United States
Environmental Protection
Agency

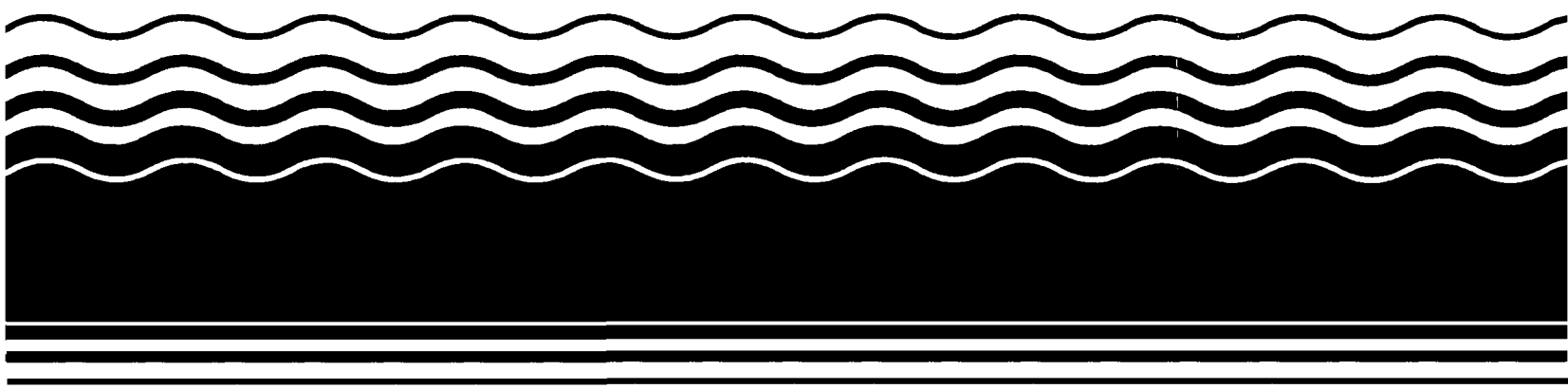
Office of
Emergency and
Remedial Response

EPA/ROD/R03-92/143
March 1992

EPA

Superfund Record of Decision:

Strasburg Landfill, PA



NOTICE

The appendices listed in the index that are not found in this document have been removed at the request of the issuing agency. They contain material which supplement, but adds no further applicable information to the content of the document. All supplemental material is, however, contained in the administrative record for this site.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R03-92/143	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Strasburg Landfill, PA
Third Remedial Action - Subsequent to follow

5. Report Date
03/31/92

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

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U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes
PB93-963916

16. Abstract (Limit: 200 words)
The 22-acre Strasburg Landfill site is an inactive landfill located within a 220-acre tract of land in Newlin and West Bradford Townships, Chester County, Pennsylvania. The site is characterized by hills draining toward Brandywine Creek and its floodplain, which form the southern and western site boundaries. The nearest wetland is the Briar Run watershed, located 600 feet east/southeast of the site. Land use in the area is primarily suburban residential, with some residual agricultural areas. The 201 single-family residences that surround the site use ground water as a drinking water source. Prior to 1973, the site was used as farmland. Subsequently, landfilling permits were granted, and from 1979 to 1983, the landfill accepted more than 3 million cubic yards of industrial and heavy metals waste and sewage treatment plant sludge, including over 1,000 cubic yards of polyvinyl chloride (PVC). In 1979, state investigations determined that landfill operations had resulted in excessive siltation of Briar Run, and in 1980, the state permanently prohibited the landfill from receiving additional industrial waste. In 1983, after the owners were cited for failure to correct onsite violations, the state ordered the landfill closed. As a result of improper landfill closure efforts, over 15 leachate seeps have increased cap erosion

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Strasburg Landfill, PA
Third Remedial Action - Subsequent to follow
Contaminated Media: soil, debris, leachate
Key Contaminants: VOCs (TCE, toluen, xylene)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 64
	20. Security Class (This Page) None	22. Price

Abstract (Continued)

and flowed into adjacent ground water and surface water, including Briar Creek. In 1983, state studies detected VOCs and organics in both onsite monitoring wells and offsite residential wells. The state initiated an interim action to control the leachate flow in which surface water runoff and leachate were directed into unlined sediment ponds. A 1989 ROD, addressed OU1 the contaminated residential wells and exposure pathways, and provided for an interim remedy to limit site access. A 1991 ROD addressed site access and security; and provided for the construction of a security fence and additional warning signs. This ROD addresses OU3, the landfill surface, including the integrity of the cap, nearby surface streams, air in and around the landfill, the surficial aquifer, and protection of ground water from further contamination. Ground water remediation will be addressed in a subsequent ROD. The primary contaminants of concern affecting the soil, debris and leachate are VOCs, including benzene, TCE, toluene and xylene.

The selected remedial action for this includes excavating and removing the existing landfill cover, regrading the slopes of the landfill to conform with the State and RCRA performance requirements, and replacing the landfill cap with a multi-layer cap; installing a gas venting system to operate as either an active or passive system, depending upon the measured gas emissions; installing a leachate collection trench around the eastern, southern, and western perimeters of the landfill to collect leachate migrating into the surfical aquifer; treating the leachate onsite rising an UV/ozone treatment system, based on the results of a pilot test, followed by onsite discharge to surface water; monitoring ground water and air; and implementing site access restrictions. The estimated present worth cost for this remedial action ranges from $10,397,070 to $11,306,460, which includes an annual O&M cost of $312,471 for 30 years.

PERFORMANCE STANDARDS OR GOALS: Site-specific clean-up goals will meet state and closure ARARs.

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

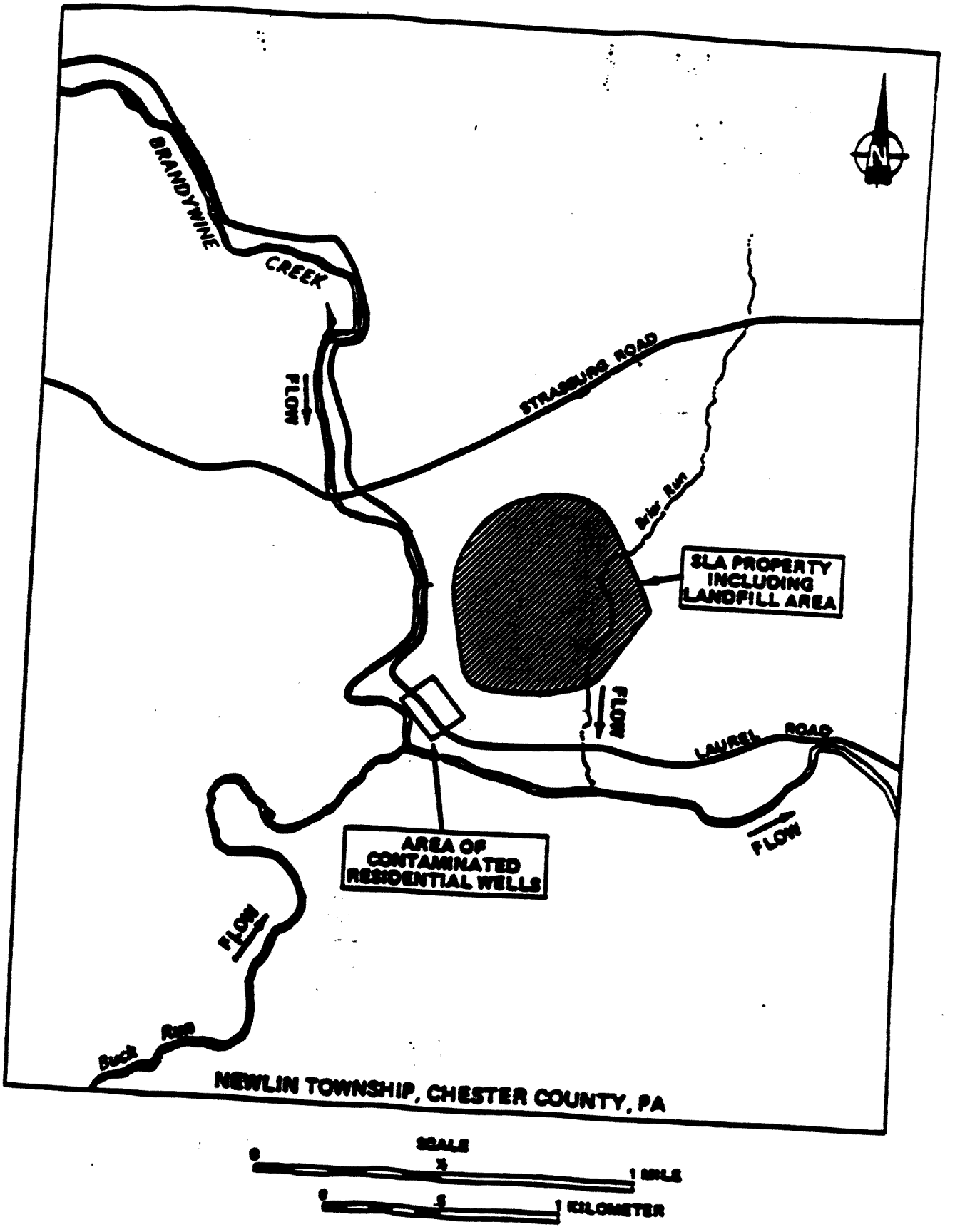

Figure 1 SITE LOCATION MAP

POOR QUALITY ORIGINAL

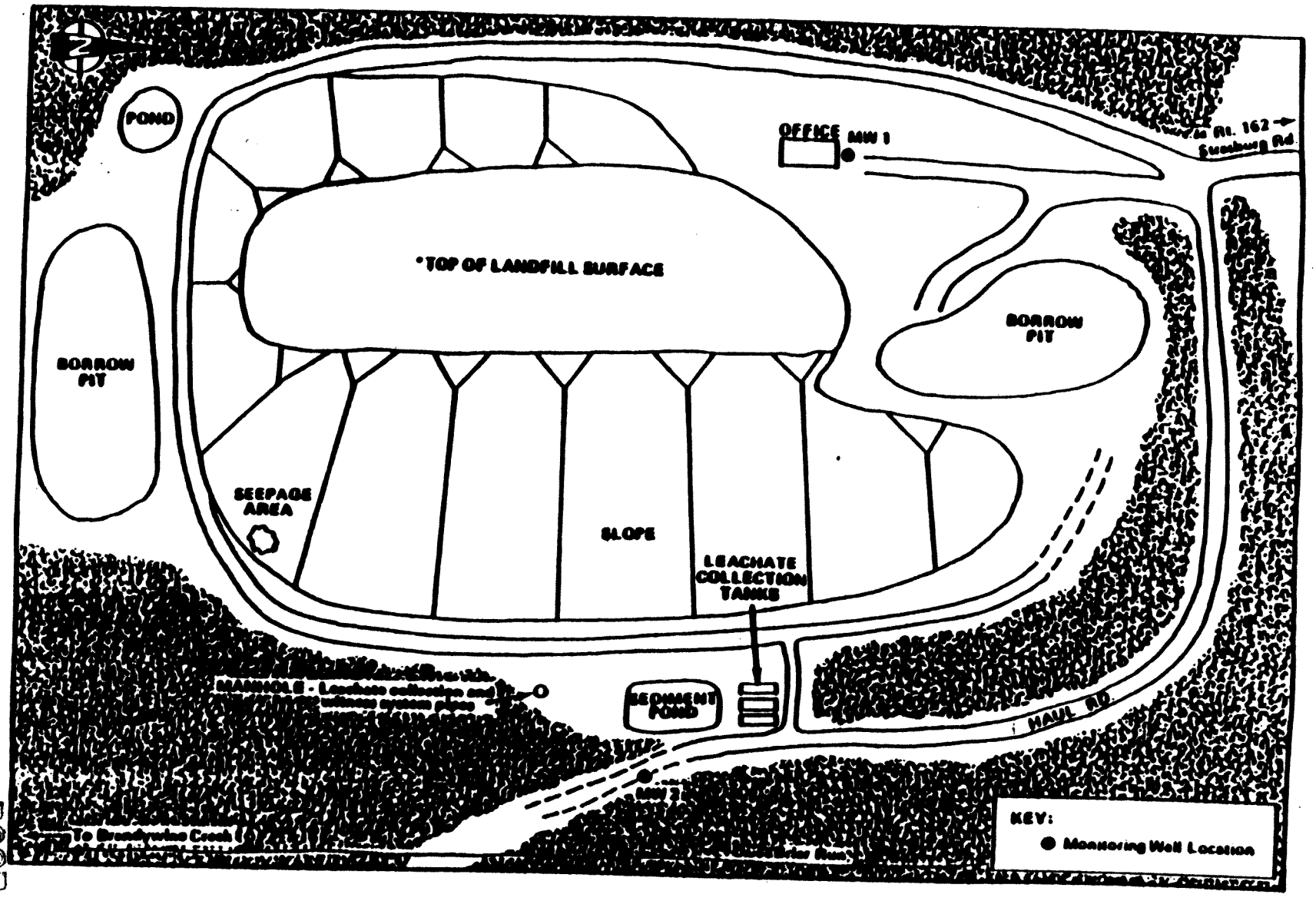

Figure 2 SCHEMATIC SITE MAP OF STRASBURG LANDFILL

POOR QUALITY ORIGINAL

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. Scope and Role of Operable Unit (OU 3) or Response Action Within Site Strategy

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. Summary of Site Characteristics

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.

Nature and Extent of Contamination

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:

- Ingestion of domestic well water which could be contaminated with leachate flowing through fractures in the bedrock.

- 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;

- 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

- 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. Summary of Site Risks

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

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

Pathway	Case	Receptors					Composite Contributions by Exposure Route	Risk Risk Contributions by Chemical
		Adults 30-Year Exposure	Children 1 - 6 Years	Children 6 - 12 Years	Children 12 - 18 Years	Child/Adult 1 - 31 Years		
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	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

FINAL DOCUMENT

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:

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

- o Periodic ambient air monitoring;

- o 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. Summary of Comparative Analysis of Alternatives

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 maintenance 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.

POOR QUALITY
ORIGINAL

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.

Implementability

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:

- Groundwater monitoring;
- Ambient air monitoring;
- Signs; and
- 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. Statutory Determinations

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.

Protection of Human Health and the Environment.

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.

Compliance with Applicable or Relevant and Appropriate Requirements.

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.

Strasburg Landfill - Operable Unit 3

Responsiveness Summary

There were basically three groups of Comments received in response to this Proposed Plan:

- o comments raised during the public meeting held on January 8, 1992
- o written responses from nearby residents
- o written responses from persons identified as potentially responsible parties

Comments Raised At The Public Meeting:

Comment: Alternative 5 should be selected instead of Alternative 3 since it only costs an additional $70,000 and would further reduce risks in the neighborhood.

Response: Measurements of air contaminants in and around the landfill do not indicate a need for the installation of vented gas treatment. Therefore EPA would not have sufficient basis to obligate funds to address this concern. EPA understands that conditions may change, especially with the installation of an effective landfill cap with an operable venting system. Among the conditions which may change is the type of contaminants measured in the air at the Site. Installation of a treatment system at the time of the cap and leachate collection systems may result in a vent gas treatment system which would be inappropriate for the gases measured under the new cap. Therefore, as stated above, EPA will continue to monitor the vent gases from the landfill. In the event that the contaminant concentration levels are measured at actionable risk levels, EPA will evaluate taking action to install an appropriate treatment system.

Comment: Why doesn't EPA look to treat, not just vent the landfill gases as part of this Operable Unit?

Response: There are two reasons why EPA has chosen not to include treatment of the vented gases at this time. First, the levels and types of substances measured at the vent pipes, and in other gas studies on this landfill, indicate that no treatment is necessary. The air contaminant levels are in compliance with existing regulatory levels. Secondly, conditions, such as type and/or size of landfill caps, may alter the air contaminants measured at the Site. So that, if EPA designed and installed a treatment system now, based on data from the ineffective landfill cap, we may be looking to treat the wrong substances.

EPA's selected remedy includes monitoring the air and vent gases after the new cap and leachate collection system is in place and will evaluate the new data to determine if further action is required.

Comment: Has EPA considered interdicting surficial aquifer flows before they come into contact with discharges from the landfill.

Response: EPA has looked into the possibility of taking measures to intercept groundwater prior to the landfill area, however, because of the hydrogeology of the area this idea was discounted as potentially causing more problems than it may solve.

Comment: Has EPA investigated the landfill manifests to determine what substances were taken to the landfill?

Response: EPA has not been able to obtain the complete manifest log for the landfill. EPA has conducted a thorough investigation of existing sources of information, such as shipment logs from companies and municipalities, to determine what had been sent to this site.

Comment: If we go with Alternative 3 there will be no monitoring or sampling of the gaseous emissions from the landfill. A landfill cell could rupture and generate additional gaseous compounds into the atmosphere.

Response: While not clearly spelled out in the Proposed Plan, monitoring of the Landfill gases is considered part of this alternative. The air monitoring is specified in the performance standards section of this ROD. In addition, since this comment has been raised, EPA will specify the air monitoring program to be incorporated as part of this remedial action, in the remedial design phase.

Comment: The cost ($70,000) to add a gas filtration system is small in comparison to the other costs of Alternative 3. Therefore EPA should look to add this component on at this time.

Response: While it is true that the incremental costs are small for the addition of an air filtration system, the risks measured in the air monitoring do not warrant this additional expenditure.

Comment: How close is the nearest public water supply?

Response: According to the information contained in this file, the nearest Water Supply is the B & E Water Company. They have a well field approximately 1.5 miles due east of the landfill.

Comment: Will the proposed Remedial Alternative create any contamination problems in the future?

Response: The proposed Alternative incorporates technologies which have been shown to be implementable. Based on the past knowledge EPA has regarding these systems and the information we have reviewed regarding this site, we feel that there will not be any long term environmental problems in implementing this remedy.

Care will be taken during the actual remedial action phase of the cap reconstruction to minimize or eliminate any short term contamination problems.

Comment: What will be done with the old cap soil & debris as part of this remediation?

Response: Specifics on actual disposal actions to be included as part of this alternative will be developed as part of the remedial design. In reviewing all of materials used as part of the existing cap it may be determined that part or parts of this cap may be able to re-incorporated into the new cap.

Comment: What is the plan for monitoring the home wells in and around the Site?

Response: EPA is working in cooperation with the Pennsylvania DER to develop a sampling matrix which includes the nearby home wells. According to the most recent information, the next round of home well samples is scheduled for March 1992 and will be conducted by the PADER.

Comment: West Bradford Township requested that they be kept updated as to the progress of the work on a somewhat periodic basis (approximately monthly).

Response: EPA recognizes the on-going concern of West Bradford Township regarding this site. As design and construction actions begin, EPA will make a strong effort to keep West Bradford and Newlin Townships apprised of site actions.

Comment: What are the sampling methodologies to be used in sampling the home wells for hazardous constituents?

Response: The sampling will use two separate methodologies to qualify and quantify the sampling results. These are identified as EPA Method 524 and EPA Method 502.2.

Comment: With regard to the surface discharge of the treated leachate, under what conditions would the discharge be moved from Briar Run to Brandywine Creek?

Response: Discharge of the treated leachate will have to be in compliance with PA Clean Streams Law and Federal Discharge limitations. Because of the limitations of treatment technology and the relatively small flow in Briar Run, it may be technologically impossible to treat the waste stream down to levels permissible in Briar Run, whereas the Brandywine has a much larger flow and therefore a higher assimilative capacity.

Comment: Were there any alternatives considered other than stream discharge for the treated leachate, such as land application?

Response: EPA did review some other alternatives, including land application, for disposal of the treated leachate flow. Land disposal was discarded as a potential alternative because the weather conditions in Chester County would not allow for this technology to be implemented 12 months in a year. Cost and operation and maintenance concerns were also factors in discarding this as a possible treatment alternative.

Comment: Will the entire 22 acre landfill be covered with the protective cap?

Response: The exact extent of the cap will be determined at the design phase of the selected alternative. At present, it is expected that the entire 22 acre landfill will be covered with the new cap.

Written Comments From Nearby Residents:

There were two written responses received from nearby residents, both were in favor of the proposed cap and leachate system, one resident requested that EPA select Alternative 5 instead of Alternative 3, as this Alternative would require the additional installation of a treatment system for the vented landfill gas.

Response: This is the same issue that was raised during the public meeting - see Response to first comment above.

Written Comments From Potentially Responsible Parties:

The first set of written comments received were from the Clean Harbors Company, the company that currently maintains and operates the leachate collection system. Their comments (with responses) are as follows:

Comment: The risks associated with the air emissions from the landfill are in the range of 10^{-6} and therefore collection and treatment are not warranted and therefore only Alternative 1 (no action) is warranted.

Response: EPA concurs that the risks presently measured (associated) with regard to air contaminants do not warrant treatment of the landfill gases at this time, however, as also determined during this investigation, the landfill cap is extensively compromised in numerous locations and landfill contaminants appear to exchange freely into the atmosphere and the groundwater. EPA concurs with the recommendation that the landfill gases be monitored on a routine basis. EPA disagrees that Alternative 1 is the only action warranted since the air pathway is only one of several exposure pathways under which nearby residents are exposed. Alternative 3 already provides for monitoring of landfill gases with the proviso that further action (i.e. treatment) will be implemented if the contaminant levels or constituent changes (to actionable levels) with respect to time or remediation.

Comment: The security fence and warning signs as specified in the OU2 ROD will deter residents from traversing the Site.

Response: EPA concurs that the security fence and warning signs will be effective in deterring most residents and recreational visitors from contact with most landfill seeps. The fence will not serve as a barrier to keep seep material on the landfill, and, furthermore, residents have already inquired of EPA as to when the fence will be erected as they have indicated that they recreate right outside of the proposed fence area.

Comment: The risks associated with residential use of groundwater is stated as too high and does not take into account the fact that the residences with the highest levels of measured contaminants are now on filter systems.

Response: EPA and PADER have continued to monitor the residential drinking water in the area around this landfill. It is true, as asserted, that the measured levels of contaminants in groundwater have gone down in recent sampling events. There are three reasons why EPA feels that the risk levels as stated are reasonable for this action:

1) Rainfall in the area has been below average for the past few years, this may cause the actual concentration levels to artificially lower.
2) Since the time of the initial residential well sampling at least one additional residence has shown evidence that the plume is spreading. This home is not on a filter system.
3) There have been continued problems with the residential filter systems which have remained unresolved for extended periods of time.

Comment: Removal and reconstruction of the landfill cap may release large quantities of landfill gases and thereby increase the inhalation risk to site workers and nearby residents. Replacement of the cap is not warranted given the fact that 98% of the existing cap is intact.

Response: EPA is very concerned about issues relating to exposure risks associated with landfill cap reconstruction. EPA has already shown that landfill cap reconstruction is implementable and the issue of site safety will be addressed during the design phase of this operable unit. EPA disagrees with the statement that because 98% of the existing cap is intact, replacement is not warranted; EPA's investigations have observed that the cap has been compromised in numerous locations to the point that replacement of the cap is warranted.

Comment: The proposed secondary leachate collection and treatment system assumes the leachate is entirely in the vadose zone and the proposed design will be impracticable.

Response: The commenter raises some of the same technical issues that EPA sees as needing to be addressed during the design phase of this remedial action. EPA agrees that the geological conditions will need to be further assessed and studied during the design phase of this project. EPA disagrees that this system is impractical and feels that the system is practical and will show to be an effective treatment system for the surficial leachate discharge to groundwater.

A large set of comments regarding this proposed plan were submitted by the Maxus Corporation on behalf of the Occidental Chemical Corporation (OCC) (a potentially responsible party). The comments regarding this proposal are addressed below. It should be noted that interspersed with these comments are other assertions by the Commenter as to EPA's official positions, policies, and statements. EPA does not accept any of these assertions as true. Furthermore, this commenter goes to considerable effort to assert non-liability on the part of OCC at this site. The purpose of this responsiveness summary is to address comments raised as they pertain to the proposed remediation. Issues regarding liability, and the administrative protocols associated with past operations at the landfill not

associated with this remedy are not discussed in this response summary.

Comments submitted by MAXUS by letter dated February 5, 1992:

Cover Letter:

1. **Comment:** Strasburg Landfill functioned as a normal sanitary landfill for municipal household wastes and sewage sludge.

   Response: It is clear in all of the records relating to the operation of the Strasburg Landfill that it was permitted and operated to accept both industrial and municipal wastes. This permit was revoked by PADER when it was determined that the industrial wastes were not being handled correctly. There is also information that the landfill continued to accept industrial wastes after this approval was rescinded. Therefore, based on the information that EPA has received to date, it would be incorrect to categorize this landfill as a "normal" municipal type landfill.

2. **Comment:** EPA's selection of Alternative 3 is based on a flawed risk assessment which grossly overstates possible human risks. Strasburg should be removed from the National Priorities List and closed as a non-hazardous sanitary landfill.

   Response: As stated in 1. above, and as has been established through monitoring, documented in the site investigation (SI) and the remedial investigation (RI), the Strasburg Landfill is not a non-hazardous sanitary landfill. The risk assessment developed for this site is not "flawed" but rather based on established data. The actions taken by EPA through the Records of Decisions (RODs) for operable units 1 and 2 are, or will be, effective in reducing immediate risk to the surrounding community (long term and some immediate risk still remain). EPA feels that, if these actions had not been decided previously, the data would call for them to have been specified as part of this action.
   The data collected during the RI only verifies the data collected during the SI which was used as a basis to place this site on the NPL. Nothing uncovered to date at this Site would warrant its removal from the NPL.

   Furthermore, neither the remedial investigation nor PADER's quarterly monitoring of residential wells provides any evidence to support the assertion that the site is recovering on its own. Given the highly fractured bedrock geology in the area, it is very difficult to identify contaminant sources with certainty. However, identification of fault traces leading from the landfill area toward the

Wheatland Drive area suggests that the landfill is a possible source of the contamination.

3. **Comment:** PADER failed to properly oversee and manage operations and closure of this Site and this is a non-hazardous landfill.

   Response: This comment does not address any of the actions proposed in this plan but rather goes to allegations of liability. As stated previously, EPA does not consider this Site as a non-hazardous landfill.

4. **Comment:** There is no basis for the inclusion of UV/ozone technology. Expensive pretreatment would be required for this type of treatment. UV/ozone technology will enormously increase the amount of waste generated during the treatment process and will transfer significant contaminants to the air through volatilization.

   Response: The feasibility study report recommended pilot studies to develop the necessary data to evaluate if UV/ozone treatment is a practical or reliable treatment method for Strasburg Landfill leachate. The recommended pilot studies will also provide information to develop site specific costs, including operational, maintenance and disposal costs associated with the UV/ozone treatment system for Strasburg Landfill leachate.

   - Scaling was an anticipated problem as noted in the FS text. According to the vendor, scale can be cleaned by routine maintenance and should not require a significant amount of time (See FS page 4-34).

   - Pretreatment efforts were not described in the FS as they will be determined as a result o the treatability tests. However, EPA does agree that if extensive pretreatment is required costs could be prohibitive. The Ultrox SITE report indicates a treatment (i.e. O & M costs) cost range of $.25 to $17 per 1000 gallons. At the 10 gpm rate O & M costs (exclusive of testing; apparently Maxus only considered the operation costs and not the maintenance and insurance costs) were estimated at $1.2 per 1000 gallons for 200 ppb influent or $1.4 per 1000 gallons for 400 ppb influent. These costs would appear consistent with those presented in the Feasibility Study. As noted in Maxus' evaluation, if extensive pretreatment residues are generated, this could significantly increase the cost. At this point in time, it is not clear whether air stripping or UV/ozone will generate more residue. To assist in this evaluation, EPA will review the operational data on the existing air stripping system. Once the treatability

test is completed, pretreatment needs of both systems can be compared and a more detailed benefit analysis can be performed.

- o Also note that in the FS both UV/ozone and air stripping were costed without significant pretreatment for comparison, since reliable pretreatment information was unavailable and will be generated during design. The costs presented in the FS for O & M may be underestimated if extensive pretreatment is required.

5. **Comment:** The RI/FS and supporting documents contain numerous misstatements and flaws which are addressed in Attachment I.

   Response: EPA denies this allegation and each of the specific assertions are discussed below (as raised) in responses to Attachment I comments.

6. **Comment:** EPA has essentially concealed the significance of the 1,000,000+ cubic yards of municipal waste disposed of at the site. EPA's contractor is confused over the difference between polyvinyl chloride and vinyl chloride. Furthermore EPA disregards the fact that vinyl chloride is typically detected in municipal solid waste vent gases and product. Under the right conditions, Vinyl Chloride monomer may be formed in the landfill itself.

   Response: At no time has EPA attempted to hide the fact that this facility was also used for the disposal of municipal wastes, nor the estimated size of the landfill. Furthermore, a number of municipalities have admitted that they sent both domestic trash and sewage sludges to this landfill while it was in operation.

   The issues of: who brought vinyl chloride monomer to the site; how PVC degrades in a landfill; and how various chemicals which may be present in a landfill may, under the right conditions produce additional vinyl chloride (VC) monomer do not impact the selection of remedy at this Site and go instead to the issue of liability. It is not the purpose of a proposed plan to address issues of liability. Rather, the issue is that VC monomer, along with a host of other organic and inorganic hazardous substances, have been determined to be present on the Site and to be migrating off of the site; and, it is because of these determinations that EPA seeks, through this decision document to take remedial action to correct this contamination.

7. **Comment:** The Commenter asserts that the RI is incorrect in stating that OCC was prohibited from disposing of its PVC

wastes at this landfill because it inconsistent with the wastes described in its PADER Module No. 1 Form.

Response: EPA fails to see the connection between this comment and the selection of the proposed remedy. EPA has not failed to consider the significance of the municipal waste contributions in the selection of this remedy. The documentation in EPA's file indicates that OCC has sent large quantities of scrap poly vinyl chloride and hazardous waste sludges containing vinyl chloride monomer, to the landfill and that these scrap quantities contained vinyl chloride monomer, a contaminant often measured as emanating from the landfill. Additional documentation in EPA's file indicate that PADER recommended to the Strasburg Landfill that they discontinue accepting these wastes. The commenter has misinterpreted that EPA asserts this comment was contained in the McCaffery report.

8. **Comment:** Maxus requests that the proposed remedial action plan be suspended pending notification of the PRPs consistent with §113 (k)(2)(D) of CERCLA.

Response: This request is denied in this action since it does not address the proposed plan remedy. It is also denied for the following reasons:

1) Maxus does not assert that they represent any other PRP other than themselves or OCC and they did receive timely notification of this action as evidenced by their response.

2) As stated in the subject ROD, notification of this proposed plan was published in the local daily newspaper on December 24, 1991 to satisfy the requirement of §113(k)(2)(D) and, in addition;

3) A copy of the proposed plan was individually mailed to each of the PRPs at the addresses contained in the EPA Region III listings at the time of the issuance of the proposed plan.

ATTACHMENT I

GENERAL COMMENTS

1. **Comment:** EPA needs to correct the Administrative Record to show that DSCC PVC wastes are not vinyl chloride or ethylene dichloride wastes.

   Response: This comment does not address the remedy proposed in this plan but rather goes to the issue of liability. However, since part of the risk analysis for this action is based on the determined presence of vinyl chloride both in the groundwater and in the soils, DSCC stated, in correspondence to EPA that the waste PVC which they sent to the Strasburg Landfill contained vinyl chloride monomer.

2. **Comment:** Wheatland Drive groundwater contamination appears to be from the residents. EPA should say that these residents are not threatened by the landfill.

   Response: This allegation is incorrect. The RI stated that sampling conducted a few years ago showed low levels of TCE in several home well samples from Wheatland Drive residences. These results were not duplicated in the subsequent sampling event. One possible cause of these results may have been one of the residents putting a degreaser into their septic system; however, EPA is aware that these type chemicals move quickly in certain hydro-geological structures and has not ruled out contamination from the landfill as a source. EPA remains concerned that the Wheatland Drive residents are threatened by the landfill.

3. **Comment:** Why hasn't EPA investigated the possibility that Zarzycki and other residents to the southwest contaminated their own groundwater?

   Response: There is no evidence to support the assertion that local residences contaminated their own groundwater through the use of individual septic systems.

4. **Comment:** Where residents have already contaminated their groundwater, risks should only be considered as increased risks.

   Response: There is no evidence to support the assertion that local residences contaminated their own groundwater through the use of individual septic systems.

5. **Comment:** EPA should inform the public that Wheatland Drive residents are protected from site groundwater, and that these residents contaminated their own groundwater. EPA

should retract the statement that no contaminants were found in the Wheatland Drive wells.

Response: Maxus misunderstood EPA's statement in the public meeting. There were no appreciable levels of contaminants found in the most recent round of domestic well sampling on Wheatland Drive samples. TCE was found in Wheatland Drive home well sampling conducted a few years ago; however, it could not be determined or ruled out that the contamination was from the landfill. EPA does not agree that all of the subsurface contamination from the landfill is screened by Briar Run.

6. **Comment:** EPA should remove the Strasburg Landfill from the National Priorities List.

Response: See response to Cover letter comment #1; in addition, the risk levels currently measured in and around this site remain high enough to warrant inclusion on the NPL.

7. **Comment:** The vinyl chloride levels found at the Strasburg Landfill are consistent with levels found at landfills receiving only non-industrial wastes.

Response: EPA does not necessarily agree with this comment. Whether this is true or not has no bearing on the remedy selected for this operable unit.

8. **Comment:** Risk assessments should report the "reasonably" calculated cancer risks, not just maximal estimates.

Response: The risk assessment was prepared according to EPA guidelines. The risk assessment presents the estimated excess cancer risks associated with the "reasonable maximum exposure" that might occur to chemicals of potential concern at the site. EPA's Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (December 1989) (HHEM) mandates the use of risk estimates based on the reasonable maximum exposure case as the basis for regulatory decisions. Exposure assumptions to be used in estimating the reasonable maximum exposure are provided in other EPA guidance including the Exposure Factors Handbook (July 1989) and OSWER directive 9285.6-03 entitled "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors" (March 1991). These assumptions were used in developing the exposure estimates for the risk assessment. The HHEM does not recommend comparing site risks to general population risks.

9. **Comment:** Risk assessments should use the most current and accurate data not historical data.

Response: Risk of exposure is cumulative and may have occurred when concentration were higher. Although the data shows a decreasing trend, there is no evidence to support the assertion that concentrations will continue to decrease. Due to the cell construction technique used at the landfill, there may be a delay when contaminants are released. Furthermore, EPA has demonstrated that a release to groundwater has occurred and an exposure route exists. EPA used the best available data for the risk assessment.

This comment is internally contradictory. On the one hand it states that only the most current data should be used in the risk assessment then it wants historical data to be used to predict future contaminant concentration for use in the RA.

The HHEM in Section 5.1 provides for combining results from different investigations, provided the analytical methods and data quality are comparable. The risk assessor contacted the PADER laboratory that analyzed the samples for the PADER residential well monitoring program for the Strasburg Landfill area and was satisfied that the methods used and the overall quality of this data were comparable to groundwater data generated by the RI. The PADER data showed that the groundwater contaminant concentrations fluctuate considerably from quarter to quarter. In light of this variability, the limited data available from the remedial investigation (only one round of sampling from most wells) did not appear to be sufficient to adequately characterize the groundwater contamination in the area. Since the PADER data provided a broader data base than the RI data and also provided an historical record of the groundwater contamination in the area, it was included in the risk assessment. The PADER data does show that the greatest groundwater contaminant concentrations in the residential area southwest of the landfill occurred during the 1986 to 1988 time period. It also shows that the level of contamination is highly variable from quarter to quarter and does not provide adequate information to confidently predict the rate at which contaminant concentrations might decline in the future. Risk estimates corresponding to both the historical average and the 1990 average concentrations, a period during which contaminant concentrations had declined from their 1986-88 highs, were included in the risk assessment. The possibility of further decreases in groundwater contaminant concentrations and the possible overestimation of the risks that could result were included in discussions of the uncertainties associated with the risk estimates.

10. **Comment:** The following reasons justify a no cancer increase risk determination from groundwater:

10a. **Comment:** Wheatland Drive residents are separated from the landfill by Briar Run which is a groundwater discharge point.

Response: EPA acknowledges that Briar Run is a groundwater discharge for the local shallow groundwater system. However, rock fractures in the deep groundwater system may exist and provide a route for contamination to migrate southeast toward the Wheatland Drive area. Many of the Wheatland Drive wells extend to depths well below the Briar Run creek bed, therefore it is entirely possible that contaminants could migrate from the landfill, under Briar Run via bedrock fractures and reach the wells in the Wheatland Drive area.

10b. **Comment:** All contamination in the southwest residential wells are below Federal MCLs.

Response: The most recent residential well results showed contamination above MCLs. Also, the Commonwealth of Pennsylvania has an ARAR to require groundwater clean-up to "background" levels. Any exposure to a carcinogen is assumed to marginally increase an individual's risk of cancer. The MCLs are based on technical feasibility as well as human health risks and are sometimes set at levels corresponding to estimated cancer risks of 10^{-4} or higher (e.g., vinyl chloride and arsenic). The maximum contaminant level goals (MCLGs), which are based solely on potential health risks, are set at zero for carcinogens as a matter of public policy. The statement that residential groundwater to the southwest is below MCLs is incorrect. The concentrations of tetrachloroethene, trichloroethene and vinyl chloride exceeded their MCLs during 1990.

10c. **Comment:** Groundwater concentrations of hazardous substances are decreasing.

Response: See response to Comment 9 on page 12 (above).

10d. **Comment:** All cancer risks should be reported in their range of ZERO up to the calculated risks.

Response: This comment is unclear; however, the risk assessment was prepared according to EPA guidelines.

10e. **Comment:** EPA should not use historical data to calculate Reasonable Maximum Exposures for future risk exposure calculations.

Response: Based on the responses to comment 9, 10(a), (b), (c) and (d)[above], that assertion is incorrect. Groundwater is regarded as a potential drinking water source throughout the area not just at the locations of existing water supply wells. Groundwater contaminant concentrations have been shown to fluctuate substantially from quarter to quarter, therefore, it is incorrect to conclude that risks at existing wells have been eliminated based on a single sampling event during which no MCLs were exceeded. Further, as discussed in the risk assessment (RA), vinyl chloride can pose potentially significant cancer risks at concentrations below the detection limits used in the available analyses. For all of these reasons, it is incorrect to conclude that potential cancer risks from groundwater contamination from the Strasburg Landfill have been eliminated.

There are no comments from Maxus Energy numbered 11 and 12.

13. **Comment:** Contact risk should be recalculated due the implementation of the fence. Overall risk should be recalculated as per comments in Attachment V.

Response: The security fence is designed to be porous and will not prevent leachate from migrating off-site. Furthermore, leachate has been observed in the past migrating off of the landfill. (Also see responses to Attachment V).

14. **Comment:** The commenter asserts that the UV/ozone treatment system is not practical or feasible because pretreatment requirements were not adequately assessed. Operational costs, including disposal, were underestimated.

Response: The pilot studies recommended in the feasibility study report will identify if pretreatment is necessary. Likewise, the pilot studies will provide information to evaluate site specific costs, such as disposal. Also, the pilot studies recommended will provide the necessary data to determine if UV/ozone treatment is a practical or reliable treatment method for Strasburg Landfill leachate. Pretreatment requirements to remove iron, suspended solids and, manganese should be similar to that required for air stripping. Therefore, in keeping with the overall goal for treatment and complete destruction of waste, UV/ozone was selected as the recommended method pending results of the treatability tests. Should the treatability tests indicate an overall higher cost of operation relative to air stripping with vapor phase carbon adsorption, then a change

could potentially be made at that time to the most cost effective method.

15. **Comment:** The commenter asserts that air stripping should be selected as the leachate treatment method because it has been demonstrated to be effective.

Response: Air stripping was installed at the Strasburg Landfill by PRPs to replace the need for daily leachate removal by tank trucks to an off-site disposal facility. This reduced the daily cost of leachate hauling and disposal and eliminate the risk of transportation related accidents. Air stripping is a mass transfer of volatiles from water to air, whereas, UV/ozone is an innovative treatment technology that destroys volatiles. The pilot studies recommended in the feasibility study report will provide information on the pretreatment and overall operational costs for the system. Pending this cost information and the potential for PADER to require Vapor Phase carbon adsorption, the initial method selected to be included in the selected alternative was UV/ozone. This is in keeping with EPA's overall policy of preference for methods which destroy contaminants. Should the treatability study indicate an overall high cost of operation (primarily from pretreatment requirements) relative to air stripping with vapor phase carbon adsorption, then a change could possibly be made at that time to the most cost effective method.

B. **SPECIFIC COMMENTS ON REMEDIAL INVESTIGATION**

1. **Comment:** PADER may have been incorrect in stating that low rainfall amounts in recent years may have caused reduced contaminant concentrations in groundwater. Less rainfall should yield higher concentrations.

Response: This comment has no effect on the remedy selected. EPA agrees, however, with the potentiality presented by PADER. The production of leachate in the Strasburg Landfill is somewhat dependant upon rainfall production. As the rainwater seeps through the compromised cap and combines with the hazardous wastes buried inside creating leachate. The leachate, at least a portion of it, is then carried off site in the groundwater. If the quantity produced is smaller and the receiving stream (groundwater) is constant, the resultant concentration should be lower.

2. **Comment:** The field soil gas and flux box data should have been validated by a second independent reviewer.

Response: The soil gas and flux box data were qualified by the field chemist using standard EPA procedures, by

analyzing QC samples such as duplicates, blanks and standards. The use of an a second in-field reviewer was not thought to be cost effective.

3. **Comment:** Vinyl chloride concentrations in the Zarzycki well were always lower than the concentrations of 1,2-dichloroethane and trichloroethane. This confirms that the vinyl chloride is due to degradation of other chemicals.

   Response: The commenter attempted to show that the vinyl chloride measured is due to degradation of other chemicals. EPA asserts that vinyl chloride measured may be from a number of sources within the landfill, including potential degradation of chemical products and also deposition of vinyl chloride monomer.

   EPA does not agree that vinyl chloride, found down gradient of MW-3I, is due to degradation of other chemicals. Due to a number of reasons, including but limited to: the fractured nature of substrate bedrock and the methodologies used at various times for analyzing for vinyl chloride in the groundwater.

   Lastly, EPA denies the assertion that vinyl chloride concentrations outside the landfill are solely due to chemical degradation.

4. **Comment:** EPA's contractor may have significantly underestimated the cost to provide electrical power to the site to run the UV/Ozone equipment etc.

   Response: The cost estimates included in the FS are in fact only estimates based on (potential) motor usages. More definitive costs will be developed at the time of Remedial Design. However, the changes in cost due to electrical power are not significant to the point that would alter the remedy selection.

5. **Comment:** EPA does not identify the specific location of the asphaltic spray liners. EPA needs to document the existence of these liners and the fact that they may have not been compatible with the substances deposited there.

   Response: The assertion that EPA needs to document the existence and compatibility of the linear material is denied. EPA has already demonstrated that contaminants from the landfill are entering the groundwater. Further demonstration of this assertion was not felt necessary as it did not go to the selection of a remedy.

6. **Comment:** The commenter asserts that site specific wind speed data was not used for the risk assessment. Also, the

commenter asserts that Philadelphia Airport weather data should not be used for air modeling or risk assessment at the Strasburg Landfill.

Response: The risk assessment required information on both the annual average wind speed as well as its directional frequency and velocity frequent distribution (stability array or STAR data). This information was readily available for the Philadelphia Airport weather station but not for Chester County. It was determined that the airport data would be reasonably representative, so it was used. It is also important to note that minor differences in the wind patterns would result in only minor differences in the exposure and risk estimates. Uncertainties in the wind data are probably very small in comparison to other uncertainties in the risk assessment process.

Wind speed and direction data were collected by a portable meteorological station deployed on site while the ambient air samples were being collected. This information was used to establish the wind direction and speed that prevailed when the air samples were collected which allowed the soil gas sampling locations that were upwind of the ambient air sampling points during actual sample collection to be determined. This allowed EPA to determine which areas of the landfill had contributed emissions detected in the ambient air samples and made it possible to calibrate and validate the vapor emission model selected.

The mean wind speed used in the air dispersion modeling is given in the RI in Table D-2 as 4.35 meters/second which is equal to 9.73 mph.

7. **Comment:** EPA failed to consider whether the homes were equipped with shower stalls or showers in tubs and should perform the risk calculation based on the specific size of the shower enclosure.

Response: Standard EPA assumptions concerning the size of shower stalls were used in completing the risk assessment. [see Figure 3-8 in the RI]. The risk estimates presented are not intended to represent risks to specific individuals or in specific residences, but rather the risks associated with using groundwater, with the contaminant concentrations observed in the residential areas, as a source of potable water used for general domestic purposes. It is reasonable to assume that most people shower or bathe. Showering results in a somewhat greater potential exposure to volatile contaminants and therefore is the appropriate assumption to use in estimating the reasonable maximum exposure that might occur. The assumed shower stall dimensions were 2.5 feet x 5 feet x 7 feet (Table D-5) which corresponds to the air

volume above a typical residential bath tub. Assuming a shower stall, with dimensions of, perhaps, 2.5 feet x 2.5 feet x 6 feet, would have resulted in a smaller air volume and hence higher estimated air concentrations and exposures.

In regard to the comment regarding Zarzycki's deep well (ref.Figure 4-4 in the RI), it can not be guaranteed that Zarzycki's deep well is the only well southwest of the landfill that will ever be used as a drinking water source and that vinyl chloride and other contaminants, found repeatedly in other wells in that area, will never appear in these wells. However, since the intent of the risk assessment is to estimate the risks that use of groundwater as a drinking water source anywhere in the vicinity of the landfill could pose, the approach used in the risk assessment for this operable unit is appropriate.

8. **Comment:** EPA should use the data obtained from the shallow Zarzycki well for risk assessment purposes.

   Response: The commenter asserts that the data gathered from the Zarzycki shallow well should not be used for assessment purposes. However, EPA disagrees, since the shallow well is a sample point in an aquifer used for domestic water purposes.

9. **Comment:** Page 4-70 of the RI states that the Strasburg Landfill is the only known contaminant source for Wheatland Drive. The residents may have contaminated their own wells.

   Response: There is no statement on Page 7.70 in the RI report regarding the contaminant source for Wheatland Drive residents.

10. **Comment:** The commenter asserts that Table 4-19 (vinyl chloride data) should be rejected based on the qualifiers.

    Response: EPA rejects this assertion and believes that the data was used appropriately in making this determination. The field results reported in Table 4-19 were not used in the quantitative risk assessment. The laboratory results reported in Table 4-20 were used.

11. **Comment:** The commenter asserts that improper data was used in calculating the risk associated with ambient air portion of the risk assessment. The commenter also asserts that there can be no off-site inhalation hazard determined from the air.

    Response: Vinyl chloride was detected in ambient air sample EE012 at 0.48 ppb. The wind direction and velocity at the

site were monitored by a portable met station while the air samples were being collected. The on site wind direction data indicated that the wind was blowing from the southeast to southwest sector during the time sample EE012 was being collected. Thus it was downwind from the high soil gas area along the southwestern edge of the landfill.

It is often possible to detect and estimate the concentrations of chemicals when they are present in samples at concentrations below their formal detection limits. HHEM Exhibit 5-4 indicates that it is acceptable to use such data (J-qualified data) in a risk assessment, and estimated values typically are used since they provide the best available estimates of the concentrations actually present.

The ambient air data was not used directly in the risk assessment because it is only representative for the weather conditions (wind direction and velocity) that existed at the time it was collected. The risk assessment requires estimates of the annual average concentrations at potential exposure points. These values were estimated by starting with the measured soil gas concentrations, which do not vary significantly for hour to hour or day to day, then using mathematical models to predict the average ambient air concentrations. The modeling approach was verified by comparing the modeled concentrations for the wind conditions observed on site the day the air samples were collected to the air concentrations actually measured on site that day. Very good agreement, about $\pm$20%-which is well within experimental error, was obtained.

The values of 1,516 and 2,428 ppb for vinyl chloride listed in Table 5-14 are the average soil gas concentrations used as a starting point to estimate the annual average ambient air concentrations by the modeling process just described. The modeled concentrations for on site air used in the exposure and risk estimation calculations are given in Table 5-41. The estimated exposure point air concentration for vinyl chloride is 3.83×10^{-4} mg/m^3 which is equivalent to 0.18 ppb* and is consistent with the concentration of 0.48 ppb measured on site. When performed correctly this "reality check" appears to be quite satisfactory.

(*Note that the 0.18 ppb concentration is an estimate of the average vinyl chloride concentration in the breathing zone along the perimeter road at the toe of the landfill where a site visitor might walk or ride an ATV. It is not the modeled concentration predicted for the EE012 sample location on the day sampling occurred.)

12. **Comment:** The commenter asserts that an informant listed the PVC waste in the south side of the landfill.

Response: This is a misquote from the RI report. The location of the PVC deposited waste is consistent with the location of the high vinyl chloride soil gas measurements.

13. **Comment:** The commenter asserts that the underdrain system was built in the groundwater table.

Response: EPA has no documentation to support or deny this allegation. EPA understands that the purpose of the underdrain system was to collect groundwater before coming in contact with landfilled material.

14. **Comment:** The commenter asserts that various organic compounds with densities greater than 1 are likely sources of deep groundwater contamination.

Response: This assertion is only true if the contaminant is present at a concentration above its water solubility limit so that it forms a separate non-aqueous phase liquid (NAPL) layer. If the density of the separate liquid layer is greater than that of water, it will sink. However, at lower concentrations at which a contaminant is completely dissolved (like in the groundwater at the landfill), the contaminant distributes more or less uniformly in the water and does not sink independent of the water in which it is dissolved. The comment is incorrect.

15. **Comment:** The commenter asserts that only validated and reliable data should be used in risk assessments.

Response: The HHEM in Section 5.1 provides for combining results from different investigations provided the analytical methods and data quality are comparable. The risk assessor contacted the PADER laboratory that analyzed the samples for the PADER residential well monitoring program for the Strasburg Landfill area and was satisfied that the methods used and the overall quality of this data were comparable to groundwater data generated by the RI. The PADER data showed that the groundwater contaminant concentrations fluctuate considerably from quarter to quarter. In light of this variability, the limited data available from the remedial investigation (only one round of sampling from most wells) did not appear to be sufficient to adequately characterize the groundwater contamination in the area. Since the PADER data provided a broader data base than the RI data, and also provided a historical record of the groundwater contamination in the area, it was included in the risk assessment. The PADER data does show that the greatest groundwater contaminant concentrations in the

residential area southwest of the landfill occurred during the 1986 to 1988 time period. It also shows that the level of contamination is highly variable from quarter to quarter and does not provide adequate information to confidently predict the rate at which contaminant concentrations might decline in the future. Risk estimates corresponding to both the historical average and the 1990 average concentrations, a period during which contaminant concentrations had declined from their 1986-88 highs, were included in the risk assessment. The possibility of further decreases in groundwater contaminant concentrations and the possible overestimation of the risks that could result were included in discussions of the uncertainties associated with the risk estimates.

As stated in the Remedial Investigation Risk Assessment Section 5.2.2.1 (p. 5-12), no CLP methods have been established for air or gas samples. A standard (non-CLP) EPA method was used to evaluate ambient air; however, this method is not suitable for analyzing soil gas samples. As discussed in Response B-11, ambient air data collected on a single occasion is not suitable for use in the risk assessment. The soil gas data was judged to be the best data available to use in estimating the annual average ambient air concentrations needed in the risk assessment. The general practice of using the best available data to estimate exposure point concentrations was used throughout the risk assessment.

16. **Comment:** The commenter asserts that EPA cannot make arbitrary assumptions that chemicals are present in performing risk assessment calculations.

Response: The criteria used to determine if there was reason to believe a chemical might be present in a sample were clearly stated in the risk assessment. It should be noted that this approach results in lower, more realistic estimates of contaminant concentrations than the uniform use of 1/2 the DL recommended in the HHEM.

17. **Comment:** The commenter asserts that only air results from Table 5-10 for vinyl chloride and other contaminants should be used for calculating the contaminant concentrations for air pathway exposure assessments. Also, the commenter asserts that the risk assessment should not use calculated exposures that exceed measured ambient air values.

Response: The soil gas results were not simply averaged. A weighting factor was used to account for the size of the area represented by each sampling point. Thus when more points were added in an area the area represented by each

point decreased and the weighting factor was reduced accordingly. The average soil gas concentrations obtained in this way are reasonably representative of the high soil gas concentration area along the edge of the southern half of the landfill. This area can be regarded as a hot spot within the overall Superfund site and was assessed as such in accordance with guidance in the HHEM Section 6.5.3. There is also a perimeter road that runs along the edge of the landfill in the high soil gas area which is known to be used by site visitors. Since potential exposure to site visitors was being assessed, it was appropriate to use the soil gas concentrations in the hot spot to model the ambient air concentrations in this area.

The issue of the estimated exposure point air concentrations was discussed in the response to comment B-11.

18. **Comment:** The commenter asserts that all water and sediment data should be used in the risk assessment calculations, not a limited selection that results in a biased risk estimate.

Response: The contaminant concentrations in Table 5-15 were used to assess potential direct contact exposures to contaminants in the seep areas and settling ponds on site. Data from Tables 4-41 and 4-43, which report results for water and sediment samples from seep areas and settling ponds on site, were included in this calculations of the UCL concentrations given in Table 5-15. Data for methylene chloride and acetone from these tables were not used because they had "B" qualifiers indicating that these compounds were also present in the associated blanks at concentrations that rendered these data unusable for risk assessment purposes (HHEM, Section 5.5). Data from Tables 4-40 and 4-42, which report results for water and sediment samples from off-site locations along Briar Run and Brandywine Creek, were not included in the calculations of the UCL concentrations in Table 5-15 because they were not collected from the potential exposure points under consideration.

19. **Comment:** The commenter asserts that all PADER and other unvalidated data should be removed due to the age of the data and uncertainties as to its validity. Also, the commenter asserts that data from the Zarzycki shallow well should not be considered because that well water zone is no longer used for residential consumption.

Response: The reasons for using the PADER data were discussed in the response to comment A-9 and the reasons for using the ambient air and soil gas data were discussed in the response to comment B-11. The responses to comments A-10e and B-7 discuss the reasons for using all of the available groundwater data in assessing groundwater risks.

20. **Comment:** The commenter asserts that vinyl chloride does not exceed MCLs and should not be used for risk assessment purposes.

Response: EPA's policy for conducting risk assessment is to develop values based on cumulative effects of substances determine present. (See response to comment A-10b).

21. **Comment:** The commenter asserts that Table 5-17 should be revised to show no detectable vinyl chloride in the historical or current RME case for the risk assessment.

Response: See responses to comments A-10e and B-7.

22. **Comment:** The commenter asserts that the exposure duration should be nonexistent after the installation of the remedy in OU2.

Response: As stated above, the fence is not intended to prevent leachate from leaving the landfill. Values based on EPA guidance or information in the scientific literature were used in the exposure estimation calculations for all parameters for which they were available. Some factors such as the exposure frequency and exposure time depend on site specific factors such as the proximity of residential areas to the site, ease of site access, the physical characteristics of the site and climatic conditions. The values used for exposure time and frequency were based on estimates of the level of site visitor activity which were based on observations made during numerous site visits. If ATV riders only rode through contaminated leachate and sediment once during a site visit, the volatiles might well evaporate from the skin making a dermal exposure time of 10 minutes reasonable. However, if someone is "off roading" on site it is probably more likely that they would ride around the site and through seep areas repeatedly, re-exposing themselves on each occasion. This would certainly be an appropriate reasonable maximum exposure assumption. For these reasons EPA believes that the exposure time and frequency assumptions used were appropriate.

The baseline risk assessment estimates the risks the site could pose assuming no remedial actions are taken (the no-action alternative). Separate risk estimates were prepared for the various potential exposure pathways, exposure points and receptors to facilitate evaluation of the potential risk reductions that could be obtained by implementing remedial measures affecting specific exposure pathways or exposure points.

be a groundwater discharge point, preventing groundwater contamination on the other side.

Response: The reasons for using data from monitoring wells 2S and 5I to evaluate potential future groundwater risks in the Wheatland Drive area are discussed on page 5-54 of the RA. The highly featured bedrock geology in the area makes it difficult to predict groundwater flow patterns with confidence. The fracture trace study done by EPA identified fracture traces leading from the landfill to the residential area along Wheatland Drive, therefore a possible groundwater migration pathway linking the landfill and the Wheatland Drive area may exist. Many of the Wheatland Drive wells extend to depths well below the Briar Run creek bed, therefore, groundwater might well pass under Briar Run on its way to the Wheatland Drive area. Contaminants were found in monitoring wells MW-2S and 5I, located about midway between the landfill and the closest Wheatland Drive homes. Given the uncertainties in the groundwater flow patterns and the possible existence of a migration pathway linking the landfill and Wheatland Drive, it is possible that these contaminants could reach Wheatland Drive in the future. Since these contaminants have not been found at Wheatland Drive in the past, the contaminant concentrations found in monitoring wells MW 2S and 5I were used to assess the possible future groundwater risks that might occur if this contamination were to reach the Wheatland Drive wells in the future.

26. **Comment:** The commenter asserts that the most recent 1990 well results are representative of the upper confidence level. The commenter also asserts that EPA should use only the most recent active residential well data for assessing risk to Laurel Road residents.

Response: See responses to comments A-9, A-10c, and B-7.

27. **Comment:** The commenter asserts that Tables 5-50 and 5-51 need to be recalculated using only recent data.

Response: This assertion is denied. See other responses to comments A-9,A-10c, and B-7.

28. **Comment:** The commenter asserts that the modeling of surface air exposures to small animals based on subsurface (soil gas) measurements is inappropriate. Soil gas measurements should only apply to animals burrowing to the depth where the measurements were made, and surface field mice are not at risk from subsurface contaminants. Surface air measurements should be used to estimate small animal exposure.

Response: The use of soil gas measurements for air pathway estimates, rather than ambient air measurements, is justified in response to comment B-11. In addition, an estimate of air concentrations near the ground surface was needed to determine the exposure to small animals. Ambient air samples were taken several feet above the ground, and therefore could not be used for this purpose.

The burrowing activities of small animals were not considered in the risk assessment, because evaluation of exposure in the near-ground breathing zone is considered to be more generally applicable to burrowing and non-burrowing animals alike.

The statement that surface field mice are not at risk from soil gas contaminants is unjustified. Upward, pressure-driven movement of gases is expected to be a dominant vapor release mechanism for this landfill. Still air at the soil-air interface is likely to contain high levels of contaminants, relative to the overlying turbulent air layer. Therefore, small animals could have significant exposure to soil gas contaminants.

29. **Comment:** Commenter asserts that EPA has not properly informed the public with risk associated with the landfill.

Response: EPA disagrees. The commenter's conclusion about the source of groundwater contamination is not supported by the available information. The probability of the true groundwater risks southwest of the landfill exceeding the estimated risks is unknown. The 1 in 10,000 figure was used for illustrative purposes only as discussed in the response to comment B-24.

30. **Comment:** The commenter asserts that vinyl chloride may have been brought to the site from household and other municipal waste.

Response: EPA does not disagree with the assertion; however, this comment does not concern the selection of remedy for this operable unit.

Comment: The commenter also asserts that EPA should not rely on unvalidated and qualified field data for risk assessments.

Response: Risk assessments performed for this investigation are consistent with EPA guidelines. See response to A-9 & B-10.

ATTACHMENT C

SPECIFIC COMMENTS ON FEASIBILITY STUDY

1. **Comment:** The commenter asserts that the risks associated with the site with the implementation of OU2 is less than 1 x 10^{-6} for all people.

   Response: The risk assessment developed for the operable unit was based on the assumption of OU2 being in place and is calculated as 1 x 10^{-4}, which in accordance with the National Contingency Plan (NCP), is just cause for the action envisioned for this operable unit.

2. **Comment:** The commenter asserts that the Strasburg landfill should be characterized as a typical municipal landfill.

   Response: EPA disagrees because the landfill was permitted and did accept industrial waste.

3. **Comment:** The commenter asserts that chromium and nickel discharge limits should not be required below natural levels.

   Response: EPA states that water discharge limits are not related to natural soil sampling conditions and are established to attain stream water quality criteria.

4. **Comment:** The commenter asserts that vinyl chloride data should not be used.

   Response: See responses to Comment B-15.

5. **Comment:** The commenter asserts that since vinyl chloride is not present in MW-3I, downgradient users should not be affected by any vinyl chloride release from the landfill.

   Response: EPA denies this assertion. See response to comment B-3.

6. **Comment:** The commenter asserts that the risk assessment for air exposure should be recalculated.

   Response: EPA denies this assertion. See response to Comment B-11.

7. **Comment:** The commenter asserts that health risks have been reduced to acceptable levels through the implementation of OU1 and OU2.

Response: EPA denies this assertion. See response to Comment C-1.

8. **Comment:** The commenter asserts that homeowners have contaminated their own groundwater, particularly in the Wheatland Drive area.

   Response: EPA denies this assertion. There is no evidence to support the assertion that contamination has been caused by any other source than the Strasburg Landfill.

9. **Comment:** The commenter asserts that OV/ozone should not be considered practical or reliable for treating leachate generated at the Strasburg landfill.

   Response: See response to Comment A-14 of Attachment 1. In addition, the contaminant loading for leachate collection from other areas of the site may increase. The pretreatment requirements for UV/ozone have not been determined; therefore, the commenter's claim that significantly more waste will be generated for UV/ozone is unsubstantiated (information will be generated during treatability test).

10. **Comment:** The commenter "concurs" that waste removal, groundwater barriers and groundwater extraction are not practical or effective.

    Response: Since this comment is taken out of context, EPA cannot agree or disagree.

11. **Comment:** The commenter asserts that supplied water should not be considered as more protective of human health than the current water supply.

    Response: EPA is not considering incorporation of a public water supply as part of the operable unit.

12. **Comment:** The commenter asserts that the carbon treatment units will be re-engineered for point-of-use treatment.

    Response: The carbon treatment units are already installed. Re-engineering of the carbon treatment units is not being considered.

13. **Comment:** The commenter asserts that all of the factors associated with operations, maintenance and disposal have not been considered.

    Response: The commenter is confusing groundwater data with leachate data. There is no evidence to show the concentration of VOCs in the leachate are decreasing. Due to cell construction techniques used at the landfill, there

may be a delay when contaminants are released. The treatment schemes discussed in the feasibility study report are inclusive and comprehensive to address possible scenarios at the site.

14. **Comment:** The commenter asserts that risk level as of November 1990 are considered safe and the situation continues to improve.

    Response: Based on the information gathered to date, EPA disagrees with this assertion.

15. **Comment:** The commenter asserts that the secondary leachate collection system must remain above seasonal high water table level.

    Response: This issue will be resolved during the design stage for this operable unit.

16. **Comment:** The commenter asserts that the existing cap need only to be repaired and not replaced.

    Response: Based on observations performed by landfill experts, the existing cap has been extensively compromised. This is evidenced by numerous leachate seeps - which continue to flow and emerge at new locations across the surface of the landfill. Therefore, EPA feels it is more cost and risk based effective to replace rather than repair the existing landfill cap.

17. **Comment:** The commenter asserts that the no action alternative must consider current risk reduction activities and that 98% of the existing cap is intact.

    Response: The no action alternative did consider the current risk reduction activities. Furthermore, EPA has not asserted that 98% of the cap is intact but rather that observations have shown that at least 2% of the cap was observable and was severely deteriorated.

18. **Comment:** The commenter asserts that replacing the cap would be dangerous to workers and local residents and repairing the existing cap would be as effective as replacement.

    Response: EPA is aware of the dangers associated with replacing landfill caps and will ensure that appropriate safeguards, including extensive on-site air monitoring, will be implemented. As stated above, EPA has stated it is not feasible to repair the existing cap. Replacement of the cap is necessary.

ATTACHMENT II

DSCC'S PVC WASTE

1. **Comment:** The commenter asserts that DSCC only disposed physically oversized polymer resins.

   Response: According to information provided by DSCC to EPA, the material from their operation contained vinyl chloride monomer.

2. **Comment:** The commenter asserts that there was no misrepresentation of the waste contents by DSCC.

   Response: Based upon available information, EPA does not assert that there was a misrepresentation of the waste contents.

3. **Comment:** The commenter asserts that no evidence has been presented to show that unreacted vinyl chloride could somehow dissociate from the PVC under landfill condition [as in U.S. vs. New Castle County, et al.].

   Response: This comment is not concerned with the remedial action proposed by the decision but rather goes to the issue of potential responsibility (and the subject of potential future enforcement actions). Although EPA disagrees with this statement and comparison, EPA will not respond further, at this time to this assertion.

ATTACHMENT III

SOURCES OF VINYL CHLORIDE AT THE SITE

1. **Comment:** The commenter asserts apparently contradictory statements regarding the production of vinyl chloride from PVC. On the one hand, the commenter asserts that PVC resin cannot degrade to vinyl chloride monomer and, on the other hand, cites documented sources where levels of vinyl chloride have been measured as a result of PVC products.

   Response: EPA has not attempted to quantify the vinyl chloride present at the landfill because to date we have not be able to review complete disposal records of material taken to the site. As stated above, in response to comment on Attachment II-3, the issue of vinyl chloride production does not concern the issue of remediation as proposed for this operable unit.

ATTACHMENT IV

CAUSES OF LEACHATE RELEASE AT THE SITE

1. **Comment:** The commenter asserts that there are no unusual volumes of hazardous substances concentrations at the site that would require a Superfund response. Furthermore, the commenter asserts there were numerous technical problems documented that were associated with development, operation and maintenance of the landfill.

   Response: EPA neither agrees or disagrees will the assertion regarding the history of the site. Since this site poses a threat to the human health and the environment, as defined in the NCP, EPA is tasked with effecting remedial actions to correct these problems as they exist today. EPA agrees that it must consider the development, operation and maintenance of the landfill to the extent those actions directly affect current remedial strategy.

ATTACHMENT V

Flaws in the Risk Assessment

The comments listed in this attachment regarding the risk assessment have been addressed in the specific comments listed above.

Paragraph 1

Comment: EPA has ignored the site risk reductions resulting from the installation of the fence on Operable Unit 2.

Response: The baseline risk assessment estimates the risks the site could pose assuming no remedial actions are taken (the no-action alternative). Separate risk estimates were prepared for the various potential exposure pathways, exposure points and receptors to facilitate evaluation of the potential risk reductions that could be obtained by implementing remedial measures affecting specific exposure pathways or exposure points. Furthermore, as pointed out previously, the fence will not serve as an effective barrier in keeping the leachate on the landfill.

Paragraph 2

Comment: EPA needs to recalculate risks using the expected exposure concentration for each year. Using this approach no risk from the site exists.

Response: The data used in the risk assessment acknowledges that groundwater contaminant concentrations southwest of the landfill appear to be decreasing. The reasons for this observed decrease is not clear, however, PADER has indicated that it may be due to the recent years' low total rainfall. The available data show an overall decrease in groundwater contaminant concentrations from the 1986-88 time period to 1990; however, they also show that the concentrations vary substantially from quarter to quarter. Given this variability and the absence of consistent and predictable trends in the data, a reliable estimate of the rate of potential future decreases in contaminant concentrations could not be obtained from the available data.

It might be theoretically possible to model the future groundwater contaminant concentrations; however, there are at least half a dozen environmental processes, each with its own substantial uncertainties, that would have a bearing on the concentrations. These processes include the rate at which contaminants are released from the landfill, the rate at which contaminant concentrations within the landfill are

depleted over time as a result of migration and degradation, the velocity and direction of groundwater flow, retardation of contaminant movement in the groundwater as a result of interactions with organic carbon and soil minerals, possible biodegradation and biogeneration of contaminants in the groundwater, and changes in contaminant concentrations due to other chemical reactions and volatilization. The complexity of the problem and the magnitude of the uncertainties involved in estimating the combined effects of all of these processes effectively preclude obtaining reliable estimates of future groundwater contaminant concentrations through modeling.

With all of the difficulties and uncertainties inherent in trying to predict future groundwater contaminant concentrations, it would be very difficult to know whether any estimates obtained would be adequately health protective. Use of the steady-state assumption is likely to overestimate long-term exposure concentrations, as acknowledged in the risk assessment; however, it can be confidently assumed to be health protective. HHEM acknowledges in Section 6.5.1 that it is frequently necessary to assume steady-state conditions because the information required to estimate non-steady-state conditions is not readily available.

Paragraph 3

Comment: Based on the commenter's interpretation of the data, there should be no excess cancer risk due to vinyl chloride or other contaminants, because the measured levels will go to below the MCL.

Response: The role of the baseline risk assessment is to provide EPA's risk managers with estimates of the aggregate risks posed by a site, taking into account all of the contaminants present and all of the environmental media and pathways by which exposures could occur. This is usually done by combining site specific exposure estimates with quantitative toxicity estimates for each chemical of potential concern, as in the present risk assessment. Occasionally, for very simple sites having only a small number of contaminants and exposure pathways, a compilation of MCLs and other ARARs can be used in place of a site specific risk assessment provided ARARs have been established for all of the contaminants and environmental media involved. This was not the case for the Strasburg Landfill. For more complex sites a list of ARARs is compiled separately then both the aggregate health and environmental risks, estimated by the risk assessment, and the available ARARs are taken into account by the risk

manager(s) in selecting an appropriate remedial response for the site.

Any exposure to a carcinogen is assumed to marginally increase an individual's risk of cancer. The MCLs are based on technical feasibility as well as human health risks and are sometimes set at levels corresponding to estimated cancer risks of 10^{-4} or higher (e.g., vinyl chloride and arsenic). The maximum contaminant level goals (MCLGs), which are based solely on potential health risks are set at zero for carcinogens as a matter of public policy. The statement that residential groundwater is below MCLs is incorrect. The concentration of vinyl chloride exceeded its MCL in Zarzycki's shallow well as recently as July of 1990.

Paragraph 4

Comment: The commenter asserts that the Feasibility Study states that the residents on Wheatland Drive are protected from contaminants in the groundwater because Briar Run serves as a discharge point. Also, that since Operable Unit 2 has been approved only non-contact site risks should be used.

Response: Many of the Wheatland Drive wells extend to depths well below the Briar Run creek bed, therefore, groundwater might well pass under Briar Run on its way to the Wheatland Drive area. Contaminants were found in monitoring wells MW-2S and 5I, located about midway between the landfill and the closest Wheatland Drive homes. Given the uncertainties in the groundwater flow patterns and the possible existence of a migration pathway linking the landfill and Wheatland Drive, it is possible that these contaminants could reach Wheatland Drive in the future. Since these contaminants have not been found at Wheatland Drive in the past, the contaminant concentrations found in monitoring wells MW-2S and 5I were used to assess the possible future groundwater risks that might occur if this contamination were to reach the Wheatland Drive wells in the future. It is a misinterpretation of the data to state that all of the eastern flowing contaminated groundwater is intercepted by Briar Run.

The baseline risk assessment estimates the risks the site could pose assuming no remedial actions are taken (the no-action alternative). Separate risk estimates were prepared for the various potential exposure pathways, exposure points and receptors to facilitate evaluation of the potential risk reductions that could be obtained by implementing remedial measures affecting specific exposure pathways or exposure points.

EPA is not convinced that there are no area residents among the individuals jogging or riding horses or ATVs on the site. In fact, it seems unlikely that individuals would come to a Superfund site from some distance away, bringing their horses and ATVs with them, to engage in these activities. Furthermore, EPA has obtained several statements from nearby residents that they have used the site area, including the landfill for recreation purposes. As stated previously, the fence is not intended to be a barrier for the leachate seeps. Since the leachate can flow though the fence, the risk of contact exposure exists.

Paragraph 5

Comment: EPA should use 10^{-4} as an acceptable risk for this site considering, among other factors, the low population densities, actual site conditions, and Operable Units 1 and 2.

Response: The acceptability of a particular risk level is a risk management, not a risk assessment issue.

The risk assessment does not state that there is only a 1 in 10,000 chance of the actual risks being as high as the estimated risks. The probability of the true groundwater risks southwest of the landfill exceeding the estimated risks is unknown. The 1 in 10,000 figure was used for illustrative purposes only as discussed in the response to comment B-24.

Paragraphs 6 and 7

Comment: The increased risk presented by this site to the community has no real basis in reality and is merely a paper calculation.

Response: The cancer risk estimates were prepared and reported in accordance with EPA guidance (HHEM 1989 and "Guidelines for Carcinogen Risk Assessment:, Federal Register 51:33992-34012, 1986).

The methods used for estimating and reporting potential cancer risks are based on prudent public health policy as discussed in Section 5.4.3.3 of the risk assessment. The methodology was adopted in 1986 through a formal rule making process that took public comments into consideration. The cancer risks in the general population were well known when EPA's guidelines for carcinogen risk assessment were adopted. However, EPA elected to discuss cancer risks posed by Superfund sites in terms of the additional, excess or incremental risks posed by a site, apart from the baseline cancer risks experienced by the general population.

Comparison of estimated site risks to general population risks is not part of the baseline risk assessment process or report format recommended in the HHEM.

ATTACHMENT VI

UV/Ozone Treatment

Comment: The commenter asserts that the UV/ozone treatment system for the leachate is not practical or reasonable for the Strasburg Landfill site. The cost and implementability has been underestimated in particular pretreatment and associated residual disposal.

Response: The feasibility study report recommended pilot studies to develop the necessary data to evaluate if UV/ozone treatment is practical or reliable treatment method for Strasburg Landfill leachate. The recommended pilot studies will also provide information to develop site specific costs, including operational, maintenance and disposal costs associated with the UV/ozone treatment system for Strasburg Landfill leachate.

- Scaling was an anticipated problem as noted in the FS text. According to the vendor, scale can be cleaned by routine maintenance and should not require a significant amount of time (See FS page 4-34).

- Pretreatment efforts were not described in the FS as they will be determined as a result of the treatability tests. However, EPA does agree that, if extensive pretreatment is required, costs could be prohibitive; however, experience with similar pretreatment efforts has shown that this has not been the situation. The Ultrox SITE report indicates a treatment (i.e. O & M costs) cost range of $.25 to $17 per 1000 gallons. At the 10 gpm rate O & M costs (exclusive of testing; apparently Maxus only considered the operation costs and not the maintenance and insurance costs) were estimated at $1.2 per 1000 gallons for 200 ppb influent or $1.4 per 1000 gallons for 400 ppb influent. These costs would appear consistent with the Feasibility Study. As noted in Maxus' evaluation if extensive pretreatment residues are generated this could significantly increase the cost. At this point in time, it is not clear whether air stripping or UV/ozone will generate more residue. To assist in this evaluation, EPA will review the operational data on the existing air stripping system. Once the treatability test is completed, pretreatment needs of both systems

can be compared and a more detailed benefit analysis can be performed.

- Also note that in the FS both UV/ozone and air stripping were costed without significant pretreatment for comparison, since reliable pretreatment information was unavailable and will be generated during design. The costs presented in the FS for O & M may be underestimated if extensive pretreatment is required.

In addition to the above comments, the PADER has commented, after the Public Comment period, in two separate letters, regarding the draft Record of Decision. Most of their comments addressed grammatical errors in the document and points of clarification. These have been corrected. In addition, the following substantive comments have been raised:

Comment: The PADER requested the addition of the PA Hazardous Waste Regulations to the Site ARARs.

Response: EPA concurs with this comment and the Decision Document was corrected to reflect the appropriate PADER citations.

Comment: PADER commented that Alternatives 3 and 5 were essentially the same with the exception of landfill gas emissions and do not justify requiring separate alternatives.

Response: EPA agrees that the sole distinction between the Alternatives is the type of treatment for the landfill gas emissions. The alternatives are presented separately because, under the evaluation criteria, the risks currently measured from the landfill gases do not warrant the incremental increase in costs associated with active landfill gas treatment as presented in Alternative 5.