposes).

- o Migration of contaminants within landfill leachate to the ground surface in seep areas and the sediment pond, where site visitors could be accidentally exposed to the contaminants through direct dermal contact, incidental ingestion, or inhalation of volatiles emanating from the leachate. Note: the security fence to be implemented as part of OU 2 for this site will minimize dermal contact. The fence will not restrict migration of the leachate from the landfill area.

The pathways were quantitatively evaluated in the Risk Assessment section of the Strasburg Landfill Remedial Investigation report. The groundwater pathway was found to pose the greatest potential risk of the three pathways. (see Tables 5 and 8 for summary of Site risks) The impact of groundwater on people most directly impacted by the observed contamination has been partially addressed in past actions at the Site. The final RI/FS for this Operable Unit also considered and addressed, to a limited extent, remedial alternatives for groundwater. Control of site access does not affect this pathway. Using site contaminant concentrations presented in the tables above, a reasonable maximum exposure (RME) estimate was developed based on estimated frequency and exposure duration that the receptor population (Site visitor) is likely to experience. Various physiological parameters (e.g., breathing rate, ingestion rate, body weight, etc.) were incorporated to obtain an estimate of the lifetime average daily dose of a contaminant. For the inhalation pathway, site visitors come in contact with volatile contaminants on site by inhalation only. For the accidental contact pathway, site visitors could be exposed to contaminants by direct dermal contact, incidental ingestion, and by inhalation of vapors from leachate.

A brief review of the key parameters for the three pathways follows:

For the inhalation pathway: Since site visitors walk, jog, and ride horses, motorcycles or ATV's on site, an inhalation rate corresponding to light to moderate activity was used. The exposure time, the expected duration of a site visit, was assumed to be one hour per day. The exposure frequency, the number of days per year during which site visits might occur, was assumed to be 100 days/year. Averaging time, the period over which the estimated exposure is averaged, was taken as 30 years for noncarcinogens (90 percentile for time spent at one residence) and 70 years for carcinogens, corresponding to the carcinogenic potency slope factors which are based on lifetime exposures.

For the accidental contact pathway, two exposure scenarios were evaluated in the risk assessment. The first exposure scenario involved a site visitor and accidental contact with the seep material by partial or total emersion. The second exposure

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scenario involved accidental contact with the seep material by having the seep material splashed on a site visitor after riding a motorcycle, ATV, or horse through a leachate seep. Dermal absorption of contaminants depends on the dermal permeability constant of the specific chemical compound. Since specific data for this constant were not available for most chemicals found in the seep areas, constants for organic compounds were assumed and chosen to reflect an inverse relationship to the octanol/water partitioning coefficient for that compound.

For the ingestion pathway, exposure is based on the consumption of 2 liters per day of the groundwater (see Table 5).

For the first exposure scenario, skin surface area was taken as equivalent to the area of the arms, legs, hands, and feet that would likely come into contact with seep water or sediment. The exposure frequency for the first accidental contact exposure scenario was assumed to be four times per year.

For the second exposure scenario, skin surface area was taken as equivalent to the area of the hands, and one half the area of the arms and legs. The exposure frequency was assumed to be 50 times per year.

Exposure time for each accidental exposure scenario was assumed to be one hour, the estimated time for a site visitor to return home and remove wet clothing. Incidental ingestion by hand-to-mouth contact was included in each accidental contact exposure scenario and was taken as 100 mg/day based on EPA guidance. Inhalation rates for the accidental contact exposure scenarios were the same as used for the inhalation pathway, other values were also the same.

Using the estimates of a lifetime average daily dose of a particular chemical under the RME scenario and assumed values for key parameters, risks posed by the chemical contaminants are then evaluated. Noncarcinogenic risks are assessed by calculating a hazard index, the ratio of estimated average daily dose to the reference dose, which is considered an allowable daily intake. A hazard index greater than 1.0 indicates that adverse effects may be possible. A hazard index value less than 1.0 indicates that adverse effects would not be expected. For carcinogenic compounds, a linearized multistage model is used to estimate the carcinogenic potency slope factor. The lifetime average daily dose is multiplied by the low-dose slope factor for each route of exposure to a particular compound; carcinogenic risk is then estimated by adding the risks due to oral, dermal, and inhalation routes.

The remedial investigation was designed to characterize the nature, extent, and limits of contamination originating at the Strasburg Landfill. The possible source areas were identified based on a review of past activities at the site and previous sampling activities. All of the potential source areas and migration pathways were investigated using various field techniques and by collection and laboratory analysis of samples. In this way, the nature of the contamination was characterized and its extent defined. Given the information available about the site, it seems unlikely that any significant source areas or migration pathways were overlooked. Since samples were collected from a variety of media encompassing all of the likely source areas and migration pathways, and samples from most of the media except soil gas were analyzed for the full Target Compound List (TCL) plus any non-TCL organics that were found, it is also unlikely that any significant contaminants would have been missed.

For the purposes of risk assessments, EPA uses the notation of 10^{-4} which means an incremental risk of 1 additional cancer in an population of 10,000 people exposed for 30 years. These numbers are incremental over the normal risk of approximately one cancer in every four individuals that occurs naturally. 10^{-6} represents a risk of 1 additional cancers in an exposed population of one million people.

EPA has recently adopted a policy that acceptable exposures to known or suspected carcinogens are generally those that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}. In addition, EPA will use the 10^{-6} risk level as the point of departure for determining remediation goals for NPL sites. For systemic toxicants (noncarcinogens), EPA defines acceptable exposure levels as those to which the human population, including sensitive subgroups, may be exposed without adverse effects during a lifetime or part of a lifetime, incorporating an adequate margin of safety (EPA 1990). This acceptable exposure level corresponds to hazard index of 1. If the hazard index is less than 1, no adverse effects would be expected. If the hazard index is greater than 1, adverse effects could be possible.

Based on the human health risk assessment presented in the Strasburg Landfill Remedial Investigation Report, estimate hazard indices for systemic toxicants did not exceed 1 (the largest was 0.15) for any the pathways. Therefore, the remainder of this discussion focuses on the sources of the potential cancer risks. The magnitude of the potential cancer risks posed by site contaminants are summarized in Table 8. Estimates of reasonable maximum exposure and risks potential residential receptors are based on 30-year exposures, since that is the 90th percentile amount of time an individual lives at a single residence (EPA 1989b).

Table 6

CONTAMINANT CONCENTRATIONS IN WATER AND SEDIMENT IN SEEP AREAS USED FOR EVALUATING ACCIDENTAL CONTACT WITH THESE AREAS

UCL* Concentration = Upper 95th % Confidence Limit on Arithmetic Mean

Chemical	(µg/kg-soil µg/L-water)
ORGANICS (µg/kg-soil; µg/L-water)	
Benzene	6.1
bis(2-Ethylhexyl)phthalate	280
Chlorobenzene	20.8
Chloroethane	4.85
1,2-Dichlorobenzene	3.98
1,4-Dichlorobenzene	16
1,1-Dichloroethane	24.8
1,2-Dichloroethane	2.94
1,2-Dichloroethene	22.2
1,2-Dichloropropane	4.43
Ethylbenzene	39.5
Naphthalene	38.9
Toluene	1.4
Trichloroethene	4.97
Vinyl chloride	19.1
Xylenes	104
INORGANICS (mg/kg-soil; mg/L-water)	
Antimony	15.6
Arsenic	15.9
Barium	257
Beryllium	1.31
Chromium	66.9
Mercury	.000475
Nickel	20.6

Table 7

STRASBURG LANDFILL
SUMMARY OF CONTAMINANTS FOUND IN SOIL GAS AND AMBIENT AIR

COMPOUND	AMBIENT AIR Concentration Range/Detection Frequency (ppb)	SOIL GAS Concentration Range/Detection Frequency (ppb)	FLUX BOXES Concentration Range/Detection Frequency (ppb)			
Benzene	24/91	2 - 10,000	9/10	3 - 150	0/10	--
Dibromomethane	0/91	--	6/10	4 - 224	0/10	--
1,1-Dichloroethene	40/91	17 - 1,700	5/10	2 - 840	0/10	--
1,2-Dichloroethene	0/91	--	7/10	2 - 11,000	2/10	0.08 - 0.64
Dichlorotetrafluoroethane	N/A	--	N/A	--	3/10	0.03 - 0.06
Ethylbenzene	N/A	--	N/A	--	1/10	0.29
Tetrachloroethene	17/91	10 - 4,400	7/10	1 - 567	1/10	0.09
Toluene	N/A	--	N/A	--	1/10	1.53
Trichloroethene	30/91	80 - 5,400	3/10	3 - 84	1/10	0.14
Trichlorofluoromethane	N/A	--	N/A	--	3/10	0.46 - 1.65
1,3,5-Trimethylbenzene	N/A	--	N/A	--	1/10	0.04
Vinyl Chloride	44/91	60 - 11,000	6/10	1 - 129	1/10	0.48
m/p-Xylene	N/A	--	N/A	--	3/10	0.23 - 0.57
o-Xylene	N/A	--	N/A	--	2/10	0.10 - 0.18

N/A: Not analyzed.

Table 8

SUMMARY OF ESTIMATED EXCESS LIFETIME CANCER RISKS TO STRASBURG LANDFILL SITE RECEPTORS

		Receptors						
			Children					
Pathway	Case	Adults 30-Year Exposure	1 - 6 Years	6 - 12 Years	12 - 18 Years	Child/Adult 1 - 31 Years	Composite Contributions by Exposure Route	Risk Risk Contributions by Chemical
Inhalation of Airborne Contaminants	RME to Site Visitors	5.6×10^{-7} (1%)	--	2.5×10^{-7}	1.3×10^{-7}	6.4×10^{-7} (1%)	Inhalation - 100%	VC - 51% 1,1-DCE - 44% Benzene - 4% TCE - 3%
Accidental Contact with Seep Areas 8%	RME	5.4×10^{-6} 8%	--	2.0×10^{-6}	1.2×10^{-6}	6.5×10^{-6} 8%	Dermal - 50% Ingestion - 7% Inhalation - 44%	Arsenic - 80% VC - 9% Beryllium - 1,1-DCA - 2% BEHP - 1%
Total Risks to Site Receptors	RME	6.0×10^{-6}	--	2.3×10^{-6}	1.3×10^{-6}	7.1×10^{-6}		

Key:

RME = Reasonable Maximum Exposure
PCE = Tetrachloroethene
TCE = Trichloroethene
VC = Vinyl chloride
BEHP = Bis(2-ethylhexyl)phthalate
1,1-DCA = 1,1-Dichloroethane
1,2-DCA = 1,2-Dichloroethane
1,1-DCE = 1,1-Dichloroethene
1,2-DCP = 1,2-Dichloropropane

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Among 30-year residents, the greatest exposure and risks would accrue to an individual living at a residence from birth through early adulthood, since children tend to experience greater exposure than adults in the same setting. This occurs for two main reasons: children engage in more exploratory behavior than adults, thereby increasing their potential contact with contaminants, and children have greater ingestion-rate-, inhalation-rate-, and skin-area- to body-weight ratios than adults, thus increasing the intensity of their exposure in a given situation. For these reasons, potential risks to a composite child/adult receptor, age 1 to 31 years, were estimated by summing risks for age groups explicitly evaluated.

For on-site air exposure and accidental contact with seep areas, the risk for children 6 to 12 years old and 12 to 18 years old, were combined with adult risks representing 18 years of exposure to complete the 30-year exposure period. Children 1 to 6 years old would be unlikely to wander onto the landfill unaccompanied by an adult; thus, omission of the age group from these pathways would be unlikely to affect the estimated composite risks. Using the risk estimates for the composite child/adult population, the most sensitive population, as shown in Table 8, the magnitude of potential cancer risks to site visitors posed by site contaminants was estimated to be 6.5×10^{-6} for accidental contact with seep areas and 6.4×10^{-7} for inhalation of airborne contaminants. The excess lifetime cancer risk for a site visitor exposed for 30 years to the site contaminants in the air and seep areas is 7.1×10^{-6}.

This means that an individual visiting the Site for the recreational purposes described (walking, jogging riding horses, ATVs or motorcycles) has a little more than one chance in a million of developing a cancer that otherwise would not have developed.

Also shown in Table 8 are the risk contributions attributable to the different chemical contaminants and to the different routes of exposure. For the inhalation pathway, all of the exposure is attributed to inhalation with the greatest risk posed by vinyl chloride (51%) followed by 1,1-dichloroethene. For the accidental contact pathway, half of the exposure is attributed to dermal route, 44% to inhalation, and the remainder to ingestion; most of the risk (80%) is attributed to arsenic exposure.

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

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that is not likely to be without an appreciable risk of adverse health effects. 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 have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

As discussed above, the incremental cancer risk, using all these conservative assumption factors is 7.1×10^{-6}. While this [risk] is within the 10^{-6} to 10^{-4} risk range that EPA uses to initiate remedial action, it is above the 10^{-6} "starting point" the EPA uses as a baseline for decisions.

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

ECOLOGICAL RISKS

Ecological field investigations and risk assessments were conducted in the 400-acre study area surrounding the Strasburg Landfill site to characterize the biological communities and determine if significant ecological resources are potentially affected by site contamination. The ecological site survey and contacts with natural resource trustee personnel indicated the presence of high-quality habitat in the study area. The landfill is surrounded by apparently healthy, diverse terrestrial and aquatic communities, including river, wetland, forest, and open-field ecosystems harboring abundant wildlife populations. Stream surveys of benthic invertebrates indicated no alteration of community structure directly downstream from the site, and there was no other obvious evidence of adverse effects of chemical contamination on the existing populations, communities, or ecosystems. Other than the identified wetlands, no significant sensitive or protected biological resources (such as endangered species) are known to occur in the study area. Several species with special status in the Commonwealth of Pennsylvania have been reported in the vicinity, however, and these or other protected species could conceivably come in contact with the site or establish populations there. The Brandywine Conservancy Management Center manages two nature preserve properties within one mile of the landfill, providing potential source populations of special-status species.

The ecological risk assessment for the Strasburg Landfill site identified elevated levels of contaminants relative to background concentrations and environmental concern levels in seep areas, surface water, sediments, and soil gas. Potential low-level, chronic exposure of aquatic biota to site-related contaminants is considered likely from uncontrolled releases at seep areas and from runoff into surrounding wetlands and streams. No single contaminant appears to be occurring in surface water at levels toxic to aquatic life, but bioassay results demonstrate that seep water is toxic to indicator organisms tested under laboratory conditions. Shannon Diversity Indices were calculated for the benthic invertebrate samples collected at upstream and downstream locations in Briar Run and Brandywine Creek. For both streams, the diversity indices were higher downstream of the landfill than upstream. Thus, there is no evidence of a decrease in diversity of benthic invertebrates downstream of the landfill in either Briar Run or Brandywine Creek.

Although sediment contamination is not sufficient to alter benthic community composition in Briar Run, there is evidence of elevated levels of metals in wetland sediments with the potential to migrate downstream. This migration may have toxic effects on some aquatic organisms.

Terrestrial organisms may also be exposed to site-related contaminants, particularly landfill air emissions of volatile organic compounds (VOCs). For example, small mammals such as field mice inhaling air on the landfill perimeter may be exposed to toxic levels of VOCs migrating from soil gas to the near-ground ambient air. Elevated and potentially toxic levels of vinyl chloride occurred in soil gas plume areas on the east and west sides of the landfill, and benzene, PCE, and 1,1-DCE were present at elevated and potentially toxic levels on both sides of the landfill. Small mammals could also be at risk from elevated levels of barium in drinking water at the seeps. The potential risks to small mammals decrease rapidly with distance from the landfill and are likely to be negligible for all populations except those residing on the landfill and its perimeter or in wetlands adjacent to the landfill. Because of the limited spatial distribution of chemical contamination, predators and scavengers that utilize small mammals as prey probably face negligible risks from feeding on a contaminated food source or from reduced abundance of prey populations.

In summary, it can be clearly seen that the Site poses risk to the human health and the environment. Leachate seeps pose risk to site visitors and trespassers. Leachate also enters the local natural environment through run-off into Briar Run and surrounding soils. We also know that leachate continues to discharge to the groundwater from the poorly capped landfill. Alternatives to address reduction of these risks were developed and evaluated.

7. Description of Alternatives

The Superfund statute and regulations require that the alternative chosen to clean up a hazardous waste site meet several criteria. The alternative must protect human health and the environment, meet the requirements of environmental regulations, and be cost effective. Permanent solutions to contamination problems should be developed wherever possible. The solutions should reduce the volume, toxicity, or mobility of the contaminants.

The intent of this action is to reduce the health risk to people through elimination of present routes of exposure. In accordance with 40 CFR §300.430 a list of remedial response actions and representative technologies were identified and screened to meet the remedial action objectives at this site. The FS studied a variety of technologies to determine if they were applicable for addressing the contamination at the Site. The technologies determined to be most applicable were developed into remedial alternatives. In addition, EPA has evaluated the No Action Alternative (Alternative 1) as required by the National Contingency Plan (NCP). These alternatives are presented and discussed below. All costs and implementation time frames provided for the alternatives below are estimates.

This action is planned to be the final action for all media except groundwater. As stated above, groundwater will be finally addressed in OU 4 and will be based on the data collected and modelling after this action is fully implemented. The intent of the OU 4 action will be to address any risk to human health and the environment caused by exposure to the groundwater.

The current routes of exposure include ingestion of contaminated groundwater, inhalation of landfill vapors and direct contact with leachate seeps both in and around the landfill surface. The population to be protected are those people who reside in the area who use the groundwater for ingestion and bathing purposes and also those persons who utilize the Site for recreational activities such as motorcycle or all terrain vehicle riding, walking, jogging, or hunting. The health risk will be reduced by replacing the existing, improperly installed cap and by capturing and treating the subsurface leachate flow before it reaches the aquifers used for domestic purposes.

The following alternatives which were identified and evaluated in the FS, will be developed and discussed using the following sequence: identification of remedial action objectives; identification, effectiveness, implementability, costs.

Note: The cost and time factors listed in this plan are estimated values based on best engineering judgment by EPA.

Alternative 1 - No Action

Capital Cost: $ 500
Operation and Maintenance (O&M) Costs: $197,996/yr
Present Worth: $3,044,700
Implementation Time: 2 months

Pursuant to the NCP, this alternative was developed to provide a baseline to which the other remedial alternatives can be compared. For the purposes of this alternative, no action is considered to be "no further action" and includes, as part of the costs, maintenance of the landfill cap. This on-going cost is also included in the other alternatives described below. This alternative, which involves no remediation, is considered in the detailed analysis to provide a baseline to which the other remedial alternatives can be compared. This alternative, however, would include some baseline items that are considered to be appropriate based on present circumstances at the site:

- Quarterly monitoring of the 11 existing monitoring wells, and EPA-designated residential wells in the surrounding community.

- Periodic ambient air monitoring;

- Operation and Maintenance of the existing landfill cap (such as mowing and repairs) and the remedies being implemented under OU 1 and OU 2.

Alternative 1A - Limited Action

Capital Cost: $ 1,000
O & M Costs: same as above
Implementation Time: 1 month

Alternative 1A would include all of actions listed above in the "no action" alternative, with the addition of deed restrictions on the immediate landfill property (at no additional cost or time). Deed restrictions, which are considered "institutional controls," are sometimes implemented at locations to restrict actions such as the development of new drinking water wells. Under this alternative, EPA would seek to restrict usage of the site for usages, such as human habitation, until such time as the risk levels in the various exposure media were reduced to acceptable levels.

Alternative 2 - Source Containment (capping) and Landfill Gas Emissions Collection (venting)

Capital Cost: $6,162,497
O & M Costs: $277,011 / yr
Present Worth: $10,420,850
Implementation Time: 24 months

Alternative 2 involves containment of the landfill by capping, in addition to the provisions made under the no-action alternative (excluding the environmental monitoring). Containment technology, such as capping, is intended to reduce landfill emissions, infiltration of precipitation, and the amount of leachate produced would be reduced. The capping technology selected is a multilayered cap, due to the existing slopes and intended land use. From among the various types of multilayered caps, the type whose performance is specified in 25 PA Code Chapter 264, Subchapter G is selected for containment of the landfill.

This technology involves clearing and grubbing, grading, and covering site soils with approximately 24 inches of compacted clay and an impermeable synthetic membrane that is covered by approximately 24 inches of compacted sand. The compacted clay and synthetic membrane act as barriers to the infiltration of water, while the top sand layer provides a drainage way for percolating water. Overlying these materials is 12 inches of loam (topsoil) to allow for revegetation. This sequence of materials meets the requirements of 25 PA Code, Chapter 264, Subchapter G for capping at a new facility. This technology takes advantage of the self-repairing properties of clay, along with the impermeable nature of a synthetic membrane. Six operations are required to complete the construction of this cap, and seams in the membrane require careful installation and sealing.

The existing cap would be removed (excavated) prior to the installation of a new cap (specified for hazardous material landfills). Capping would be performed over the entire 22-acre area (including the sides) of the Strasburg Landfill.

In addition to capping, the gas generated within the landfill would be vented to the atmosphere by installing a passive type of gas collection system. This collection system would be installed at the time the landfill cap was being installed. The collection system would be flexible enough to allow the addition of a gas treatment unit in the future, if determined essential. A passive gas collection system has advantages over active gas collection. If the landfill gas is collected actively, it would draw air into the landfill, which will increase the volume of the gas and shift the solid-to-gas equilibrium, increasing volatile organic compound (VOC) concentration in the gas. It may also interfere with the anaerobic biological decomposition process and therefore reduce the quantity of methane gas being generated. Calculations performed during the feasibility study showed that introduction of excessive amounts of oxygen into the landfill could cause a fire to start due to spontaneous combustion.

Operation and maintenance (O&M) of the landfill cap consists of maintaining the vegetative cover (including mowing and grubbing); making repairs in the cap as they are needed; and removing debris from the leachate witness system.

<u>Alternative 3 - Source Containment; Landfill Gas Emissions Collection; and Secondary Leachate Collection, Treatment, and Discharge</u>

Capital Cost: $6,502,997.
O & M Costs: $312,471./yr
Present Worth: $11,306,460.
Implementation Time: 30 months

In addition to all aspects of Alternative 2, Alternative 3 includes a secondary leachate collection system on the southwest, south, and southeast sides of the landfill. A trench around the southern boundaries of the landfill will be used for collecting the leachate flowing by gravitational force. Currently, the leachate is being collected by the existing leachate collection system below the landfill and treated in an air stripper constructed and maintained by Clean Harbors, Inc. Additional leachate collected by the secondary leachate collection system would be treated by UV-ozone oxidation and discharged to the surface water. For an innovative technology such as UV-ozone oxidation, pilot tests would be conducted prior to full-scale operation. This alternative would not only reduce the vertical infiltration of water but also would collect and treat the leachate rather than allowing it to migrate off site.

O & M of the cap would be the same as with Alternative 2.O & M of the leachate collection and treatment system would entail keeping the collection system free of sedimentation and maintaining the UV/ozone treatment in working order so that NPDES compliance can be maintained.

Alternative 4 - Source Containment; Landfill Gas Emissions Collection and Treatment

Capital Cost: $6,232,497.
O & M Costs: $310,011./yr
Present Worth: $10,998,140.
Implementation Time: 26 months

Alternative 4 consists of the actions described for Alternative 2, in addition to the treatment of landfill gas emissions. Even after installing the landfill cap, as per Alternative 2, the need for treating landfill gas emissions containing VOCs and methane might exist.

Landfill gas emissions would be collected actively and treated for VOCs by a Vapor Phase Activated Carbon (VPAC) column followed by flaring to destroy methane. If the moisture content of the landfill gas emissions is high enough to warrant moisture removal before treatment, then demoisturizing columns containing silica gel, self-indicating molecular sieves, or desiccants would be utilized. Landfill gas emissions would be dried before entering the VPAC column for treatment of VOCs, which would help to prolong the life of the column.

For the purpose of this proposal, an active collection and treatment system for landfill gas emissions is designed based on several assumptions. The concentration of VOCs in the landfill gas was estimated using air emissions data from the risk assessment section of the RI report. The gas-generation rate was estimated using factors in the Solid Waste Handbook (Robinson 1986). The volume and weight of the landfill contents were estimated using approximate area and depth calculations. The spent carbon filter units would also have to be disposed of in a manner consistent with appropriate RCRA regulations.

O & M costs for the cap maintenance will be the same as for Alternative 2. O & M costs incurred for the gas venting system will involve periodic replacement of the gas filter system units, including filter media, and appropriate disposal costs.

Alternative 5 - Source Containment; Landfill Gas Emissions Collection and Treatment; Secondary Leachate Collection, Treatment, and Discharge

Capital Cost: $6,572,997
O & M Costs: $345,471./yr
Present Worth: $11,883,750.
Implementation Time: 30 months

Alternative 5 is a combination of alternatives 3 and 4. This alternative would include the multilayered type landfill cap (as containment); active landfill gas collection, filtration, and flaring of landfill gases; expanded leachate collection and treatment via an extended trench around the southern and southwestern boundaries of the landfill; and the basic actions planned under the no-action alternative. A detailed description of this alternative is a summation of alternatives 1, 3, and 4.

O & M costs associated with Alternative 5 would be a combination of the O & M elements associated with Alternatives 3 and 4.

8. <u>Summary of Comparative Analysis of Alternatives</u>

An analysis was performed on all of the alternatives using the nine criteria specified in the NCP in order to select a remedy for OU 3. An explanation of the nine criteria is attached as Exhibit A. These nine criteria are organized according to the groups below:

THRESHOLD CRITERIA

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

PRIMARY BALANCING CRITERIA

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

MODIFYING CRITERIA

Community acceptance
State acceptance

These evaluation criteria relate directly to the requirements in Section 121 of CERCLA, 42 U.S.C. Section 9621, which determine the overall feasibility and acceptability of the remedy.

Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. State and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan.

The following is a summary of the comparison of each of the alternatives' strengths and weaknesses with respect to the nine criteria.

Overall Protection of Human Health and Environment

All of the alternatives evaluated for this remedy are considered to prevent contact with contaminated surface soil and leachate, thereby limiting human exposure and reducing future risks. The no-action and limited action alternatives would not reduce the health risks associated with the site more than the two interim actions, i.e., point-of-use carbon treatment for the two affected residential drinking water wells (implemented March

EXHIBIT A. DESCRIPTION OF EVALUATION CRITERIA

Overall Protection of Human Health and the Environmental - addresses whether or not a remedy will: cleanup a site to within the risk range; result in any unacceptable impacts; control the inherent hazard (e.g., toxicity and mobility) associated with a site; and minimize the short-term impacts associated with cleaning up the site.

Compliance with ARAR's - addresses whether or not a remedy will meet all the applicable or relevant and appropriate requirements of other environmental statues and/or provide grounds for invoking a waiver.

Long-term Effectiveness and Permanence - refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Reduction of Toxicity, Mobility, or Volume through Treatment - refers to the anticipated performance of the treatment technologies that may be employed in a remedy.

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

Implementability - describes the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Cost - includes the capital for materials, equipment, etc. and the operation and maintanance cost.

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

Community Acceptance - will be assessed in the Record of Decision following a review of the public comments received on the RI, FS, and the Proposed Plan.

1990) and fencing the immediate landfill area to restrict site access (implementation pending).

The no-action and limited action alternatives would not provide any protection of the environment. They would continue to allow landfill-generated leachate to migrate into groundwater and contaminated groundwater to migrate off site. The interim action, point-of-use carbon treatment, implemented earlier as part of OU 1, is effectively reducing the human health risks in the groundwater pathway at the two affected residential drinking water wells southwest of the landfill.

Alternative 2 (source containment by capping and gas venting) would reduce the human health risks and environmental receptor exposure by reducing or eliminating the direct-contact pathway with leachate seep material. These actions in conjunction with the interim action to restrict site access will reduce the site-specific identified health risks to acceptable levels. This alternative would not, however, reduce the human health risk or environmental receptor exposure to the inhalation exposure pathway, since only gas venting, and not gas collection and treatment, is included in Alternative 5.

Alternative 3 (source containment by capping, gas venting, leachate collection, treatment, and discharge) would reduce the amount of leachate that may contaminate the groundwater and migrate off site in addition to the protection provided by implementation of Alternative 2. This alternative provides source containment by capping, which would reduce the vertical infiltration of rainwater, therefore reducing the volume of leachate to be treated. Because less leachate would enter the groundwater, the groundwater contamination process would be slowed down. This action would supplement the interim action point-of-use carbon treatment implemented earlier as part of OU 1, which treats the contaminated groundwater that is used as drinking water at the two residences southwest of the landfill.

Alternative 4 (source containment by capping, and gas collection and treatment) would reduce the human health risks and environmental receptor exposure by reducing or eliminating the direct contact pathway with leachate seep material and the inhalation pathway of landfill gas emissions. These actions, in conjunction with the interim action to restrict site access, will provide a reduction of the site-specific identified health risks to acceptable levels. The items in this alternative will not eliminate groundwater contamination because landfill-generated leachate will continue to contaminate groundwater and migrate off site.

Alternative 5 (source containment by capping; leachate collection, treatment and discharge; and gas collection and treatment) would reduce the human health and environmental receptor exposure by reducing or eliminating the direct contact pathway with leachate seep material and the inhalation pathway of landfill gas emissions. These actions in conjunction with the previously implemented interim action to restrict site access will provide a reduction of the site-specific identified health risks to an acceptable level. Leachate collection, treatment, and discharge would reduce the amount of leachate available to contaminate groundwater and migrate off site. The landfill cap will reduce or eliminate water, particularly rainwater, from peculating through the landfill and into the groundwater. This action would supplement the interim action, which was part of OU 1 which is point-of-use carbon treatment, implemented earlier, to treat contaminated groundwater used as drinking water at the two residences southwest of the landfill.

Alternatives 2 and 4 are less protective since they do not address the leachate which has been evidenced as entering the water table. Alternatives 3 and 5 both provide additional protection in that both propose to add additional collection and treatment for leachate in the upper portion of the aquifer. Alternative 5 is most protective in that it also seeks to treat the vented air emissions from the landfill.

Compliance with ARARs

CERCLA requires that remedial actions meet applicable or relevant and appropriate requirements (ARARs) of other federal and state environmental laws and/or provide grounds for invoking a waiver. These laws may include, but are not limited to : the Toxic Substances Control Act, the Clean Water Act, the Safe Drinking Water Act, and RCRA.

A "legally applicable" requirement is one which would legally apply to the response action if that action were not taken pursuant to Sections 104, 106, or 122 of CERCLA. A "relevant and appropriate" requirement is one that, while not "applicable," is designed to address problems sufficiently similar to those encountered at the Site, and is appropriate to the circumstances of the release, or threatened release, such that its use is well-suited to the particular site.

There are a number of specific requirements which will need to be met for this action. The Federal and State ARARs include:

- The landfill cap: The Pennsylvania Municipal Landfill Regulations, as contained in 25 PA Code § 273.322 (a) and (b), are applicable for this landfill cap. However, because the landfill accepted wastes which were hazardous as specified in 40 CFR §261 Subpart C (or constituents as contained in Subpart D), and 25 PA Code Part 261 Subpart C (or constituents as contained in Subpart D), the following

PA Hazardous Waste Regulations would be relevant and appropriate to this action, as specified in Title 25 PA Code, Chapter 264, Subchapter G sections:

264.111 Closure Performance
264.117 Postclosure care and;
264.118 Postclosure Plan, Amendment of Plan
Specifically subsections a, a(1), a(2)(i) and (ii), a(3)
and Subchapter N sections:
264.301 Design Requirement General: specifically subsections: 264.301(5),(6), and (12)-(15)
264.303 Leachate Management
264.310 Closure, Postclosure Care

- To the extent that portions of the old cap or other materials may have to be disposed of off-site, the Land Disposal Restrictions as contained in 40 CFR Part 268

- Air Emissions from the landfill: 40 CFR Part 264 subpart AA for VOCs and the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), as contained in 40 CFR Part 61, as well as the National Ambient Air Quality Standards (NAAQS), as specified in 40 CFR Part 50, and the PA Air Pollution Control Act and Air Discharge Regulations, as specified in 25 PA Code Sections 123 and 127.1 (not exempted by Section 127.14).

- Discharges of the treated leachate from the landfill: National Pollutant Discharge Elimination System (NPDES) as specified in 40 CFR Part 122, Subpart C, and PA Clean Streams Law, as specified in 25 PA Code Chapters 92, 93, 94 and 96.

EPA and PADER have agreed to model the groundwater contamination levels after this alternative is implemented for a minimum period of two years. Therefore, Groundwater Protection, as specified in the PA Hazardous Waste Management Regulations, as contained in 25 PA §§ 264.97(i)(j) and 264.100 (a)(9), are not ARARs for this operable unit. Sampling will be conducted on a quarterly basis. A determination will be made at that time as to the type of further treatment to be considered in OU 4 for this site.

In reviewing the ARARs for this operable unit the following is a discussion as to how each of the alternatives would comply:

The no-action and limited action alternatives would not meet any identified ARARs. In addition, these alternatives would not reduce the site-specific identified health risks associated with the site.

The leachate treatment system as contemplated as parts of Alternatives 3 and 5 would meet the requirements of a PADER NPDES discharge permit to Briar Run or Brandywine Creek.

Under Alternatives 2, 3, 4, & 5, capping the landfill with a designed impermeable cap would meet the PADER closure ARARs. Groundwater would continue to be contaminated by leachate from the landfill. The amount of leachate generated by precipitation infiltrating through the cap would be significantly reduced and perhaps totally eliminated. Capping would reduce the site-specific identified health risk to human and environmental receptors by reducing or eliminating leachate seeps that exist on the landfill and by reducing or eliminating the direct-contact exposure pathway associated with the leachate seeps. Collection and treatment of landfill-generated leachate would tend to reduce the amount of leachate contributing to groundwater contamination.

Under Alternatives 3 & 5, installation of a cap would meet the PA Municipal Landfill regulations, as well as the PA Hazardous Waste Regulations. Collection and treatment of landfill-generated leachate would tend to reduce the amount of leachate contributing to groundwater contamination. The treatment system would provide adequate treatment of the collected leachate to meet the requirements of a PADER (NPDES) discharge permit to Briar Run or Brandywine Creek.

Alternative 4, installation of a cap, would meet the PA Municipal Landfill Regulations and the PA Hazardous Waste Regulations. Capping and gas collection and treatment would reduce the site-specific identified human health risks and environmental receptor exposure by reducing or eliminating the direct contact pathway for the leachate seeps and the inhalation pathway. The gas treatment plant would meet applicable design and treatment standards.

Alternative 5 would require installation of a cap which would meet the PA Municipal Landfill Regulations and the PA Hazardous Waste Regulations regarding landfill capping requirements. Collection and treatment of landfill-generated leachate would tend to reduce the amount of leachate contributing to groundwater contamination. The treatment system would provide adequate treatment of the collected leachate to meet the requirements of a PADER (NPDES) discharge permit to Briar Run or Brandywine Creek.

Alternatives 2, 3, 4, & 5 would satisfy the requirements for the landfill cap. Testing performed to date would indicate that air emissions are in compliance with the cited ARARs, however, vent gas treatment as proposed under Alternatives 4 and 5 would provide extra assurance that no violation of the NESHAPS would occur.

Long-Term Effectiveness and Permanence

As no remedial action is planned under the no-action and limited action alternatives, the magnitude of risks identified in the Risk Assessment portion of the RI report will remain; however, some of the risks may gradually reduce due to natural attenuation. The landfill, as a source of contamination (hazardous wastes), would continue to be a major source for continual leachate migration to groundwater.

Long-term periodic monitoring of groundwater and air would help to track contaminant activities in these media, and future remedial action would depend upon these monitoring results. Deed restrictions on the property and warning signs for surface water would mitigate exposure possibilities, which would protect human health but not the environment. The no-action and limited action alternatives do not include any actions to repair the extensively deteriorated existing cap, including the synthetic membrane cover. If the existing cap is not repaired, there is a potential for significant failure due to the existing steep slopes. However, even maintenance of the existing cap may not prevent further deterioration of it and the synthetic membrane cover.

These provisions, under the no-action and limited action alternatives, are routine and established techniques. Therefore, except for certain fluctuations in cost due to technical part replacement, there would not be unforeseen difficulties.

Landfill leachate would continue to migrate into the groundwater, and landfill gas emissions would continue through the existing, compromised cover. Groundwater, surface water, soil, and sediment would remain contaminated under Alternatives 1 and 1A. Therefore, these alternatives are not considered a permanent solutions.

Capping the landfill as anticipated under Alternative 2 would reduce the site-specific health risks further than the access-restriction interim-action would, by reducing the leachate and subsequent seep generation. Capping would also include proper venting of the landfill, but this would not reduce the health risk attributed to inhalation of air emissions, as no gas-treatment system is included in this alternative. This alternative would not directly reduce groundwater contamination, as capping does not include measures to collect and treat landfill-generated leachate in addition to the existing leachate collection system. However, a secondary effect of capping the landfill would be a reduction of leachate generated by the infiltration of precipitation through the cap. This would reduce the amount of leachate available to contaminate the groundwater. The groundwater may begin to attenuate naturally. This alternative would directly reduce the exposure to environmental receptors, e.g., small animals inhabiting the landfill property, by reducing the direct contact pathway with leachate seep material.

Under Alternative 3, the long-term effectiveness of capping technology will be similar to that described in Alternative 2. Alternative 3 also involves collection and treatment of leachate generated within the landfill, which would prevent further contamination of the groundwater by infiltrating leachate. The leachate collection and treatment system would be expected to have a long life, similar to capping with routine maintenance. Collection trenches are routinely installed and have been shown to be effective in capturing groundwater and leachate. Although this alternative does not cover actual groundwater restoration, it will help to reduce the risks by allowing natural attenuation.

Also under Alternative 3, to ensure long-term effectiveness, annual O&M would be required on the secondary leachate collection system and the UV-ozone treatment system.

Alternative 4 is a combination of capping and collection and treatment of landfill gas emissions. While capping alone would provide containment of the landfill, this alternative would also mitigate the risks posed by the air exposure route by treating the vented gas. As discussed previously, landfill caps are effective, assuming proper maintenance is performed. Landfill gas emissions would be treated for VOCs and methane. Collection and treatment of landfill gas will also help to prevent pressure buildup within the landfill.

Gas treatment is effective if designed properly. Carbon adsorption and flaring are well-documented and effective technologies for treating landfill gas. System maintenance and replacement make gas treatment possible for an indefinite period of time. Waste remaining on site somewhat limit the permanence of Alternative 4. The gas treatment is a permanent solution, as contaminants are destroyed.

Alternative 5 would have good long-term effectiveness. All systems as discussed previously would operate effectively for a long period of time with appropriate maintenance. The permanence of this alternative is fair at best as it only provides containment of wastes; no destruction or removal of the source of contamination is included. Because it includes containment of the landfill and treatment of both emissions and leachate, Alternative 5 would reduce risks from air exposure and groundwater contamination. The techniques used to achieve these treatments are described in previous alternatives.

Reduction of Toxicity,Mobility, or Volume Through Treatment

The no-action alternative would provide for no reduction in toxicity, mobility, or volume. Even though some institutional measures are planned under the limited action alternative, none of the contaminated medium of concern will be treated and, consequently, this alternative would not provide any reduction in the toxicity, mobility, or volume of the contaminated media either.

Alternative 2 involves the containment technology of capping the landfill using a design under the performance specifications of PA Municipal Landfill Regulation and the PA Hazardous Waste Regulations. No treatment of any kind is planned under this alternative. The contaminated contents of the landfill would be confined and sealed from the top, which would reduce leachate generation (and thus reduce groundwater contamination) and landfill emissions and would restrict mobility of the contaminants. Capping would not reduce the toxicity or volume of the landfill contents.

A passive gas collection system would vent the landfill gas to the atmosphere. Even though it will not reduce toxicity, mobility, or volume through treatment, venting would help to alleviate a possible pressure buildup of toxic gases within the landfill.

Alternative 3 would reduce mobility, toxicity, and volume of leachate, to a substantial extent, through treatment. Leachate would not be allowed to migrate into the soil and groundwater, and will be discharged to the surface water after treatment, thereby reducing volume and toxicity of contaminated (untreated) leachate. Capping would restrict mobility of the contaminants similar to Alternative 2. Contaminants in leachate would be treated. Since leachate would be collected, treated and discharged, there would be less leachate entering and contaminating groundwater. Groundwater contamination would be allowed to attenuate naturally.

For alternative 4, as with alternatives 2 & 3 above, the landfill cap will somewhat reduce the mobility of the contaminants leaving the landfill in the form of leachate. The cap will reduce the amount of leachate generated and thus the amount of contaminants entering the groundwater. Over time, it is anticipated that the reduced contaminant loading to groundwater and subsequent media (soil/sediment and surface water) would attenuate naturally. The collection and treatment of landfill emissions will eliminate the volume of gas migrating off site, thereby reducing the mobility of contaminants. The volume and toxicity of contaminants are completely reduced during the treatment of the gas.

Alternative 5 would reduce toxicity, mobility, and volume of contaminants in air emissions as well as groundwater. Due to capping, the mobility of contaminants in the landfill would also be restricted, which would have a positive impact on other media of concern, such as groundwater, surface water, and soil/sediment.

Capping the landfill would reduce infiltration of precipitation into the landfill, which would decrease the quantity of leachate generated within the landfill. As the amount of leachate carrying contaminants and entering the groundwater aquifer decreases, the rate at which the groundwater is contaminated would also decrease, thereby reducing the toxicity due to contaminants in groundwater. Also, the leachate generated, even after capping, due to infiltration of rainwater from the sides of the landfill, would be collected, treated, and discharged to the surface water of Briar Run. This would also reduce the toxicity in groundwater due to reduced loading of the leachate.

Landfill gas emissions would be collected and treated before being released into the atmosphere. Treatment would reduce VOCs and methane, which would mitigate the toxicity of landfill emissions.

Short-Term Effectiveness

Under the no-action and limited action alternatives, institutional measures and access control rather than remedial actions are planned. These activities would not pose any risk to the community. Monitoring and access restrictions would be carried out by workers using the proper levels of personal protection as specified in OSHA. There would not be any environmental impacts from these non-construction activities. Except for warning signs at the perimeter of the Site area and deed restrictions, other activities are long-term but periodic. Installation of signs may take approximately three to four weeks. Deed restriction is a one-time event.

Under Alternative 2, the capping contemplated would involve constructing a multilayered cap over the landfill after removing the existing one. During construction, short-term environmental impacts would include noise, dust, and increased traffic through neighborhoods. These activities would not pose any significant risk to the community. Workers involved in the construction task would follow OSHA specified health and safety practices. Exposed surfaces of landfill contents would be kept to a minimum to reduce potential on- and off-site exposures. Monitoring of ambient air will be carried out along the perimeter and at the work sites to identify potential exposure to workers and residents. Operational procedures during field activities will be modified to reduce emissions. Smoking will not be allowed in the area of potential emissions. Construction of the landfill cap may take several months.

Under Alternative 3, short-term environmental impacts due to construction of the cap and passive leachate collection/treatment system would be similar to those discussed for Alternative 2. Workers engaged in construction, operation, and maintenance of the cap and leachate collection/treatment system would have to follow health and safety procedures. Construction may take several months, and operation and maintenance would be long term.

For Alternative 4, during construction of the multi-layered cap and landfill gas emissions collection/treatment system, short-term environmental impacts, as mentioned for Alternatives 2 & 3, would occur. Standard health and safety practices would be adhered to by construction workers. No smoking would be allowed around gas collection and treatment activities, to prevent any fire due to methane content of landfill gas. Special drilling techniques and increased air monitoring for methane would be carried out to avoid an explosion. Construction activities would take a few months and operation and maintenance would be long term.

Short-term environmental impacts for Alternative 5 during construction, safety procedures, and duration of activities would be analogous to those for alternatives 3 and 4.

Capping involves constructing a multilayered cap over the landfill upon removing the existing one. During construction, short-term environmental impacts would include noise, dust, and increased traffic through neighborhoods. These activities would not pose any significant risk to the community. Workers involved in the construction task would follow proper required health and safety practices. Construction of the landfill cap may take several months. Exposed surfaces of landfill contents would be kept to a minimum to reduce potential off-site exposures. Monitoring of ambient air will be carried out along the perimeter and at the work sites to identify potential exposure to workers and residents. Operational procedures during field activities will be modified to reduce emissions. Smoking will not be allowed in the area of potential emissions. Appropriate drilling techniques would be used to prevent explosions when installing gas recovery wells.

<u>Implementability</u>

Four institutional responses included under the no-action and limited action alternatives are well established and reliable techniques to achieve respective goals. Decisions regarding monitoring frequency and the number of signs will be made by consulting with the lead agency, local authorities, and any other concerned party. Future remedial actions will be based upon the monitoring results. This alternative would not inhibit future remedial action if determined to be necessary.

All of the other four alternatives evaluated for this Decision have been proven reliable and are readily available. Landfill caps are routinely specified for various types of fills. There is some "implementability" concern over the placement of a cap which would comply with the requirements of PA Municipal Landfill Regulations and the PA Hazardous Waste Regulations, especially on the steep slope areas of the landfill. This will be further evaluated during the design phase of this project. If necessary, the top portions of the landfill, especially the eastern slopes may have to be regraded. Adequate equipment and personnel are available to construct any of the remedies from a number of sources located within a few miles of the site.

Containment technology such as capping is routinely performed when subsurface contamination at a site precludes excavation and removal of wastes because of potential hazards and/or unrealistic costs. It is a reliable and established technique at landfill sites. The main disadvantages of capping are uncertain design life and the need for long-term maintenance.

Several contractors are available to construct the landfill cap, who would also provide heavy equipment and skilled workers. Necessary permits and approval would have to be obtained from regulatory agencies before actual construction began. For venting landfill gas emissions to the atmosphere, air permits may be required. Other additional remedial actions could be undertaken after installation of the cap, if determined appropriate and essential. Long-term monitoring and maintenance plans would also be designed and implemented.

The implementability of the portion of alternatives 2, 3, 4, & 5 involving capping of the landfill is dependent upon the stability, design, and condition of the Strasburg Landfill. Some concerns include:

- That the slopes of the landfill sides are too steep;
- That the stability of the landfill is not studied; and
- That part of the landfill is sitting in the groundwater.

Information on the existing design and construction details of the Strasburg Landfill, as well as stability information, will need to be collected during cap design. The cap included in these alternatives is based on assumptions about the integrity and stability of the landfill.

Special design features will be needed to cover the steep slopes of the landfill as well as for tie-in of the cap to the base. There is a potential need for a retaining wall around part of the landfill.

Venting of the landfill will be accomplished through a passive gas collection system installed with the cap. This system would involve installations of highly permeable (relative to surrounding soil) wells that would provide paths for gas to flow to points of controlled release. The installation of these wells would require specialized drilling techniques to prevent methane explosions. These types of precautions are routinely performed. The design of the gas collection system would require a test well to determine the final system parameters (well size and numbers of wells). Other limited data should also be collected during design, such as gas generation rate, moisture contents, and composition to assist in system design. This information would also be collected during a long-term monitoring program during operation, and the system would be modified accordingly.

Capping implementability was discussed for Alternative 2. A secondary leachate collection/treatment system which is a reliable and established technique for gravity collection, would also be installed. Design and installation of collection trenches are standard techniques and could be readily accomplished. Potential problems with installation include slopes around landfill, installation in rock-outcropping and standard trench requirements (shoring). Contractors are available to install the collection and treatment system, who would also provide necessary equipment and skilled workers. Approval from regulatory agencies would be obtained before construction of any system.

With regard to permits, no additional permits for the cap are anticipated to be required to implement any of the alternatives.

Implementation of Alternative 4 needs several considerations. Implementation of a cap was discussed in Alternative 2. For design and implementation of a collection/treatment system for landfill gas emissions, modeling and field pilot studies would be necessary during the remedial design.

A passive collection and treatment system for landfill gas emissions for this remedial action is estimated based on several assumptions. The concentration of VOCs in the landfill gas was estimated using air emissions data from the risk assessment section of the RI report. The gas-generation rate was estimated using factors contained in the Solid Waste Handbook (Robinson 1986). The volume and weight of the landfill contents were estimated using approximate area and depth calculations.

Data such as gas generation rate, composition, and moisture content would be obtained during the RD phase of the project as discussed under Alternative 2. Several contractors are available to install the collection and treatment system for landfill gas emissions. Equipment would include carbon adsorption columns, flaring units, and possibly silica gel columns. These could be obtained readily from vendors. All required permits for installation and air emissions would be obtained from respective authorities.

Implementation of alternative 5 involves the techniques and factors discussed in alternatives 3 and 4. Containment technology such as capping is routinely performed when subsurface contamination at a site precludes excavation and removal of wastes because of potential hazards and/or unrealistic costs. It is a reliable and established technique at the landfill sites. The main disadvantages of capping are uncertain design life and the need for long-term maintenance.

Several contractors are available to construct the landfill cap and gas treatment system, who would also provide heavy equipment and skilled workers. Necessary permits and approval would be obtained from regulatory agencies before actual construction begins. For collection and treatment of landfill gas emissions to the atmosphere, air permits may be required. Other additional Remedial Actions could be undertaken after installation of the cap, if determined appropriate and essential. Long-term monitoring and maintenance plans would also be designed and implemented. The design information for the various media as discussed under alternatives 2, 3, and 4 will need to be collected for final determination of overall implementability and construction.

Cost

Estimated Costs for the various alternatives are presented in the table below:

Estimated Remedial Action Costs
(in Dollars)

Alternative	Capital	O & M	Present Worth
1. No Action	$1,000.	$197,996	$3,177,500
2. Cap,Vent Gas Collection	$6,162,497	$277,011	$9,614,665
3. Cap,Vent Gas Collection Leachate Collection & Treatment	$6,502,997	$312,471	$10,397,070
4. Cap, Gas Collection & Treatment	$6,232,497	$310,011	$10,095,920
5. Cap,Vent Gas Collection & Treatment,Leachate Collection & Treatment	$6,572,997	$345,471	$10,878,330.

Capital, operation and maintenance (O&M), and present-worth costs as applicable for the four institutional response activities for the no-action alternative are contained in the above Table. These activities include:

- o Groundwater monitoring;
- o Ambient air monitoring;
- o Signs; and
- o Deed restrictions (1-A Limited Action).

Total capital cost for Alternative 1 is $1,000. Annual O&M cost for this alternative is $197,996. Thirty-year present-worth costs for this no-action alternative is $3,044,700. Cost for deed restrictions (Alternative 1-A) is estimated as a one time $500 item.

The cost for alternative 2 includes both the cost for the no-action alternative, capping, and gas collection. The Table above gives the capital, O&M, and present-worth costs for the four activities contained in the No-Action Alternative and those for capping and gas collection. The cost for a retention wall was also developed. If necessary, the wall would be added to all options involving capping. As all alternatives except the no-action alternative include capping, the cost of this potential retention wall should not affect the overall cost comparison of alternatives.

Total capital cost for Alternative 2, as listed above, is $6,162,497. Annual O&M cost for this alternative is $277,011. Thirty-year present-worth costs for this alternative is $10,420,850.

For Alternative 3, the cost for a passive leachate collection and treatment system is added to the cost of Alternative 2. Total capital cost for Alternative 3 is $6,502,997. Annual O&M cost for this alternative is $312,471. The 30-year present-worth costs for this alternative is $11,306,460.

Cost for Alternative 4 is obtained by adding the cost for treatment of landfill gas emissions to the cost of Alternative 2. There is no present risk basis for imposing the cost for vented gas treatment. However, after the cap is in place the vent gases will be continued to be monitored. This cost may be justified in the future if the risk measured warrants further treatment. Total capital cost for Alternative 4 is $6,232,497. Annual O&M cost for this alternative is $310,011. Thirty-year present-worth cost for this alternative is $10,998,140.

The cost for Alternative 5 is developed by adding the cost for leachate collection/treatment to that of Alternative 4. This alternative is the most costly one as it includes more treatment schemes than any other alternative.

Total capital cost for Alternative 5 is $6,572,997. Annual O&M cost for this alternative is $345,471. Thirty-year present-worth cost for this alternative is $11,883,750.

Based on the above cost comparison, the present worth cost of alternatives 2 through 5 are all within 10% of each other. Based on the considerations discussed under the other criteria, EPA concludes that the landfill cap, vent gas collection system, and leachate collection and treatment system identified in Alternative 3 is cost effective and reasonable for the work under consideration. The additional costs associated with gas treatment as contemplated with alternatives 4 and 5 are not justifiable based on the Air ARARs.

State Acceptance

The PADER has visited the site on a number of occasions and has observed the continuing deterioration of the existing cap. Since neither the no action or the limited action alternatives address this continuing source of local contamination, the Commonwealth would not accept these alternatives.

The Commonwealth feels that the issue of leachate, as it impacts the area groundwater needs to be addressed. Alternative 2 does not involve any action, other than capping the landfill which will address that groundwater contamination. As such, the Commonwealth will not concur with this selection.

Alternative 4 will comply with the ARARs for the landfill cap, however, it does not address the issues associated with groundwater protection which are more fully addressed by the proposed leachate collection system discussed in Alternative 3 above. The Commonwealth will not concur in this selection.

Alternatives 3 & 5 both address the issues of the deteriorated cap and the treatment of the leachate flows. Alternative 5 also includes treatment for the vented landfill gases. In terms of reduction of risk to the environment both alternatives 3 & 5 would be acceptable to the Commonwealth.

Community Acceptance

Community Acceptance is assessed in the attached Responsiveness Summary. In general, the resident community continues to be concerned over the continued, and increasing recreational use of this abandoned property and would be opposed to the no action and limited action alternatives. The community also agrees that the present cap is not effective and is concerned about the continued emergence of new leachate streams on the landfill. At the time of the public meeting the public agreed that something needed to be done to address the leachate flows from the landfill. This action is not addressed by alternative 2. Therefore the community would not accept this alternative.

Furthermore, there is general community agreement that Alternative 3 is both practical and will address their concerns over the risks posed by the landfill as long as a diligent monitoring program is continued.

With regard to Alternative 4, at the public meeting there was strong support for vent gas treatment, but not without the leachate collection system. As a stand-alone alternative this alternative would not be acceptable to the community. The concern was not so much for the actual risk for the air emissions but rather for elimination of the offensive odor.

Alternative 5 was the preferred alternative by the community, as it provides the most treatment of any of the alternatives.

9. Selected Remedy And Performance Standards

Based on the comparison of the nine evaluation factors for each of the five alternatives, Alternative 3 is the selected alternative. The components of this selected alternative are as follows:

- source containment by capping;
- passive gas collection;
- leachate collection;
- leachate treatment and discharge; and
- operation and maintenance of the above systems

Capping the landfill with a cap that meets the PA Municipal Landfill Regulations, 25 PA Code §273.322 (a) and (b) and the PA Hazardous Waste Regulations, 25 PA Code Chapter 264, Subchapter G would reduce the amount of leachate generated by precipitation infiltrating through the existing landfill cap and through the refuse. A leachate collection system around the southeast, south, and southwest sides would collect leachate that migrates from the toe of the landfill. The leachate will be treated by UV/ozone oxidation and discharged to Briar Run.

In conjunction with the two previous interim actions, i.e., point-of-use carbon treatment for the two affected residential wells southwest of the landfill, which was implemented in March 1990; and restricting access to the immediate landfill area by fencing, which is pending implementation, the actions recommended in this report will reduce human and environmental receptor exposure to acceptable levels.

If implementation of the selected remedy demonstrates, in corroboration with physical and chemical evidence, that it will not be possible to meet the remediation goals for this action, and it is thus technically impracticable (either technically infeasible or unreliable) to achieve and maintain the capping, venting, and leachate treatment system goals at this Site, the EPA, in consultation with the Commonwealth of Pennsylvania, would intend to amend this ROD or issue an Explanation of Significant Differences to inform the public of alternative access controls.

The five-year review required by Section 121 of CERCLA is applicable to the selected remedy. This review will be conducted in conjunction with the other remedial actions developed and specified for this site.

Performance Standards

(1) Removal of the Existing Landfill Cover

The existing landfill cover, including the perforated liner, will be removed from the surface of the landfill. Soils removed from this cover may be tested and, if shown to be acceptable to EPA, may be reused in the recapping of the landfill. Removed substances from the existing cover, which cannot be reused, will be disposed of in a manner approved by EPA.

(2) Installation of Landfill Cap

A landfill cap will be constructed on the top and the sides of the landfill. This cap will be constructed to meet the performance specifications applicable under 25 PA Code 273.322(a) and (b) and the relevant and appropriate specifications as contained in the PA Hazardous Waste Regulations, 25 PA Code Chapter 264, Subchapter G Sections:

264.111 Closure Performance
264.117 Postclosure care and use of property
264.118 Postclosure Plan, Amendment of Plan, specifically subsections a, a(1),a(2)(i) and (ii), a(3) and;

Chapter 264, Subchapter N sections:
264.301 Design requirement general: specifically subsections 264.301(5), (6), and 264.301(12))-(15)
264.303 Leachate Management
264.310 Closure, Postclosure Care

The cap shall be constructed as follows (subject to EPA approval at the design phase of this remedy):

a) a top soil layer two feet thick, or more, to provide freeze thaw protection;

b) a soil drainage layer 12 inches thick with a hydraulic conductivity of 10^{-2} cm/sec or greater, or a geosynthetic drainage layer; and

c) a two-component low-permeability layer comprised of a 30-mil (minimum thickness) geomembrane and two feet of clay with a hydraulic conductivity of not more than 10^{-7} cm/sec.

(3) Revegetation of the Landfill Cap

Vegetation shall be established on the new soil cover (i.e. the entire extent of the cap). Revegetation shall provide for an effective and permanent vegetative cover of the same seasonal variety native to the site and capable of self regeneration and plant succession. Revegetation shall provide a quick germinating, fast-growing vegetative cover capable of stabilizing the soil surface from erosion.

(4) Installation of Landfill Gas Venting and Monitoring Systems

A landfill gas venting system shall be installed on the surface of the new landfill cap to minimize the potential for landfill gas migration off of the site. To prevent future complications regarding Active/Passive gas ventilation, the landfill cap will be constructed to comply with the Active gas treatment system. The system, however, need only be operated and maintained as a passive system as long as human health and the environment safe levels are maintained. The number of landfill gas vents shall be determined during the remedial design. The landfill gas venting system shall meet the requirements for new air emission sources as specified in 25 PA Code §§ 123 and 127.1 (not exempted by §127.14).

Periodic ambient air monitoring shall be conducted to evaluate the landfill gas emissions. If the monitoring shows that landfill gas emissions would cause increased health risks when vented, a gas treatment system shall be installed to address this problem. At this time, the health effects estimated from current data do not warrant gas treatment.

To monitor the potential occurrence of landfill gas migration off of the landfill perimeter, gas monitoring stations shall be installed at the same time the landfill cap is installed. The number and placement of these monitoring stations will be developed during the design phase of this remedial action. The number and locations of these stations will be approved by EPA. These gas monitoring stations shall be monitored quarterly for a period of 30 years or until EPA determines that no gas monitoring is necessary.

(5) Installation of the Leachate Trench Collection System

A leachate collection system, to collect leachate in the surficial aquifer, shall be installed around the landfill cap. This collection system will extend around the circumference of the landfill starting at the existing leachate collection system and extending in a south and then westerly direction encompassing approximately 240° of the landfill cap boundary. The specific distance from the landfill cap of this collection system will be determined by EPA during the design phase of this project.

(6) Installation of the "Collected Leachate" Treatment System

A leachate collection and treatment system will be constructed in the vicinity of the existing treatment system building. The collection and treatment system will be constructed and installed to handle the leachate from the leachate collection trench. The capacity of the collection system will be determined by EPA during the design phase of this project. The treatment system shall operate to insure compliance with both air emissions and compliance with the NPDES as specified in 40 CFR Part 122 subpart C and PA Clean Streams Law, as specified in 25 PA Code Chapters 92, 93, 94, and 96.

specified in 40 CFR Part 122 subpart C and PA Clean Streams Law, as specified in 25 PA Code Chapters 92, 93, 94, and 96.

(7) Operation and Maintenance

Operation and maintenance (O & M) of the remedy shall be conducted for thirty years. This will include O & M of the landfill cap, the landfill gas venting system, and the leachate collection and treatment systems. Monitoring of the groundwater will be conducted quarterly for a period of two years with the sample locations determined by EPA and PADER. The results of this monitoring will be used to model the contaminants fate in the groundwater for the purposes of operable unit 4.

(8) Remedy Review

The five-year review required by Section 121 of CERCLA is applicable to the selected remedy. This review will be conducted in conjunction with the other remedial actions developed and specified for this site.

10. <u>Statutory Determinations</u>

Section 121 of CERCLA requires that the selected remedy:

- be protective of human health and the environment;
- comply with ARARs;
- be cost effective;
- utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and
- address whether the preference for treatment as a principal element is satisfied.

A description of how the selected remedy satisfies each of the above statutory requirements is provided below.

In summary, the selected remedy is protective of human health and the environment as required by Section 121 of CERCLA. Potential risks from exposure to contaminated surface soil and leachate are prevented by the installation of the landfill cap, the vent gas system, and the leachate collection and treatment system.

The selected remedy is the most cost-effective action approach available to protect human health and the environment. The selected remedy uses capping and treatment to eliminate the potential for direct (ingestion,inhalation and immediate contact) human exposure to contaminated surface soil and landfill leachate.

<u>Protection of Human Health and the Environment.</u>

The selected remedy (Alternative 3) will be protective of human health and the environment by reducing the principal threats posed at the Site which are addressed by this operable unit.

Landfill caps have been demonstrated as being very effective in protecting people from the risks associated with hazardous substances found present in landfills such as this one. Vent Gas systems have also been shown to be need to allow the landfill to maximize its effectiveness.

The leachate collection system is protective of human health in two ways: it reduces the immediate contact threat by readily collecting the leachate streams and not allowing them to collect on the landfill surface; and it is also protective in that it physically and chemically reduces the hazardous substances into inert substances and thereby reduces the threat to both humans and environment.

No unacceptable short term risks or cross media impacts will be caused by implementation of this selected remedy.

<u>Compliance with Applicable or Relevant and Appropriate Requirements</u>.

All applicable or relevant and appropriate requirements (ARARs) pertaining to the selected remedy and this operable unit will be attained.

As stated above, this is considered a final remedy for all media except groundwater. As such, it will comply with all federal and Commonwealth ARARs with the exception of the Commonwealth's "Clean-up to Background" groundwater ARAR. Groundwater and the related PADER groundwater ARARs will be addressed by operable unit 4.

The selected remedy will comply with the following ARARs:

o The landfill cap will comply with the performance standards as contained in the Municipal Landfill Regulations as contained in 25 PA Code 273.322 (a) and (b) and PA Hazardous Waste Regulations as contained in 25 PA Code Chapter 264, Subchapter G Sections:

264.111 Closure Performance
264.117 Postclosure care and use of property
264.118 Postclosure Plan, Amendment of Plan, specifically subsections a, a(1),a(2)(i) and (ii), a(3) and;

Chapter 264, Subchapter N sections:

264.301 Design requirement general: specifically subsections 264.301(5), (6), and 264.301(12))-(15)
264.303 Leachate Management
264.310 Closure, Postclosure Care

o Air Emissions from the landfill will comply with 40 CFR Section 264, subpart AA for VOCs and the National Emissions Standards for Hazardous Air Pollutants (NESHAPs), as contained in 40 CFR Part 61, as well as the National Ambient Air Quality Standards (NAAQS), as specified in 40 CFR Part 50, and the PA Air Pollution Control Act and Air Discharge Regulations, as specified in 25 PA Code Sections 123 and 127.1 (not exempted by Section 127.14).

o Discharges of the treated leachate will comply with the NPDES, as specified in 40 CFR Part 122 subpart C and the PA Clean Streams Law, as specified in 25 PA Code Chapters 92, 93, 94 and 96.

EPA and PADER have agreed to model the groundwater contamination levels after this alternative is implemented for a minimum period of two years. Therefore, Groundwater Protection, as specified in the PA Hazardous Waste Management Regulations, as contained in 25 PA Code §§ 264.97(i)(j) and 264.100 (a)(9), are not ARARs for this operable unit. Sampling will be conducted on a quarterly basis. A determination will be made at that time as to the type of further treatment to be considered in OU 4 for this site.

Another issue which is a "to be considered" is that care will be taken in obtaining the soils for the landfill cap so as not to disturb any local ecosystems or habitats.

Cost-Effectiveness.

The selected remedy affords overall protectiveness proportionate to its costs. Landfill caps have shown, if only through their frequent application, that they are an economical and effective means to close landfill operations. Leachate collection systems, as specified in this document, are reasonably cost effective and provide an additional, necessary treatment system to the landfill remediation.

Utilization of Permanent Solutions and Alternative Treatment (or resource recovery) Technologies to the Maximum Extent Practicable (MEP).

The selected remedy utilizes a permanent solution to the maximum extent practicable. EPA has used treatment for past remedies at this site and intends to implement further treatment technologies (again, as practicable and as needed) for future actions at this site.

The remedy selected provides the best balance of trade-offs among the alternatives evaluated with respect to the evaluation criteria. It is protective of the near-by community in that the risks of contact with the leachate streams will be eliminated. Furthermore, impacts on the groundwater will be effectively reduced, perhaps eliminated, by the implementation of the leachate collection and treatment system. Although this operable unit addresses groundwater to a limited extent, groundwater will be finally addressed by operable unit 4. The other alternatives (not selected) do not meet all of the remedial objectives for the Site. Cost and protectiveness were the reasons for not selecting alternatives 4 and 5. It was felt that the incremental increase in protectiveness was not warranted by the increased cost, however it is also noted that, if the air emissions change with the imposition of the new landfill cap, this extra (gas) treatment may be necessary based on monitoring.

Both the State and the community played a significant role in the development of this decision. Treatment technologies and continued monitoring will be implemented based on their concerns.

Preference for Treatment as a Principal Element.

The selected remedy satisfies the preference for treatment in that it employs treatment to address the principal threat posed by conditions at the site. The landfill cap provides passive treatment in that it eliminates weathering elements from coming into contact with the hazardous materials in the landfill. This action will further reduce the amount of hazardous substances (leachate) being released into the nearby environment.

The leachate collection system and treatment system provides direct, active treatment for the leachate will be collected, treated on-site and discharged to an acceptable receiving stream. The principal treats of ingestion of leachate and direct contact exposure, especially to children trespassing on the site, will be eliminated. In addition the toxic burden to the groundwater will be significantly reduced.

Based on the additional monitoring to be performed at the Site, it may be shown that groundwater contamination may persist above acceptable levels. If this is shown to be evident then the preference for treatment as a principal element will be addressed by EPA in the final decision document (OU 4) for the site.

11. Documentation of Significant Changes

The proposed plan cited RCRA as the applicable Federal law governing the placement of the landfill cap. The proposed plan also cited, as an ARAR for the landfill cap, the PA Municipal Landfill Closure Regulations as contained in 25 PA Code, Section 273.322 (a) and (b). PADER has subsequently commented that the 25 PA Code, Chapter 264, Subchapter G, Hazardous Waste Regulations are relevant and appropriate for the landfill cap. These Pennsylvania Hazardous Waste Regulations are relevant and appropriate because the landfill accepted RCRA characteristic waste and constituents of listed hazardous wastes as contained in 40 CFR Part 261, Subparts C and D, and 25 PA Code Part 261, Subparts C and D. The ROD has incorporated these comments and reflects the PADER Hazardous Waste Regulations as an ARAR.