United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R03-86/029
September 1986

EPA

Superfund Record of Decision:

Blosenski Landfill, PA

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA/ROD/R03-86/029	2.	3. RECIPIENT'S ACCESSION NO
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

The Blosenski Landfill site is located on 13.6 acres in West Caln Township, Chester County, PA. The site is bordered by heavily wooded and agricultural areas. Approximately 467 residents live within one mile of the site. Beginning in the 1950s the site operated as a landfill accepting municipal and industrial wastes. In 1971 the site was purchased by Mr. Joseph Blosenski, who operated the landfill until the early 1980s. Wastes were randomly dumped on the surface during the operating period, and included solvents, waste water treatment sludges, demolition and construction wastes, undercoating materials and open and leaking drums. Numerous citizen complaints of odors, smoke and airborne debris led to petition and regulatory actions against Mr. Blosenski. In 1982, EPA conducted a Site Inspection and found serious ground water contamination. The primary contaminants of concern are VOCs including benzene, toluene and TCE, and inorganics including lead, cadmium, chromium and mercury.

The selected remedial action for the site will be conducted in four phases. Phase 1 - installation of a public water supply to 12 residences; Phase 2 - excavation and removal of buried drums and other material with offsite disposal in a RCRA landfill; Phase 3 - perform a pre-design study to further sample ground and surface waters to delineate extent and magnitude of contamination. Based on the results of the study, (See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
~~Record of Decision~~ Blosenski Landfill, PA Contaminated Media: gw, soil Key contaminants: VOCs, heavy metals, TCE, benzene, toluene		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report) None	21. NO. OF PAGES 69
	20. SECURITY CLASS (This page) None	22. PRICE

16. ABSTRACT (continued)

ground water will be pumped and treated for a maximum of two years to ACLs established by EPA; Phase 4 - install a low permeability RCRA cover on the landfill, divert surface water and construct a gas venting system. Phases 1-3 will be implemented concurrently. Estimated capital cost of the remedy ranges between $11,000,000 and $15,000,000, with a baseline cost of $13,000,000. O&M costs are estimated to be $534,300 for the first two years.

RECORD OF DECISION
REMEDIAL ALTERNATIVE DECISION

Site: Blosenski Landfill, West Caln Township, Chester County, Pennsylvania

Documents Reviewed:

I am basing my decision principally on the following documents describing the analysis of cost effectiveness and feasiblity of remedial alternatives for the Blosenski Landfill Site:

- "Remedial Investigation Report and Feasibility Study" Blosenski Landfill Site, Chester County, Pennsylvania (NUS Corporation, February, 1986).
- "Focused Feasibility Study" Blosenski Site (PRC Engineering, February 27, 1986)
- Staff summaries and recommendations
- Recommendation by the Pennsylvania Department of Environmental Resources.

Description of Selected Remedy:

The Selected Remedy will be performed in a phased approach, with the first three of the four phases being performed concurrently.

Phase 1

Install a public water supply line to an estimated twelve (12) residences. The water will be provided by the Coatesville Water Authority. EPA will pay for the initial connections to these residences.

Phase 2

Excavate and remove buried drums in areas identified during EPA's Remedial Investigation and any material in intimate contact with the drums and free standing liquid, and dispose of these materials at a Resource Conservation and Recovery Act (RCRA) facility. In addition, EPA will perform trenching operations throughout other areas of the Site in order to identify, excavate and dispose of other buried drums.

Phase 3

Perform a pre-design study which shall include further sampling of residential wells, surface waters, and the installation of additional monitoring wells and conducting pump testing to more fully delineate the extent and magnitude of the ground water contamination. This study will also be used to collect data for the design of an effective ground water pumping and treatment system.

Based on the findings of the pre-design study, implement a source reduction program involving pumping and treating of contaminated ground water for some period of time determined during design not to initially exceed two years to Alternate Concentration Levels developed by EPA. This will include the construction of an on-site treatment facility to treat the ground water. After this specified period, an evaluation will be made by EPA as to the effectiveness of the pumping and treatment for reducing the groundwater contamination to EPA approved concentration levels and for the need, extent and duration of future groundwater remediation.

Phase 4

Install a low permeability cover on the landfill in accordance with the requirements of RCRA. Construct appropriate surface water diversion system(s).

If needed, construct a gas venting system to protect the cover. An air monitoring program will be conducted at these gas vents and treatment of the off gases will be provided, if needed.

Institute periodic monitoring for ground water and surface water contamination in the landfill area in compliance with RCRA closure regulations. This will include sampling of selected residential and/or monitoring wells in addition to surface water sampling.

Declarations

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 C.F.R. Part 300), I have determined that the remedial actions described above, together with proper operation and maintenance, is a cost effective remedy and provides adequate protection to public health, welfare and the environment. The remedial action provides for an alternate water supply to affected and potentially affected residences and minimizes the threat of further contamination of the environment. Key elements of the remedial action include a pre-design study which will assist in designing the source reduction program. After the source reduction program is implemented, the Regional Administrator will make a decision within two years of the commencement of remedial action, to determine if further remedial action is needed or if a closeout sequence on the pumping and treating should begin. The State of Pennsylvania has been consulted and agrees with the approved remedy.

I have determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites. In addition, the selected alternative is the most cost effective remedy that meets all relevant and applicable environmental standards, and is necessary to protect public health and the environment.

9/29/86
Date

James M. Seif
Regional Administrator

Site Description and Summary of Remedial Alternative Selection For The Blosenski Landfill Site

Site Location and Description

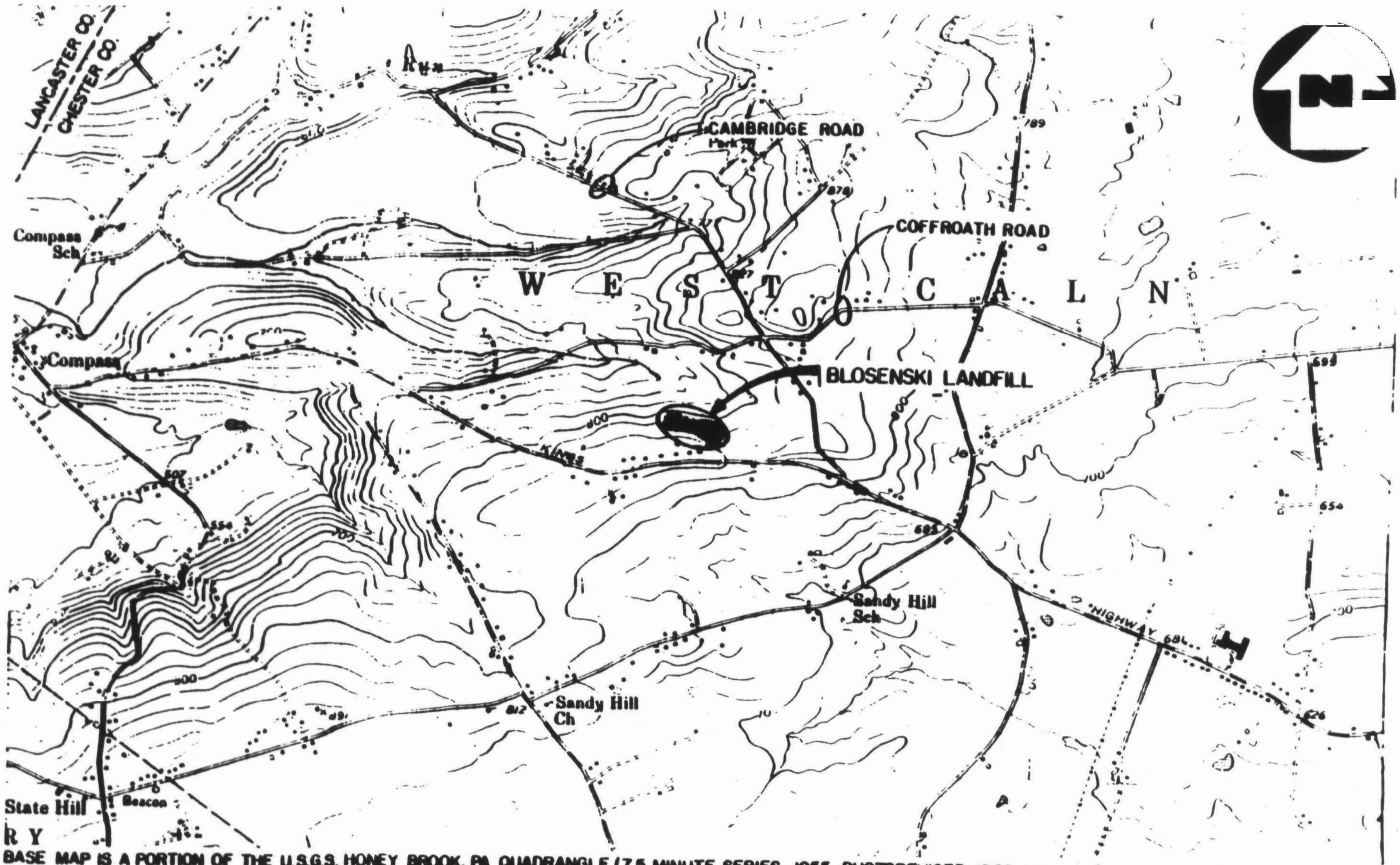
The Blosenski Landfill Site is located on 13.6 acres in West Caln Township, Chester County, Pennsylvania. It is surrounded by heavily wooded areas to the north and west, and by agricultural areas to the east and northwest. Approximately 30 residents live within a quarter-mile radius of the site. According to a dwelling count performed on the Honeybrook 7.5-minute series topographic map, approximately 467 residents live within 1 mile of the site. The Pennsylvania Department of Environmental Resources (PADER) estimates indicate that 600 residents live within 3 miles of the site. The closest dwelling to the site is the house trailer located adjacent to the site on the southern perimeter.

The land surrounding the Blosenski Landfill Site is primarily deciduous forest and cropland. The land is used for agricultural, residential, and commercial purposes. A service station is located south of the site, across Kings Highway. Numerous private homes are located along Kings Highway, to the south, and along Cambridge Road, which lies northeast of the site. There are also residences north of the site on Coffroath Road which extends east from Kings Highway and intersects Cambridge Road northeast of the site (see Figure 1). Wooded areas are located between Coffroath Road and the northern border of the site, and also to the west of the site. Agricultural areas lie within one-quarter mile of the site, both to the northwest and to the east. A trailer park is located three-quarters of a mile to the north, and the Sandy Hill Church and School and the Kings Highway Elementary School are located within 2 miles of the site, to the southeast and east, respectively.

An intermittent, unnamed tributary of Indian Spring Run is approximately 500 feet north of the site. This tributary runs about 2 miles to the west before joining Indian Spring Run. Indian Spring Run joins Pequea Creek about 3.5 miles west of the site. Pequea Creek eventually flows into the Susquehanna River, approximately 30 miles southwest of the site.

Site History

Beginning in the 1950's, the landfill was reportedly operated for the disposal of municipal and industrial wastes. Aerial photography for that period, however, indicates that visible landfill activity began between 1951 and 1957. No specific information is available about site operations from that period until the landfill was purchased in 1971 by Mr. Joseph M. Blosenski, Jr.. From that time, until operations ceased in the late 1970s to early 1980s, wastes accepted at the site were apparently dumped on the surface, as evidenced by mounding of the landfill surface. Wastes, which reportedly included drummed industrial wastes, truckloads of sludges, and municipal and commercial refuse, were dumped randomly at the site. The various disposed wastes were not segregated, and the area was not lined. Materials reported to have been disposed on site include solvents, paints, undercoating materials, wastewater treatment sludges, cans of joint cement/sealer, demolition and construction waste, wallboard and plaster, concrete block, waste from land clearing, paper, wooden pallets, cans, open and leaking drums (near the southeast corner of the landfill), old vehicles, and leaking tankers (at the western portion of the landfill).



BASE MAP IS A PORTION OF THE U.S.G.S. HONEY BROOK, PA QUADRANGLE (7.5 MINUTE SERIES, 1955, PHOTOREVISED 1969 AND 1974). CONTOUR INTERVAL 20'.

FIGURE I

LOCATION MAP
BLOSENSKI LANDFILL SITE, WEST CALN TWP., PA
SCALE: 1"=2000'

Aerial photography of the site from 1957 to 1983 showed various operating and junked vehicles on site, including cars, bulldozers, tank trucks, and open-bed garbage trucks. Ground stains and dark-toned standing liquid were evident throughout the site area. A berm running along the northern perimeter of the site was visible in earlier photos, with standing liquid at its base. In a 1969 aerial photo, a trench, possibly excavated to prevent leachate and runoff from leaving the site, was visible extending from the northeastern corner of the fill area to the northeastern corner of the site. A trench north of the fill area on the western portion of the site was also evident in a 1971 photo. In the 1969 photo, possible leachate stains lead down the eastern slope of the fill area to a pit at its base, and several other pits were visible over the site. A tank truck apparently discharging a dark liquid could also be seen in this photo.

In the 1975 photo, the fill area appeared to be covered with earthen material, except in the northwestern and southeastern sections. A ditch, which apparently carried runoff to the southwestern corner of the site, bordered the fill area on the south. Refuse was visible on the east face of the fill area as well as southeast of this area. Throughout the years, the landfill area expanded to the west, east and southeast. Much of it was revegetated, and the trenches and ditches evident in earlier photos became less distinct. By 1983, after the site ceased operations, ground stains were visible only intermittently across the site, mounded material was apparent along the center, and some grading of the soil was evident to the east.

Over the years of operation, nearby residents registered numerous complaints of odors, smoke, and airborne debris arising from open burning of trash at the site. There is a lengthy list of regulatory actions against the owner, including site inspections, consent decree negotiations and violations, summary hearings, contempt petitions, and closure orders by the Pennsylvania Department of Environmental Resources (PADER). Numerous permit applications for operation of the landfill were filed by Mr. Blosenski, but a permit was never granted.

Four monitoring wells were installed along the northern property line in the summer of 1982 by PADER's consultant, Robert H. McKinney, Jr., Associates, Inc. However, three of these wells were apparently destroyed in the spring of 1983 and cannot be used. During the winter of 1982, 50 to 60 drums and a leaking tank truck were removed from the site. Currently the property is not fenced.

As part of the initial screening of potential sites under Superfund, a Site Inspection was conducted by EPA at the landfill on April 20, 1982. The results of the inspection revealed serious ground water contamination at the site. As a result of this Site Inspection, a Hazard Ranking

System score of 30.57 was generated by EPA, resulting in the placement of the Blosenski Landfill Site on the National Priorities List (NPL) in December, 1982.

Current Site Status

A remedial investigation (RI) was performed at the Blosenski Landfill site from the Fall of 1984 through the Spring of 1985.

The RI consisted of several activities: geological characterization, hydrogeologic study, surface investigation, and subsurface excavation. Data from these activities were used as the basis for assessing the nature and extent of site-related contamination and the associated risks to the public health and the environment.

The geological characterization involved literature research, as well as field studies. The literature search consisted of reviewing references and available maps. The field studies included the construction of monitoring wells, excavation of test pits, geological examination of outcrops, and study of air photos. The geologic investigation was performed to gain understanding of subsurface conditions as they may influence contaminant migration. This was achieved by drilling 15 test borings at 11 locations around the site. Representative samples from the borings were analyzed for EPA Hazardous Substances List (HSL) compounds. The HSL represents a number of organic and inorganic (approximately 154 compounds) targeted by EPA as being toxic pollutants. In addition to these physical and chemical observations, procedures such as fracture trace analysis were used to characterize on site subsurface conditions.

The results of the geologic study indicate that the Blosenski Landfill site is situated in the Piedmont physiographic province. The characteristic topography of this part of the Piedmont includes upland areas separated by broad intervening valleys. Rocks underlying the site and nearby areas include the Chickies Quartzite and Harpers Phyllite.

A fracture trace analysis of the site and the surrounding area showed that the site is located between two faults that strike approximately east/west, with a linear feature suggesting a possible fault near the southern boundary of the site. A total of 62 fracture traces were identified in the analysis with the findings suggesting that two fracture systems exist in the landfill area.

The data generated by the geologic investigation revealed that the most important aspect of the geology at the Blosenski Landfill site is the presence of fractures and schistosity with preferred orientations. The resultant impact on ground water movement in this type of geology is some degree of unpredictability of ground water flow patterns.

The hydrogeological study performed during the RI was supplemented by the geologic investigation and also involved the installation and sampling of monitoring wells. These wells were placed on the perimeter of the landfill and at upgradient and downgradient locations. Figure 2 shows the location of the monitoring and residential wells and includes the results of analyses of ground water samples for HSL compunds. These wells were then used to observe ground water gradients and fluctuations in water levels over the course of the study. The wells also served as a means to perform hydraulic conductivity testing of the aquifer in localized areas.

Samples of the ground water were obtained from these wells on several occasions throughout the RI, as well as from residential wells in the area, for analysis of Hazardous Substance List (HSL) compounds and other water quality indicators.

Numerous HSL volatile organics were detected in ground water collected from both monitoring and residential wells in and around the Blosenski Landfill site. Volatile contaminants detected in ground water samples include some contaminants identified in surface and subsurface samples and some not detected in other environmental media at this site. Contaminants identified in the ground water and their maximum concentrations encountered in monitoring wells are listed in Table 1. Contaminants identified in residential wells are listed in Table 2.

Table 1.0

Monitoring Wells Samples

Chemical	Maximum Concentration (ppb)*
benzene	11,000
toluene	600
ethylbenzene	54
total xylenes	78
chlorobenzene	34
1,1,1-trichloroethane	430
1,2-dichloroethane	74
1,1-dichloroethane	270
chloroethane	93
tetrachloroethene	5
trichloroethene	260
1,2-dichloroethene	890
1,1-dichloroethene	21
vinyl chloride	450
chloroform	270
methylene chloride	2,000
acetone	43,000
2-butanone	350
2-hexanone	21
4-methyl-2-pentanone	7

*parts per billion

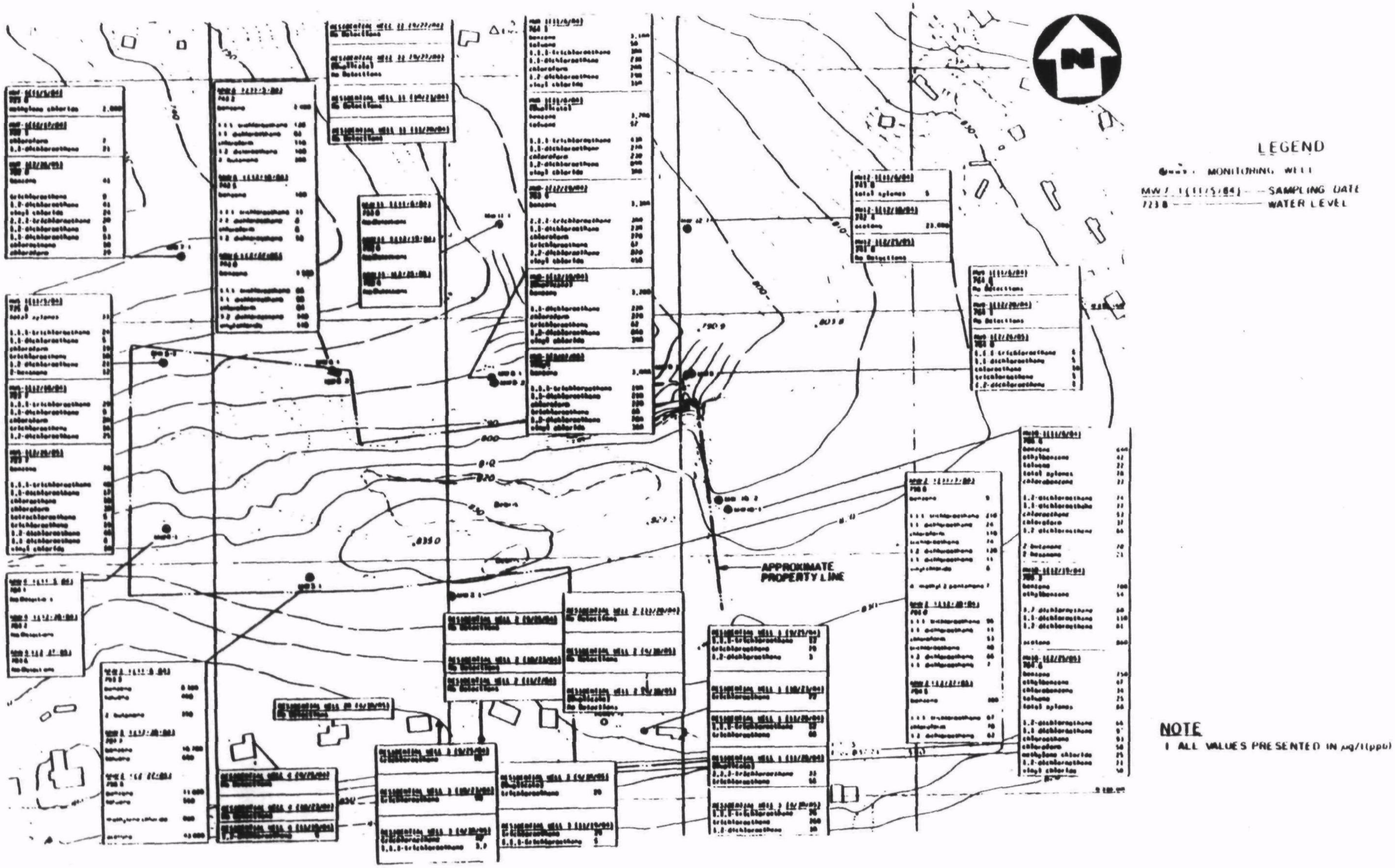


Figure 2

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SCALE IN FEET

HSL VOLATILES DETECTED IN GROUNDWATER SAMPLES(MONITORING & RESIDENTIAL WELLS)
NUS REMEDIAL INVESTIGATION RESULTS, 1984-1985
BLOSENSKI LANDFILL SITE, WEST CALN TWP., PA

Table 2.0

(3) Residential Well Samples

Chemical	Maximum Concentration (ppb)
1,2-dichloroethene	18
trichloroethene	260
1,1,1-trichloroethane	26
Benzene	14

A total of 29 residences in the vicinity of the site were sampled during the RI. Of those sampled, 3 residences that are situated adjacent to the site (to the south) showed some type of significant volatile organic contamination in their wells. Five other residential wells in the general vicinity of the site showed some type of low level contamination with either volatile organic or inorganic compounds.

Figure 2 presents the results of various organic compounds analyses for the sampling rounds conducted in late 1984 and early 1985. The figure reveals that high levels of contamination are evident at several well locations.

HSL compounds were detected in a number of surficial soil samples collected on and in the immediate vicinity of the Blosenski Landfill Site. Surface soil samples were taken from the top six inches of soil at 22 locations. Nine of the soil samples were taken from the embankment on the north side of the landfill area, where surface leachate had been detected. Chemicals detected and maximum concentrations encountered are presented in Table 3 below.

Table 3

HSL Compounds in Surficial Soil Samples

Volatile Organics

Chemical	Maximum Concentration (ppb)*
benzene	12
toluene	4,000
total xylenes	1,100
ethylbenzene	500
1,1,1-trichloroethane	390
1,1-dichloroethane	20
tetrachloroethene	110
trichloroethene	8
1,2-dichloroethene	29
methylene chloride	1,300
acetone	850
2-butanone	1,000
4-methyl-2-pentanone	110

*ppb = parts per billion

Table 3 (continued)

Semi-Volatile Organics

Chemical	Maximum Concentration (ppb)
phthalate esters	180,000
phenols	20,000
naphthalene	5,000
polynuclear aromatics	17,500
isophorone	660
1,4-dichlorobenzene	330
diethlyphthalate	34
dibenzofuran	660
PCB 1260	53,000
PCB 1242	10,000
3,3-dichlorobenzidine	700
n-nitrosodimethylamine	66
benzoic acid	8,000
VTIC (Volatile Fraction-Tentatively Identified Compounds)	5,038
SVTIC (Semi-Volatile Fraction-Tentatively Identified Compounds)	190,000

Inorganics

Chemical	Maximum Concentration (ppb)	Literature Background Level (ppb)	(Source)
As (Arsenic)	23,000	7,400	Shacklette
Cd (Cadmium)	280,000	60	Bowen
Hg (Mercury)	640	120	Shacklette
Pb (Lead)	1,720,000	17,000	Shacklette
Cr (Chromium)	71,000	52,000	Shacklette

The findings of the surface investigation indicate that the residual soil, which mantles the onsite bedrock, is variable in thickness. At the landfill hillcrest, it is about 6 feet thick. At the base of the hill below the landfill, material designated as soil is commonly 20 feet or more in thickness. These thicker intervals include colluvium derived from mass movement of soils and rock from the hillside above.

Given the nature of landfilling activities on site, it is difficult to accurately define the natural soil horizon. In some areas of the site, particularly in the western area, extensive grading and excavation had occurred, apparently to provide borrow material for landfill cover. Therefore, variance in soil cover can be expected across the site.

The subsurface investigation performed during the RI was intended to specify the areas in which drum burial had taken place. A total of 22 test pits were excavated throughout the landfill area (Figure 3). Of these, buried drums were found in test pits TP-5, TP-6, TP-11, TP-17, and TP-18. These pits were located on the southern, western, and eastern portions of the landfill.

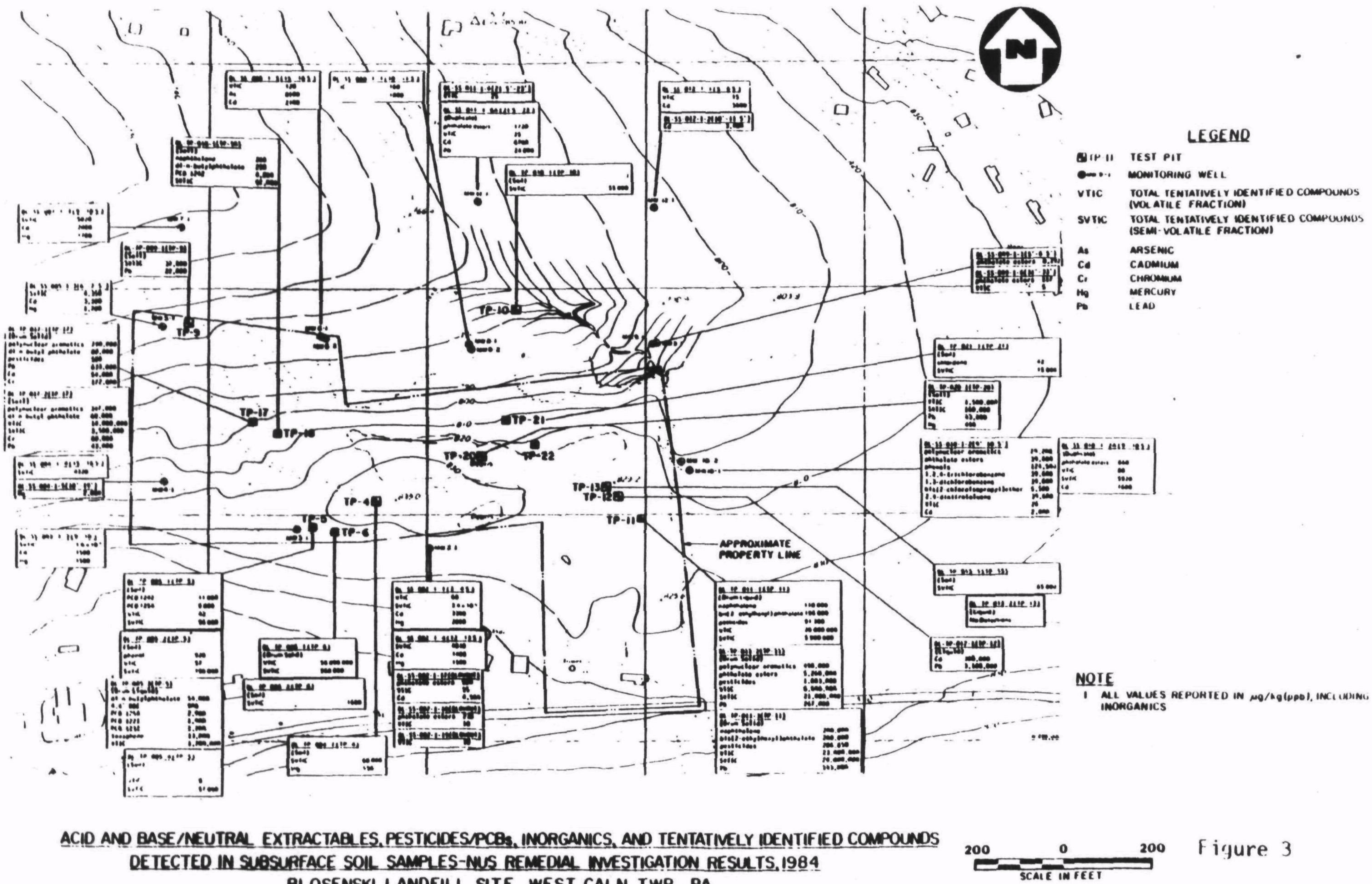
Subsurface soil samples were obtained from both well borings and test pits. During excavation, buried drums were found in test pits TP-5, TP-6, TP-11, TP-17, and TP-18. These drums were all either crushed or broken open. Black perched water was found during excavation of test pits TP-11, TP-12, and TP-13. Test pit samples included solid and liquid drum contents, subsurface soil, and perched water. Typical HSL compounds detected in well borings and test pits samples (which included drum wastes and leachate) are presented in Table 4.

Table 4

Subsurface Media Contamination (Volatile Organics)

Chemical	Maximum Concentration (ppb)*
benzene	2,000
toluene	5,900,000**
ethylbenzene	15,400,000**
total xylenes	61,000,000**
1,1-dichloroethane	120
chloroethane	2,030
trichloroethene	860
methylene chloride	4,900
2-hexanone	100

* ppb - ug/kg for solid samples; ug/l for liquid samples
**maximum concentration present in waste samples from buried drums



ACID AND BASE/NEUTRAL EXTRACTABLES, PESTICIDES/PCBs, INORGANICS, AND TENTATIVELY IDENTIFIED COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES-NUS REMEDIAL INVESTIGATION RESULTS, 1984
BLOSENSKI LANDFILL SITE, WEST CALN TWP., PA

Figure 3

Table 4 (continued)

Semi-Volatiles

Chemical	Maximum Concentration (ppb)
phthalate esters (drum solid)	5,260,000
naphthalene (drum liquid)	200,000
polynuclear aromatics (well borings)	79,200
bis (2-ethylhexyl) phthalate (drum liquid)	196,000
PCB 1254 (drum liquid)	2,900
PCB 1221 (drum liquid)	1,900
PCB 1232 (drum liquid)	2,000
toxaphene (drum liquid)	13,000
1,2,4-trichlorobenzene (well borings)	39,600
1,3-dichlorobenzene (well borings)	39,600
bis (2-chloroisopropyl) ether (well borings)	5,500
2,4-dinitrotoluene (well borings)	39,000
VTIC (soil)*	14,000,000
SVTIC (soil)**	3,500,000

*Volatile Fraction-Tentatively Identified Compounds
**Semi-Volatile Fraction-Tentatively Identified Compounds

(Inorganics)

Chemical	Maximum Concentration (ppb)
Pb (lead) (drum solid)	633,000
Cd (Cadmium) (drum solid)	54,000
Cr (Chromium) (drum solid)	172,000
Hg (Mercury) (well borings)	2,000

Chemical analytical results indicate contamination in the following areas:

- Subsurface media in the vicinity of test pits TP-11, TP-12, and TP-13, located in the eastern portion of the site.
- Subsurface soil in the vicinity of MW 2-1.
- Subsurface soil in the vicinity of MW 3-1.

Remaining subsurface samples were contaminated with only low levels of toluene and/or methylene chloride and do not indicate that these sampling locations are in the immediate proximity of major sources.

Surface water samples were taken from the intermittent tributary of Indian Spring Run, north of the site, and just upstream of the Coffroath Road crossing of the same stream. Because of the intermittent nature of flow in this stream, and dry weather during the RI, surface water was not present in many locations during the sampling periods. Where surface water samples were collected, sediment samples were taken at the same locations.

Volatiles in surface water and sediment samples reveal evidence of site related impact upon the stream north of the site. Volatile HSL organics detected in the available surface water samples and sediment samples included the following:

Surface Water

Volatile Organics	Concentration, ppb *
2-butanone	27
1,1- dichloroethane	9
chloroform	4
1,2-dichloroethene	3

Sediment

methylene chloride	1,400 ug/kg **
trichloroethene	5 ug/kg

*ppb = parts per billion
**ug/kg = microgram per kilogram

In May 1986 EPA Field Investigation Team (FIT) performed additional sampling of the surface water spring and the intermittent stream down-gradient and west of the site. Analyses of the surface water spring found the following volatile organics:

	ppb
Vinyl Chloride	13
1,1-Dichloroethane	35
Trans-1,2-Dichloroethane	26
Chloroform	13
1,1,1-Trichloroethane	29
Trichloroethene	11

The presence of volatile organics in both sediment and surface water samples indicate that discharge of contaminated ground water is occurring.

PCBs were detected in two surface soil samples: PCB 1260 (53,000 ppb) and PCB 1242 (10,000 ppb). The occurrence of these oily substances and the presence of base/neutral and acid extractables at these locations may be evidence that these areas also constitute contamination sources. Although erosion constitutes a primary migration mechanism for PCBs deposited on the surface, sediments and surface waters appear presently unaffected.

The U.S. Fish and Wildlife Service (USFWS) conducted a field investigation downstream of the Blosenski Landfill in April 1984. The investigation involved the collection of fish specimens from two locations. The first fish specimens were collected approximately 400 meters west of the site in the unnamed tributary that the site runoff drains into. The second fish specimens were collected at approximately 1.8 kilometers west of the site, downstream from the first location. The native fish (brook trout, suckers and dace) were submitted for analyses for selected metals, pesticides, PCBs and pathological examination.

The results of the inorganic analyses indicated that most of the inorganics tested for were either not detected or within expected ranges. Analyses for pesticides found low level concentrations of toxaphene which was believed not to indicate a significant hazard to fish and wildlife resources. Toxaphene was found on-site during the RI at 13,000 ppb in a a liquid drum sample. PCBs were detected at 0.44 and 1.3 parts per million (ppm) in fish samples. While the levels detected in the brook trout samples are currently below the Food and Drug Administration action level of 2 ppm (edible portion), it exceeds the National Academy of Science/National Academy of Engineering Criteria of 0.5 ppm in whole fish established to protect fish eating wildlife.

Based upon fish collections, fish flesh analysis, and the pathological examination of fish, the USFWS concluded that contaminants leaching from the landfill are not causing significant adverse impacts to downstream fish and wildlife at this time. This conclusion was viewed in light of the fact that they did not test for HSL compounds, and the fact that although the fish population appeared to be healthy and the individual fish appeared to be in good health, the fish downstream are exhibiting some signs of stess that could be caused by environmental contaminants.

The USFWS recommended that the levels of PCBs in the samples are high enough to warrant further sampling by EPA to determine if they are coming from the Blosenski landfill. The USFWS was also concerned that although there does not appear to be a significant contaminant problem downstream of the site at present, contaminants that are now at the site could move off and enter the aquatic environment at some time in the future.

Transport through ground water is the most significant mechanism of contaminant migration at the Blosenski Landfill Site. Contaminants can reach the ground water zone either dissolved in water or as liquid phases immiscible in water (Mackay, et al., 1985). The dominant factor in dissolved contaminant migration within the Chickies Quartzite is advection. This is the process by which solutes are transported by the bulk motion of flowing ground water. These migrating contaminants are also subject to dispersion within the fracture influenced flow system, although dispersion will not significantly alter flow paths at the site.

The potential sources of ground water contamination are from the areas surrounding MW 3-1 and MW-10. Buried drums with high concentrations of volatile organic compounds (such as benzene and toluene, in the percent range) in the liquid and solid phase were found in and around these areas. In addition, contaminated surface and subsurface soils were found in these areas and contained many of the same organic compounds found in the ground water (such as benzene, toluene and trichloroethene). Generally aromatic organic contaminants, less dense than water, were found in the ground water samples obtained from these wells. Many of the same contaminants found in the surface and subsurface samples were also found in other downgradient monitoring wells, such as MW 6-1 and 8-1.

Contamination was found in nine of eleven monitoring wells. The distribution of these contaminants follows patterns of advection transport, due to general hydraulic gradient in conjunction with fracture/joint preferred flow in localized directions.

The implications from the geologic and hydrogeologic studies are as follows:

- The perched water table found in the eastern portion of the site where drums were uncovered probably transmits contaminants in a lateral direction prior to infiltration into the bedrock ground water. Thus contaminant transport through the vadose (unsaturated) zone may be horizontal as well as vertical, allowing contaminants to enter bedrock ground water some distance from the source.

- Contaminants deposited at the southern periphery of the site may be transported to the north, east, south, or west to varying degrees, depending on seasonal weather conditions.

- Circuitous flow paths and multiple on site contaminant sources probably account for the extent of ground water contamination to the north of the suspected deposition areas.

- Ground water contours reflect local topography around the intermittent tributary to Indian Spring Run. The absence of contamination in MW 12-1 and MW 11-1, north of the site, is probably indicative of preferential flow to the northwest in a transmissive region below the intermittent stream bed.

- Although conclusive evidence is not available regarding the location of the southern ground water divide, topography suggests that it would be located in the vicinity of Route 340. A shallow hydraulic gradient may exist between MW 2-1, 3-1 and residential wells 2 and 3 to the south, indicating that this divide is located somewhat north of Route 340. Fracture flow, abetted by the conical influence of residential well pumping, probably causes migration of chemicals to the south of the site.

- The hydrogeology of the site and the analytical data indicate that the contaminants are migrating to the north as far as the intermittent tributary of Indian Spring Run.

Information provided by residences reveal that residential well 2 is approximately 25 feet deeper than residential well 1. Samples from residential well 2 have been free of contaminants on all sampling occasions. It seems possible that flow patterns vary with depth, especially under the influence of pumping.

It also appears that biodegradation may play a part in the fate of chemicals at the Blosenski Landfill Site. Among the implications of this is the possibility that the chlorinated ethenes 1,2-dichloroethene and 1,1-dichloroethene may biodegrade to the potentially more toxic vinyl chloride. It is also possible that this substance will appear in residential wells 1 and 3 to the south of the site. For example, although vinyl chloride was not detected in soil and waste samples obtained at the site, it was identified in several ground water samples. A sample from MW-2 contained vinyl chloride at a concentration of 6 ug/l. Samples from downgradient wells such as MW 6-1, MW 7-1, and MW 8-1 contained vinyl chloride at concentrations ranging as high as 450 ug/l. However, the possible existence of a vinyl chloride source cannot be discounted.

In addition to the hydrogeologic studies, surface and subsurface investigations were performed during the RI. The surface investigation included collecting samples of surface soils, water, and sediments, as well as conducting a geophysical survey of the site. The subsurface excavations were performed to locate and confirm the presence of buried drums. The limited scope of the excavations precluded quantifying the extent or origin of buried waste on site. However, the activities resulted in the identification of distinct contaminant source areas in different areas of the site, which added further support to confirming the cause of local ground water contamination.

Air monitoring during the RI resulted in identifying volatile vapors mainly in the areas of the test pits and from the boreholes.

It appears that density difference among contaminants may affect their migration patterns at this site. Trichloroethene and 1,1,1-trichloroethane have been consistently detected in residential well number 1 and 3. These contaminants are the most dense of the various volatiles detected at the site. It is possible that these contaminants descend further into the bedrock near the source and reach flow conduits more readily affected by residential well pumping.

Comparison of the subsurface results with those surface soils reveals that surface and subsurface soil contamination is present in similar areas. Although the test pits did not uncover a large number of buried drums, these results in no way preclude the presence of drums in areas that were not excavated. However, the discovery of drums in three distinct site areas suggest the presence of at least three significant contaminant source areas. Based on the site geology and hydrogeology discussed previously, contaminants emanating from these sources are migrating through subsurface fractures and faults to other onsite and offsite locations.

Based on the information provided in the RI, a Feasibility Study (FS) was developed which identified a range of remedial alternative measures and their associated costs for remediation of the contamination at the Blosenski landfill. In addition, a Focused Feasibility Study was developed for this site in order to provide an evaluation and cost estimate for alternative sources of potable water for affected residences.

Endangerment Assessment

Organic and inorganic chemical substances were detected in the various waste, air, surface and subsurface soil, ground water, sediment, and surface water samples collected at the site. The apparent source of contamination in the area is the waste buried and dumped on the soil at the Blosenski Landfill Site.

Volatile organic chemicals, the primary contaminants, have entered the water table and migrated beyond site boundaries. It appears that these contaminants are transported to the northwest via ground water flow in a transmissive zone lying beneath the intermittent tributary to Indian Spring Run.

Chlorinated aliphatic compounds (primarily trichloroethene and 1,1,1-trichloroethane) were consistently detected in residential wells located to the south of the site. The most probable source of the residential well contaminants lies in the vicinity of MW 2-1 on the southern portion of the site.

Two other sources of ground water contaminants were identified: on the west side, near MW 3-1 (monocyclic aromatics); and on the east near TP-11 (monocyclic aromatics and chlorinated aliphatics).

Although detected at the site, semivolatiles, pesticides, PCBs, and inorganic substances do not appear to be migrating beyond the site boundaries. These relatively immobile chemicals appear to be confined to the immediate vicinity of the deposition areas.

The major exposure pathway and subsequent health risk at this site is the ingestion and domestic use of contaminated ground water. The major contaminants detected in the monitoring wells and residential wells are volatile organics. As a class, volatile organics are soluble in water and do not readily adsorb to soil particles and therefore are likely to migrate as a solute in ground water. For most of these compounds, chemical and biological processes are unlikely to attenuate the observed concentrations to a large extent. Reduction of concentrations will occur primarily by diffusion and/or dilution. Distance from the contaminant source will reduce contaminant concentrations, as is reflected in the RI data.

Several contaminants, most notably n-nitrosodimethylamine and bis(2-chloroethyl) ether, were found in the soils at the site but were not detected in the groundwater. These compounds have high solubilities and are known or suspected carcinogens with high potencies. Their propensity to enter the ground water could increase carcinogenic risks from ingestion over time.

A measure of acute and subchronic (10-day) toxic effects (where a threshold limit may exist) associated with ingestion of ground water was estimated by comparison of the observed concentrations of groundwater contaminants to the Suggested No Adverse Response Levels (SNARLs) guidelines developed by the USEPA Office of Drinking Water for non-regulated contaminants in drinking water.

Benzene and 1,2-dichloroethene exceed the 10-day SNARLs. No contaminants exceeded the 1-day SNARLs. The contaminant concentrations found in onsite monitoring wells do not currently reaching residential wells. However, toxic effects from short-term ingestion of ground water are possible if people were to be exposed to the detected levels at some future time.

Of the contaminants detected in the residential wells, only trichloroethene (TCE) exceeded the SNARLs. TCE (260 ug/1) in residential well no. 1 exceeded both the 10-day and long-term SNARLs. TCE has been found to have a low to moderate oral toxicity in laboratory animals. The predominant physiological response to acute TCE exposure is depression of the central nervous system.

Chronic health effects (where a threshold limit may exist) may result from long-term, repeated ingestion of ground water contaminants. The most relevant criteria for evaluation of chronic health impacts are the SNARLs. Levels of two contaminants, TCE and benzene, exceeded their long-term SNARLs.

Exposure to subthreshold concentrations of the remaining detected contaminants could have associated additive or antagonistic effects. Additive effects are most likely to result from contaminants that induce the same health endpoint by the same toxic mechanism (ICF, Inc., May 1985).

In addition to chronic effects from ingestion, domestic use of ground water (i.e., showering, lawn watering, etc.) could potentially be associated with health impacts. Repeated long-term dermal or inhalation exposure of volatilized contaminants may produce chronic toxic effects.

Studies have shown that a large fraction of highly volatile contaminants in potable water volatilize during shower usage. This results in an inhalation exposure, both to the user of the shower and to other inhabitants of the home as the shower air is distributed (Andelman, May 1985).

In addition to inhalation exposure, the absorption of chemicals in potable water during bathing may be comparable to that from direct ingestion of water (Andelman, May 1985 after Brown et al., 1984).

Organic contaminants detected in monitoring well samples that are known or suspected carcinogens (i.e., no known threshold concentration below which toxic effects would not occur) are shown in Table 5. Contaminants include those classified by the National Toxicology Program (NTP) Report on Carcinogens as substances or groups of compounds that are known to be carcinogenic or that may reasonably be anticipated to be carcinogens (USDHHS, 1983). Table 5 is also a tabulation of estimated cancer risks associated with chronic ingestion of the contaminants found in monitoring and residential wells. If the contaminants are not listed by the NTP, the International Agency for Research on Cancer (IARC) classification based on an evaluation of animal test data is included (USDHHS, April 1985).

The tabulation is limited to those compounds for which an evaluation had been conducted by the EPA Carcinogen Assessment Group (CAG). Lifetime cancer risks are based on calculations using CAG's estimated unit risk factors (USEPA, October 1984). The unit risk is defined as the lifetime risk of cancer to humans from daily exposure to a concentration of 1 ug/m^3 of the pollutant in air by inhalation, or to a concentration of 1 ug/l in water by ingestion (USEPA, October 1984).

The maximum observed concentrations of groundwater contaminants exceed the Unit Cancer Risk (UCR) derived Preliminary Protective Concentration Limits (PPCLs) for all but one (bis(2-ethylhexyl)phthalate) detected known or suspected carcinogenic compound (USEPA, October 1984). PPCLs are risk-based exposure criteria that represent the concentration of a contaminant that could be ingested daily without exceeding a 10^{-6} cancer risk. Ingestion of contaminated groundwater at the site would result in a cancer risk in excess of 10^{-6} (i.e., greater than one excess case in a population of one million).

Impacts to casual recreational users of the surface waters appear to be minimal because of the low concentrations of HSL contaminants. Dilution from downstream flow and volatilization will reduce concentrations in the surface waters. However, concentrations could increase with increased precipitation and enhanced leaching.

The chemical analyses of soil, subsurface soil, drums and test pit samples indicate contamination with a number of HSL semivolatile compounds. Because drums found during the RI were reburied in position, there is no current exposure to these drums by direct contact. However, the more mobile constituents associated with those drums could be carried to the groundwater by infiltration.

Residents drinking the contaminated water would be expected to have an increased cancer risk. Dermal contact with contaminated soils also presents an exposure route that will continue if no action is taken on site. The potential for fire also exist at the site in the areas where drums were found. Some of the drum contents were found to contain ignitable wastes.

ESTIMATED CARCINOGENIC RISK ASSOCIATED WITH INGESTION OF GROUNDWATER
BLOSENSKI LANDFILL SITE

Table 5

Contaminant	Monitoring Wells - Carcinogenic Risk/Person (a): Mean Concentration	Minimum Concentration	Maximum Concentration (b)	Residential Wells - Carcinogenic Risk/Person (a): Mean Concentration	Minimum Concentration	Maximum Concentration (b)
vinyl chloride CAS No. 75-01-4	1.0×10^{-4} @ 200 µg/l	3.0×10^{-6} @ 8 µg/l	2.2×10^{-4} @ 450 µg/l	ND	ND	ND
tetrachloroethene CAS No. 127-18-4	---	---	8.6×10^{-6} @ 5 µg/l	ND	ND	ND
trichloroethene CAS No. 79-01-6	2.0×10^{-5} @ 37 µg/l	2.7×10^{-6} @ 5 µg/l	4.0×10^{-5} @ 74 µg/l	3.2×10^{-5} @ 58 µg/l	1.6×10^{-6} @ 3 µg/l	1.4×10^{-4} @ 260 µg/l
1,1-dichloroethene CAS No. 75-35-4	4.6×10^{-5} @ 11 µg/l	2.5×10^{-5} @ 6 µg/l	8.8×10^{-5} @ 21 µg/l	ND	ND	ND
1,1,1-trichloroethane CAS No. 71-55-6	4.8×10^{-6} @ 106 µg/l	2.3×10^{-7} @ 5 µg/l	2.0×10^{-5} @ 430 µg/l	5.0×10^{-7} @ 11 µg/l	1.8×10^{-7} @ 3.7 µg/l	1.2×10^{-6} @ 26 µg/l
chloroform CAS No. 67-66-3	2.0×10^{-5} @ 101 µg/l	1.2×10^{-6} @ 6 µg/l	5.4×10^{-5} @ 270 µg/l	---	---	4.0×10^{-4} @ 2 µg/l
benzene CAS No. 71-43-2	4.3×10^{-3} @ 2014 µg/l	1.3×10^{-6} @ 9 µg/l	1.8×10^{-2} @ 11,000 µg/l	---	---	2.1×10^{-5} @ 14 µg/l
methylene chloride CAS No. 75-09-2	1.7×10^{-5} @ 841 µg/l	4.6×10^{-7} @ 25 µg/l	3.0×10^{-5} @ 2,000 µg/l	ND	ND	ND

Contaminant	Monitoring Wells - Carcinogenic Risk/Person (a): Mean Concentration	Minimum Concentration	Maximum Concentration (b)	Residential Wells - Carcinogenic Risk/Person (a): Mean Concentration	Minimum Concentration	Maximum Concentration (b)
arsenic CAS No. 7440-38-2	4.0×10^{-3} @ 8.4 µg/l	4.5×10^{-3} @ 10.6 µg/l	6.0×10^{-3} @ 14 µg/l	5.4×10^{-3} @ 12.7 µg/l	4.7×10^{-3} @ 11 µg/l	6.4×10^{-3} @ 14 µg/l
cadmium CAS No. 7440-43-9	1.3×10^{-3} @ 6 µg/l	1.1×10^{-3} @ 5 µg/l	1.3×10^{-3} @ 6 µg/l	4.5×10^{-4} @ 2 µg/l	2.2×10^{-5} @ 0.1 µg/l	2.4×10^{-3} @ 11 µg/l
chromium(c) CAS No. 7440-47-3	7.5×10^{-3} @ 6.4 µg/l	3.7×10^{-3} @ 3.2 µg/l	1.1×10^{-1} @ 14 µg/l	1.9×10^{-2} @ 18.2 µg/l	3.5×10^{-3} @ 3.0 µg/l	2.5×10^{-2} @ 22 µg/l
nickel CAS No. 7440-02-0	6.9×10^{-4} @ 21 µg/l	3.8×10^{-4} @ 12 µg/l	1.0×10^{-3} @ 32 µg/l	1.2×10^{-3} @ 36 µg/l	1.3×10^{-4} @ 4 µg/l	8.6×10^{-3} @ 267 µg/l
Total Potential Risk	1.6×10^{-2} (1 in 60)	9.7×10^{-3} (1 in 100)	1.3×10^{-1} (1 in 7)	2.8×10^{-2} (1 in 40)	8.4×10^{-3} (1 in 120)	4.3×10^{-2} (1 in 23)

(a) Cancer risk assessments provided for chemicals for which evaluations have been conducted by EPA's Carcinogenic Assessment Group.

(b) Probability of exposure to a single detection of a contaminant in drinking water is low. Risk calculations for single detections were included in the maximum concentration category to assume a "worst case" scenario.

(c) Assumes all chromium present as the +6 ion.

ALTERNATIVE EVALUATION

The overall purpose of the Alternative Evaluation in the Feasibility Study was to provide an array of technically sound, cost-effective remedial action technologies that control the source and manage the migration of contaminants, and provide protection to the public health, welfare, and the environment. In accordance with this, various cleanup objectives and criteria were established to provide a focus for the general response actions and technologies available for remediating the Blosenski Landfill Site. These objectives and criteria included:

Cleanup Objectives	Cleanup Criteria
a. No action	a. Establish current potential risk levels and take no remedial action
b. Prevent an increase in the current potential risk associated with the site	b. Establish current potential risk levels and utilize remedial technologies to prevent an increase in potential risk levels
c. Reduce the current potential risk associated with the site to acceptable levels	c. Reduce the current potential risk associated with the site to a target cleanup criteria of a 10^{-6} potential risk level, or other acceptable level
d. Reduce the risk levels to those corresponding to background concentrations	d. Utilize remedial technologies to eliminate site contaminants

Based on the above objectives and criteria, numerous source control and migration control technologies were screened in the Feasibility Study to provide a limited number of technologies applicable for remedial actions at the site. Some of these technologies were removed from further consideration based on site-specific information gathered during the RI and on the basis of other comparative criteria. These other criteria include:

- Technical performance
- Magnitude of costs
- Health and environmental impacts
- Institutional considerations

Each technology was evaluated not only in terms of theoretical feasibility but also in terms of whether the technology is applicable to the site specific conditions. The candidate technologies that were dismissed from retention are presented in Table 6 with the justification for elimination.

Table 6.0

Summary of Eliminated Technologies

[Technology]	[Justification for Elimination]
Groundwater Treatment	Evaluation of Technologies
Biological Treatment	Contaminant concentrations are not high enough to support microbes
Storage	
Onsite storage	Not a long-term solution
Offsite Disposal	
Offsite Incineration	Costs are much higher than onsite incineration
Alternative Water Supply	
1. On-line filters	Difficult to determine if operating properly
2. Bottled water	Does not reduce risk from bathing, washing clothes and dishes
3. Community deep well	Potential to become contaminated from the site
Containment	
1. Asphalt Cap	Subject to cracking when placed over waste
2. Chemically stabilized caps	Subject to deterioration by organic solvents
3. Slurry wall	Not effective for bedrock aquifer
Groundwater Collection	
Collection galleries	Not cost effective for this site
Innovative Treatment Technologies	
1. Permeable treatment beds	Not cost effective for this site
2. Bioaugmentation	Much of the waste is not biodegradable
3. Solidification	Not suitable for the amount of organics on site
4. Chemical treatment	Not suitable for wide range of wastes on site
5. Vitrification	Unproven, costly technology, not suitable for the site

In the alternative development process, several applicable remedial technologies were identified for each of the five cleanup categories which are described in the USEPA Guidance Document on Feasibility Studies under CERCLA (EPA, June 1985). Each category represents a different degree of site remediation.

These categories are presented in ascending order of cleanup, resulting in a building-block approach in which the simpler technologies are used for the lower levels of cleanup. To achieve a higher level of cleanup, more complex technologies were added to the simpler technologies. The technologies presented in each category were combined into Remedial Action Alternatives (RAAs) that will meet the requirements of that level of cleanup. The RAAs generated for each category, as a result of the development process, are summarized below.

I. No Action

1. Implement no remedial action, but perform continued long-term monitoring.

II. Alternatives That Meet CERCLA Goals but Do Not Attain Other Applicable or Relevant Standards

2. Install a low-permeability soil cap over the landfill, provide alternate water supply to affected residences, and perform long-term monitoring.

III. Alternatives That Attain Applicable or Relevant Public Health or Environmental Standards, Guidance, or Advisories

3. Install a RCRA-specification multimedia cap, and provide an alternate water supply. Extract and treat ground water. Provide RCRA groundwater-detection monitoring and long-term post-closure care and monitoring.

4. Construct a new, secured, onsite landfill and provide an alternate water supply. Extract and treat groundwater, and provide RCRA contaminant detection monitoring and post-closure care and monitoring.

IV. Alternatives That Exceed Applicable or Relevant Public Health and Environmental Standards, Guidance, and Advisories

5. Excavate and incinerate contaminated soils and wastes on site, and install multimedia cap over the residual wastes. Provide an alternate water supply, and extract and treat groundwater. Provide RCRA contaminant detection monitoring and post-closure care and monitoring. (Option: Provide in-situ stabilization of residual wastes instead of multimedia cap.)

V. Alternatives Specifying Offsite Storage, Destruction, Treatment, or Secure Disposal of Hazardous Substances at a Facility Approved under RCRA

6. Excavate and dispose of contaminated waste deposits in an offsite, secured landfill currently in compliance with RCRA. Dispose, contain, or treat contaminated soil residuals underlying the waste deposits. Extract and treat ground water and provide an alternate water supply.

The above alternatives include some type of monitoring of soil and ground water contamination. All of the above alternatives, with the exception of the no action alternative, will require grading, erosion control, surface water diversion, fencing and revegetation. Alternatives 3, 4, 5 and 6 incorporate ground water pumping and treatment. Table 7 presents Alternate Concentration Levels (ACLs) developed by EPA for ground water criteria established to protect human health, aquatic life, and wildlife. The criteria presented will be reevaluated during design as additional sampling data and results become available from the pre-design studies.

Also, criteria for Tentatively Identified Compounds (TICs) and metals will be evaluated during design. All criteria were developed using EPA criteria or advisories and empirical scientific formulations (e.g., Freundlich isotherms). Ground water extraction, treatment, and discharge/ injection will also be subject to state and local regulatory agency restrictions.

Table 7

Alternate Concentration Levels (ACLs)
Ground Water Remediation Level

Compound	ACL (source) (ug/l/ppb)**
*vinyl chloride	0.015 (10^{-6} UCR)
*trichloroethene	1.8 (adjusted 10^{-6} UCR)
*1-2-dichloroethene	70 (adjusted 10^{-6} UCR)
*1,2-dichloroethane	0.95 (10^{-6} UCR)
1,1,1-trichloroethane	22 (HA)
*1,1-dichloroethene	0.24 (10^{-6} UCR)
*chloroform	0.19 (10^{-6} UCR)
*benzene	0.70 (10^{-6} UCR)
xylene	440 (HA)
toluene	2000 (HA)
ethyl benzene	680 (HA)
phenols	300 (taste)
phthalates	3 (aquatic life)

* Carcinogens
** ug/l = microgram perliter / ppb = parts per billion

Note: TIC criteria will be determined during design or predesign
• UCR - Unit cancer risk
• HA - Health Advisory Level

Description of Remedial Alternatives

I. No Action Alternative

1. No Action with Long-term Monitoring

Under a no action alternative, no measures will be taken to mitigate the potential health risks associated with contaminant migration. The contaminants will continue to migrate into the groundwater and surface water by leachate production and storm water runoff.

The most critical exposure pathway and subsequent health risk at the site is the ingestion and other domestic use of contaminated groundwater. As long as bottled water is used for drinking, showering, and other domestic uses, contaminated groundwater should present no problem. If no action is taken at this site, it is likely that contaminant concentrations in the groundwater will increase because of the high levels of contaminants in the subsurface soil areas with drums and in the perched water table, and risks will increase accordingly. Residents drinking the contaminated water would be expected to have an increased cancer risk. Dermal contact with contaminated soils also presents an exposure route that will continue if no action is taken on site. The potential for fire also exist at the site in the areas where drums were found. Some of the drum contents were found to contain volumes of ignitable wastes.

Under this alternative groundwater will be monitored to observe changes in aquifer contamination and to monitor potential public health risks. The monitoring wells constructed during the RI can be used for continued monitoring. In addition, ten new monitoring wells will be installed: four downgradient (north) of the site, one west of the site, and five upgradient (south) of the site just north of the adjacent residences. These wells would extend approximately 40 feet into bedrock, which would put them at about the same depth as the existing monitoring wells. The adjacent residential wells, south of the site, should also be sampled concurrently with the monitoring wells. For costing purposes, it was assumed that the monitoring wells and five residential wells would be sampled four times per year. Surface soil samples would be taken to determine variation in onsite surface contamination. For costing purposes it was assumed that surface soil samples would be taken twice a year. The data collected from this program can also be used to form a data base for predicting rates of contaminant migration and decay.

Both groundwater and surface soil samples should be analyzed for EPA HSL organic and inorganic compounds. All analyses should be performed in accordance with EPA analytical protocols to ensure compatibility between the existing and additional results. For costing purposes, it was assumed that the sampling and analysis program would continue for 30 years.

The no action alternative can be implemented without obtaining regulatory permits, other than those required for monitoring well installation. However, it will not satisfy any applicable environmental protection regulations, and it will be necessary to make arrangements for an agency to conduct the sampling, analysis, and interpretation of data.

Most of the costs for the no action alternative are related to sampling and analysis. Capital costs for the no action alternative are estimated to be between $80,000 and $130,000. Annual sampling and analysis costs are estimated to be $197,700. The 30-year present worth of the costs for the no action alternative is estimated to range from $1,953,000 to $2,003,000.

II. Evaluation of Alternatives that Meet CERCLA Goals but Do Not Attain Other Applicable Standards

2. Onsite Capping of Contaminated Soils and Wastes; Extension of the Coatesville Water Authority Public Water Supply; and Long-Term Monitoring.

This alternative provides a source control remedy that meets the CERCLA objective of reducing the likelihood of present or future threat from the hazardous substances found at the site. The technologies used to meet the objective of this alternative are as follows:

- Provision of a soil cap to reduce the public health risk associated with dermal contact, ignition of the wastes or ingestion of the site's surface soil contaminants, and to reduce leachate generation, (but not reduce the concentration).

- Installation of a municipal water supply to reduce the potential health risks associated with consumption or utilization of contaminated groundwater.

- Implementation of a long-term monitoring program to provide data on the effectiveness of the remedial action and to detect any future contaminant migration from the site.

Site remediation will be initiated with the construction of 10 additional monitoring wells and the establishment of a grid matrix soil sampling and testing study. The additional monitoring wells will supply important groundwater quality, geologic, and hydrogeologic information that is needed to assess the site's groundwater conditions over time.

The soil sampling and testing study is based on data that is obtained from a 100-foot grid matrix laid out around the perimeter of the existing surface and subsurface sampling points that have contaminant levels in excess of the levels corresponding to a 10^{-6} health risk. Initially the grid matrix is used for soil gas sampling and screening purposes. Subsequent soil sampling of the grid will aid in defining the horizontal extent of the multimedia cap. The soil sampling grid will be expanded in both directions as the field data is gathered and analyzed.

The approximate area of capping is 9.37 acres. The actual construction and testing specifications will have to be prepared after the selected soil-cap material is tested and analyzed for slope stability and permeability characteristics. Soil or materials with a permeability within the range of 10^{-5} cm/sec are assumed applicable to this alternative.

The estimated quantity of material required for the cap is 40,300 tons. Additional site grading plans will be required during the design phase and the new soil quantities developed may vary from those estimated in the FS. Also, the additional soil sampling and testing may increase or decrease the limits required for the soil cap and the estimated soil quantities.

Because wastes will remain on site and groundwater will remain contaminated, potential exposure risks associated with ground water contaminant migration would not be eliminated. Potential contact and ingestion risks associated with contaminated surface soils and airborne exposures would be reduced, although background levels of soil contamination would not be achieved since the wastes are left in place.

Hazards remaining after covering the contaminated soil are dependent on the permeability and longevity of the cap. Consequently, although the cap will immediately eliminate the potential for dermal contact or ingestion of surface materials, there is a potential for future ignitabilty of site wastes and direct contact with site contaminants if the cap dries out or is disturbed in some way. Restriction of future land use should reduce the potential for cap disturbance. The cap proposed under this alternative will meet CERCLA objectives for controlling contaminant migration and exposures, but will not meet RCRA specifications for the containment of hazardous wastes.

Alternate Water Supply-Extension of Public Water Supply

This alternative utilizes an alternate water supply to replace the contaminated domestic wells found near the site and potentially affected wells. The alternate water supply system identified for all the subsequent remedial action alternatives associated with the Blosenski Landfill Site is a public water supply system. The system consists of a 4-inch branch line from the existing 18-inch water main of the Coatesville Water Authority. The approximate distance between the site and the water main is 3.5 miles. The line losses encountered over that distance coupled with a change in elevation requires that an in-line booster pumping station be incorporated into the preliminary design and cost estimate. In a Focused Feasibility Study prepared by PRC Engineering for the EPA, it was reported that the Coatesville system had an adequate supply of water to handle the additional load described in the study. The study costed and reviewed a system that replaced only the two domestic wells in the area. However, the proposed supply line was calculated to service up to 20 residences. The Coatesville Water Authority has indicated that sufficient capacity is available in their plant to supply water to the landfill area. Additional study will be needed during the design phase to determine the system routing, capacity, and service area to actual and potentially affected wells. Additional deed restrictions or other institutional devices may be required to reduce the risk of new wells being developed in the area and creating new health risks.

Upon completion of the 10 new monitoring wells described previously, a monitoring program will be initiated to provide additional information about the extent of ground water contamination and the site's hydrogeology. After site capping is completed, the monitoring program will continue as needed and adjustments will be made to supply pertinent information about the site conditions. For costing purposes, all 21 monitoring wells are assumed to remain in service for the next 30 years and will undergo quarterly sampling and analysis for HSL contaminants.

Provision of an alternate water supply for the affected residents should result in no additional impacts to either residents or remediation workers during construction. It will also eliminate contaminated ground water use to those homes that tap into the system. Overall, corresponding potential risks are not eliminated entirely, however, as long as some homes remain on wells that possibly could become contaminated in the future. Long-term monitoring, therefore, would provide data to determine any changes in contaminant related potential risks to these well users over time.

Institutional issues related to installation of a public water supply are not expected to be complex. The City of Coatesville, of course, would have to approve the proposed connection. Construction of the system then must conform to state and local standards governing a public water supply.

Capital costs associated with all elements of this alternative are estimated to range from $2,706,000 to $4,812,000. The 30-year present worth of the costs is estimated to fall between $5,122,000 and $7,233,000.

III. Evaluation of Alternatives that Attain All Applicable or Relevant Standards, Guidance, or Advisories

3. Onsite Multimedia Capping of Contaminated Soils and Wastes; Extension of the Coatesville Water Authority Public Water Supply; Groundwater Extraction, Treatment, and Discharge/Injection; and Long-term Monitoring.

This alternative provides a source control remedy and a management of migration remedy that meets the CERCLA objective of attaining applicable and relevant Federal public health and environmental standards. The intent of this alternative is to attain the objective of a potential health risk no greater than 10^{-6} associated with the site contaminants. This alternative is a combination of the following remedial actions:

- Installation of a multimedia cap to reduce the potential exposure risks associated with dermal contact or accidental ingestion of the site's contaminated surface soils, and to reduce the volume of leachate generated by the site.

- Installation of a public water supply to minimize the potential health risks associated with ingestion or utilization of the site's contaminated groundwaters.

- Implementation of a long-term monitoring program to observe future contaminant migration, and provide data on the effectivenes of site remediations performed.

- Installation of a ground water extraction, treatment, and discharge/ injection system to help restore the quality of contaminated ground water system as a natural resource.

Site remediation for this alternative will begin with construction of the ten additional long-term monitoring wells as described for alternative one.

After the site is regraded a multimedia cap is installed based on EPA's January 1985 Hazardous Site Control Division guidance, and the EPA's May 1985 Minimum Technology Guidance, EPA-530-SW-85014. The first zone is a 6-inch layer of permeable, granular material that will allow free flow of the gases generated by the capped waste materials.

The next layer of the multimedia cap is an impervious zone, consisting of a 30-mil synthetic membrane and a 2-foot thick layer of compacted low permeability soil material with a demonstrated permeability of at least 10^{-7} cm/sec.

The impervious zone is included in this design to reduce leachate production caused by percolation and infiltration of precipitation through the site's cover soil and waste pockets.

The final layer of the multimedia cap includes a 1-foot-thick flow zone of granular material to collect the infiltration that percolates down through the overlying 2-foot thick zone of cover soils.

The entire cap then will be revegetated and a security fence installed to reduce site intrusion and vandalism. The use of the multimedia cap is an effective, useful, reliable remedial action that can be implemented quickly and has demonstrated beneficial results as soon as construction is completed. The site is suitable for capping following regrading of the northern slopes to aid in constructability. The cap materials are available in the immediate area of the site, including clay soils that have laboratory falling head permeability test results of approximately 10^{-7} cm/sec.

This alternative also includes the provision of an alternative water supply to replace the contaminated domestic wells found near the site. As described for Alternative Two, the alternate water supply system identified for all of the remedial action alternatives associated with the Blosenski Landfill Site is a public water supply system consisting of a 4-inch branch line from the existing 18-inch water main of the Coatesville Water Authority. Service lines will be provided from the branch line into the affected residences.

The risks associated with the ingestion or utilization of the contaminated groundwater are virtually eliminated, so long as the water supplied by the proposed extension is not contaminated.

The ground water treatment system will be designed to handle primarily organic contaminants, exceeding Alternate Concencentration Levels (ACLs) at compliance points, however, if additional studies reveal inorganic ground water contamination, the treatment facility will be constructed to handle these contaminants as well. The first stage in the treatment system uses precipitation, flocculation, and sedimentation processes to pretreat the metals found in the ground water that could interfere with the organic treatment process.

The removal of the organic chemicals found in the site's ground water will be achieved through the use of an air stripping process to remove volatile organics, followed by carbon adsorption.

The ground water extraction and treatment system provides a feasible means of removing contaminants from the ground water. However, the efficiency of extraction is subject to the uncertainty of localized well yields due to the fractured bedrock. Ground water extraction is believed to be feasible for the following reasons: aquifer testing during the RI identified sustained yields with ground water being intercepted on every monitoring well. These wells averaged 70 feet in depth. The proposed pumping wells will be 150 feet deep, so yield should be greater. Even though the hydraulic connection between individual recovery wells may be unpredictable, the overall gradient can be controlled so that the ground water in fractures between the wells will eventually migrate toward the pumping well due to the pumping-induced gradient.

The treatment process is expected to be effective in removing ground water contaminants. Site-specific pilot testing and monitoring are required to assess the efficiency of the system prior to scale-up. A gaseous chlorinator may be needed once treatment commences if significant biological growth occurs on the packing media or GAC contactors. Pre-treatment should ensure that total suspended solids are low enough to prevent plugging of the media.

The potential exposures and corresponding health risks associated with residual contaminants will be reduced after completion of the multi-media cap. The alternate objective of cleaning the site to the same levels as the identified background levels is not attainable because the contaminants will remain on site in the waste deposits and in the soils.

Pumping and treatment of the contaminated ground water is intended to reduce the potential public health risk to a 10^{-6} risk Unit Cancer Risk or less.

The proposed multimedia cap will meet the RCRA regulations for closure of a facility (Closure and Post-closure Care 40 CFR 264.310).

Implementation of the ground water extraction and treatment system will require approval of state and local officials. Air pollution control equipment may be required on the air stripper to reduce gaseous emissions to acceptable limits. Permit requirements for air stripper emissions and ground water injection must also be met.

The estimated range of capital costs for this alternative, based on a sensitivity analysis of the estimated quantities and unit costs is between $8,481,000 and $13,037,000. Operation and maintenance costs assume a 30-year life of the cap and monitoring system, but only five years of ground water treatment. The range of 30-year present worth costs is estimated to be between $13,150,000 and $17,706,000.

4. Construction of a Secured Onsite Landfill; Extension of the Coatesville Water Authority Public Water Supply; Ground water Extraction, Treatment, and Discharge/Injection; and Long-term Monitoring.

This alternative provides a source control and management of migration remedy that meets the objective of attaining applicable and relevant Federal public health and environmental standards. Technologies used in this remedial action alternative include:

- Construction of an onsite above ground landfill to encapsulate the on site waste materials, thereby controlling contaminant migration via ground water, surface water, and air transport.
- Provision of a public water supply to eliminate potential health risks associated with ingestion or utilization of contaminated ground water.
- Extraction, treatment, and discharge/injection of ground water to remediate the contaminated aquifer.
- Implementation of a long-term monitoring program to observe future contamination levels, and to provide information on the effectiveness of the remedial actions performed.

Extension of the Coatesville water supply; ground water extraction, treatment, and Discharge/Injection; and long-term monitoring were described and evaluated in the preceding alternative. Therefore, only the onsite landfill will be described and evaluated in detail here.

A secured hazardous waste landfill meeting RCRA specifications will be constructed to contain all contaminated materials encountered at the site. The total volume of wastes to be disposed of is estimated to be 385,000 cubic yards (cy) as determined by the RI sampling results, and by comparing current and pre-landfill topographic maps. This volume includes 185,000 cy of wastes and 200,000 cy of contaminated soils. The depth of contaminated natural soils is estimated to be 15 feet, which is very close to the top of bedrock in the western portion of the site, and 5 to 10 feet above bedrock in the eastern portion. The actual extent of this excavation, which will directly affect the landfill capital cost, must be determined by additional sampling during the design and implementation phases of this alternative.

A controlled hazardous waste landfill must be double-lined and contain leachate collection and detection systems capable of removing leachate that may be produced. The landfill must be operated according to RCRA regulations listed under 40 CFR Part 264. A comprehensive ground water monitoring program must be utilized during construction and after landfill closure according to Subpart F of Part 264.

Construction and operation of a RCRA-specification landfill is a relatively new technology. Its effectiveness is highly dependent upon proper installation techniques, particularly with the synthetic membrane and the sealing thereof. Installation of the various landfill components, such as compacted soil and synthetic membranes, are widely used and accepted construction techniques. A geotechnical evaluation of the proposed landfill site should be performed during the design phase to ensure that the additional loading from the liners and waste material will not cause excessive settlement and stability problems. Installation of this alternative should take approximately 2 years.

A controlled hazardous waste landfill requires significant operation and monitoring systems. The leachate collection and detection systems require frequent inspection for leaks and clogging. The capping materials require periodic maintenance to prevent erosion and surface ponding.

Installation of a landfill would greatly increase the exposure risk (during installation) above that associated with a surface cap because all the contaminated soils will be excavated, stockpiled, and replaced.

Operation of the landfill will decrease the long-term risk of exposure and health effects to offsite receptors. The high degree of containment provided by a landfill built to RCRA specifications isolates the wastes from surface water and groundwater contact, thereby greatly reducing contaminated surface water runoff, groundwater infiltration, and offsite contaminant migration.

Installation of a controlled hazardous waste landfill includes many unknowns, such as actual amounts of contaminated soil, material costs, and site conditions during construction. The most critical factor is the volume of contaminated soil which directly affects the capital cost of the landfill. A sensitivity analysis was performed to determine the effects of variations of quantities of contaminated soils to be excavated, clay liners, and synthetic liner materials. These sensitivity factors range from -40 to +50 percent. The capital costs for this alternative range from $14,317,000 to $31,508,000. There is a significant amount of operation and maintenance costs associated with a landfill, including ground water monitoring, maintenance of the leachate collection system, and maintenance of the cover soil and vegetation. The total 30-year present worth is expected to range from $18,986,000 to $36,177,000.

IV. Evaluation of Alternatives That Exceed Applicable or Relevant Public Health and Environmental Standards, Guidance, and Advisories

5. Complete Excavation of Contaminated Soils and Wastes; Onsite Incineration With Multimedia Cap Over Residuals; Extension of the Coatesville Water Authority Public Water Supply; Groundwater Extraction, Treatment, and Discharge/Injection; and Long-Term Monitoring.

This alternative provides remediation of the site in a manner which exceeds applicable and relevant Federal public health and environmental standards, in accordance with EPA's Guidance on Feasibility Studies under CERCLA and the National Contingency Plan. The technologies comprising this remedial action alternative include:

- Excavation, incineration, and capping of the waste materials to reduce potential risks associated with dermal contact and accidental ingestion of surface materials, and to reduce organic leachate generation.
- Provision of an alternate water supply to minimize potential health risks associated with use or ingestion of contaminated groundwater.
- Extraction, treatment, and discharge/injection of groundwater to restore this natural resource, and to reduce future exposure risks to human and environmental receptors.
- Long-term monitoring of the site to detect any future contamination and provide information on the effectiveness of the remedial action.

This alternative employs complete excavation of contaminated soils and wastes. Unlike previous alternatives, however, the organic contaminants in the materials are destroyed (via incineration) before they are returned to the site for disposal. Some of the solid wastes, such as drums and scrap metal, may require offsite landfill disposal. However, the volume of this material is not expected to be significant, and offsite unit disposal costs are not expected to exceed the unit incineration costs.

The incinerator residue, along with the inorganic-laden soils and wastes, is backfilled and compacted, and the multimedia cap described in Alternative Three is placed on top of the residues. The area of the cap is assumed to be approximately 9.4 acres. Assuming overall volume reduction of 40 percent for the combined waste and soil materials after incineration (80 percent reduction for wastes and negligible reduction for soils), 231,000 cubic yards of residue will be disposed of in the area from which it was excavated.

The incineration process for this alternative is a mobile, rotary-kiln system. A 0.5 ton/hour unit will be used initially for any test burns necessary to meet RCRA requirements and to determine the most efficient loading rates for site operation. The PADER has already approved such a design. During this time, a second, larger unit (capable of processing 4 tons/hr of soils) would be built of similar design as the smaller unit. Since both units would have similar design and operating characteristics, no regulatory problems would be expected with this larger unit. It is estimated that this unit could be operating on site within one year after incineration commences with the first unit. Both units would be retained on site for a combined processing rate of 4.5 tons/hr for the duration of the project.

Incineration is a proven technology for destroying hazardous organic compounds in soils and municipal wastes. It may be effective for the destruction of these materials in certain areas at the Blosenski Landfill Site. Prior to commencement of incineration, however, pilot studies will have to be performed to determine the BTU content of the wastes/soils, percent ash, etc. The overall destruction efficiency of the incinerator must be greater than 99.99 percent. Certain materials suc as PCBs may not be incinerated on site due to special permitting requirements and the potential for generation of hazardous combustible byproducts.

This alternative as presented assumes that the residual incinerator ash will not qualify as a hazardous waste based upon the EP Toxicity Test Procedure as described in 40 CFR Part 261, Appendix II. If so, it can thus be delisted as a hazardous waste under RCRA and may be disposed of onsite under a multimedia cap as previously described. However, incineration will not destroy the heavy metals found in site materials. Because of the reduction in volume after incineration, the metals concentratios in the ash may actually be higher for a given unit mass of metals. This effect may be more pronounced in the waste materials than in the soils because of the greater volume reduction for wastes (approximately 80 percent) than for soils (negligible) after incineration.

In light of this, various options to capping the incinerator residuals should be considered. Assuming that the residual soils do not qualify as a hazardous waste based upon the EP Toxicity Test Procedure and the wastes do not, the soils can remain on site and be capped while the waste materials (approximately 37,000 cy) can be disposed off site in a secure hazardous waste landfill. A preliminary cost estimate for this option indicates that $8.8 million would be necessary in addition to the costs for the complete capping alternative.

If neither the wastes nor the soils pass the EP Toxicity Test Procedure, and the entire 231,000 cy of residual materials must be disposed off site, this alternative becomes similar to Alternative Six for excavation and offsite disposal (without incineration). The site would be backfilled with clean fill and revegetated, with an additional cost of $55.4 million over capping and leaving the ash on site.

A final option would be to build a RCRA landfill on site to dispose of the entire 231,000 cy of ash. Preliminary calculations indicate that using a landfill of similar design as in Alternative Four, an additional cost of $6.7 million would be incurred over the capping alternative.

Using the proposed incineration system outlined previously, approximately 16 years will be required to incinerate the 474,000 tons of soil and waste material. An alternative to this system would be to use multiple large (4 tons/hr) units to be built during the first year of remediation, or to design and build a unit with a higher throughput. While this could substantially reduce the time required for cleanup, it would proportionally increase the cost.

Various incineration alternatives were evaluated based on combinations of the 0.5 tons/hr unit and the 4 tons/hr unit. The proposed system accounts for approximately $24 million (present-worth) of the total remedial action alternative cost for 16 years of incineration. Various combinations of incinerators were evaluated with costs ranging as high as $63.8 million for 8 large incinerators completing the destruction in 3 years.

Risks due to inhalation of incinerator emissions should be very low to the local public provided that the air emissions are maintained below the design emissions criteria. The flue gas from the incinerator will be passed through a baghouse or scrubber to reduce emissions to required environmental standards before being discharged to the atmosphere. The emissions will be sampled and analyzed for sulfur dioxide, nitrogen oxides, and total hydrocarbons. There should be little or no environmental impact as long as the air pollution control equipment is functioning properly.

The incineration process should destroy essentially all of the organic contaminants found in the onsite soils and wastes and thus reduce the risks due to the presence of these materials. Also, incineration will not destroy the heavy metals found on site. The risks associated with the heavy metals may rise as a result of the effective increase in metals concentration as the waste volume decreases during incineration, and the fact that some metals (such as chromium) are more toxic in their oxidized state, which is facilitated during incineration.

The combination of incineration and capping should greatly reduce the amount of contaminants leaching into the groundwater and surface water. The groundwater treatment system will restore this natural resource and prevent risks to public health and the environment, while the provision of an alternate water supply will eliminate any current public health risks.

The costs for this alternative were developed assuming that the EPA would incur the capital and O&M costs for both incinerators, as opposed to rental. Once removed from the site, the units could then be used for cleanup at similar CERCLA sites. As with the previous alternative, the amount of contaminated soil was varied to determine the resulting range in capital costs. The capital cost to purchase the two incinerators was varied by $\pm$10 percent to account for vendor price fluctuation, while annual O&M costs were varied from -30 percent to +50 percent to account for the difficulty in predicting these costs at this time. The variation of these costs should be greatly reduced after field testing with the first incinerator. The resulting total capital costs for this alternative ranged from $26,113,000 to $32,207,000. The total 30-year present worth for this alternative is between $47,858,000 and $53,952,000.

5. Option - Complete Excavation of Contaminated Soils and Wastes; Onsite Incineration with Stabilization of Residuals; Extension of the Coatesville Water Authority Public Water Supply; Groundwater Extraction, Treatment and Discharge/Injection; and Long-Term Monitoring.

This alternative utilizes stabilization of the incinerator residuals in lieu of the placement of a multimedia cap, and will exceed applicable and relevant Federal public health and environmental standards. Because of the similarity to the Alternative Five for incineration, this discussion will focus only on the stabilization of incinerator residuals (ash) versus capping them.

The stabilization process that warrants further investigation for the metals-laden residuals is a pozzolanic process utilizing fly-ash and cement as the additives. The process can be either a batch or continuous operation depending upon the quantities of materials to be stabilized. Placement of materials can also be performed by one of two methods. In one method, water and a dust control material are mixed with the ash, and the resultant material stockpiled. Periodically (every few months), the stockpiled material can be placed, compacted, and allowed to "set up" until it has a form similar to concrete. The second method involves placing the ash as it is discharged from the kiln, and periodically injecting the material with the additives necessary for solidification. The second method is thought to be less expensive since there will be less materials handling involved. The determination of the most effective process for this site should be made by field or laboratory testing.

The solidfication process should tie up the metals in the ash to some extent, thus "fixing" them, although this should be verified during the design phase by laboratory analysis of a representative sample of ash. The resultant matrix should, however, be of high strength and low permeability (10^{-7} to 10^{-6} cm/sec), virtually eliminating leachate production.

The amount of contaminants leaching into the groundwater and surface water will be significantly reduced by this option, producing a corresponding reduction in potential exposure risks. State and Federal approval will have to be granted to allow disposal of incinerator ash on site by this method. The stabilized material will require delisting as a hazardous waste under RCRA by passing leachability testing in the laboratory.

Costs for this option were developed similarly to the basic Alternative Five. Differences in final costs are a result of replacing the costs for capping, backfilling, and compacting the incinerator ash (231,000 cubic yards) with the costs for stabilization (additives, mixing, spreading, and compacting costs provided by a vendor) and covering with the flow zone and topsoil materials included in this option. As such, the total capital cost for this option ranged from $30,378,000 to $43,258,000. The total 30-year present worth for this alternative ranges from $53,392,000 to $66,272,000.

V. Evaluation of Alternatives Specifying Offsite Storage, Destruction, Treatment, or Secure Disposal at a Facility Approved under RCRA

6. Excavation of Contaminated Waste Deposits and Disposal in an Offsite RCRA-Approved Landfill; the Option to Dispose, Contain, or Treat the Contaminated Soils that Underlie the Waste Deposits; Extension of the Coatesville Water Authority Public Water Supply; Groundwater Extraction, Treatment, and Injection; and Long-Term Monitoring.

Alternative Six provides a source control remedy and a management of migration remedy that meets the CERCLA category of an alternative that utilizes treatment or disposal at an offsite facility approved by the EPA. The intent of this alternative is to attain the objective of a potential health risk no greater than 10^{-6} or a health risk no greater than background health risks for the area not influenced by the Blosenski Landfill Site. This alternative is a combination of the following remedial actions:

- Excavation of the contaminated waste deposits to eliminate the source of contaminants.

- Disposal, containment, or treatment of the residual contaminated soils that underlie the waste deposits to further reduce the potential risks that may be associated with dermal contact or ingestion of the site's remaining contaminated soils.

- Installation of a public water supply to minimize the potential risks associated with ingestion or utilization of the site's contaminated groundwaters.

- Installation of a groundwater extraction, treatment, and discharge/injection system to help restore the contaminated groundwater system as a natural resource.

- Implementation of a long-term monitoring program to observe future contaminant migration, and to provide data on the effectiveness of site remediation.

Site remediation will begin with a drilling program and the installation of 10 long-term monitoring wells, and a test-boring and soil sampling program to define the limits of excavation.

This alternative requires the removal of all the wastes deposited at the site. The horizontal extent of waste deposits is based on the information obtained during the RI and information interpreted from the historical photographs presented in the EPIC study. The actual extent of waste-depositing activities may differ from the approximate limits established for this study.

Excavation and offsite disposal is a frequently used remedial action at hazardous waste sites. Little or no onsite maintenance activities are required for offsite disposal. No technical problems are foreseen in using this technology except. The estimated time for completing this alternative is approximately two years.

The offsite disposal facility must be authorized under RCRA to receive the identified contaminated soils and waste. In addition, the facility must currently comply with RCRA groundwater monitoring requirements, and must have no unauthorized surface or groundwater discharges of contaminants. A facility inspection and document/records review will be necessary to verify satisfactory compliance status. The nearest offsite landfill believed to be in current RCRA compliance is operated by CECOS International, and is located near Buffalo, New York, approximately 450 miles from the site. Implementation of this alternative may require development by the regulatory agencies of an Alternate Concentration Limit (ACL) for determining the acceptable contamination levels that may remain in the residual soils.

For this alternative, three options were developed to address remaining contaminated soils, underlying the excavated wastes.

Option A is a continuation of this alternative. Contaminated soils are excavated and taken offsite for disposal in an approved landfill. The excavated areas are then backfilled with clean soil from a local borrow area. The backfill is graded and compacted to match as best as possible the surrounding topography, and then the area is revegetated. The remaining actions are constructed and a long-term monitoring program initiated.

Option B utilizes the construction of a multimedia cap over the contaminated soils to reduce the amount of infiltration. Since the remaining contaminated soils are believed to be above the groundwater table, the amount of leachate generated by the site should be reduced to near zero. The remaining remedial actions of this alternative can be completed in conjunction with this option.

Option C consists of a series of studies to evaluate the potential use of an innovative or emerging technology such as soil washing technology to detoxify the contaminated soils.

There are two contaminated media found at the Blosenski Landfill Site that might be detoxified by utilizing an innovative or emerging technology. They are as follows:

- Burned and unburned contaminated municipal solid waste (MSW), with crushed drums and drum residuals.
- Contaminated Soils

Offsite disposal will reduce the possibility of future groundwater contamination by removing the source from the site. Due to the large volume of material to be disposed of, it may be necessary to consider using several landfills provided they will accept the waste materials. Option B will require the installation of a multimedia cap over the contaminated soils. Multimedia capping is a proven technology that has good reliability and can be expected to perform effectively for the next 30 years or more.

Option C, the soil detoxification study (or soil washing), does not require extensive construction activities. However, a high level of technical expertise will be required to develop a thorough study and apply it to the actual field conditions. Since the exposed contaminated soils will be susceptible to filtration and leachate production, the shortest period of time possible must be used to develop, perform and evaluate the site-specific soil washing technology. The study should be well along even before the excavation of the waste deposits is initiated. Data from the initial soil investigation should be used to evaluate the applicability of the technology. The pilot study should be initiated as soon as a large enough area of contaminated soils is exposed. Ideally the soil washing technology should be ready for field application before the waste excavation is 50 percent complete or rejected so that one of the other options can be initiated.

Excavation, capping or detoxification of the contaminated soils will greatly reduce the residual dermal and accidental ingestion risks. It is intended that excavation and detoxification will leave behind only soils whose concentrations result in less than a 10^{-6} risk.

The offsite disposal facility must be authorized under RCRA to receive the identified contaminated soils and waste. In addition, the facility must currently comply with RCRA groundwater monitoring requirements, and must have no unauthorized surface or groundwater discharges of contaminants.

The excavated wastes would be manifested and transported to the RCRA disposal facility by licensed haulers in accordance with DOT (49 CFR Parts 170-199 and 390-397) and RCRA (40 CFR Parts 262 and 263) regulations. All necessary transportation licenses, permits, and manifests must also be obtained from PADER before this alternative may be implemented.

Costing for this alternative is highly dependent upon the volume of waste excavation, which in turn affects transportation and disposal costs. It was assumed that the materials would dewater sufficiently by gravity for transport and disposal, and that all of the wastes will be disposed of in one location, 450 miles from the site.

Option A

Capital cost estimates for this alternative option range from $89,388,000 to $257,503,000. The total 30-year present worth for this alternative is expected to be between $93,858,000 and $261,973,000.

Option B

Capital cost estimates for this alternative option range from $44,815,000 to $123,872,000. The total 30-year present worth for this alternative is expected to be between $49,484,000 and $128,451,000.

Option C

Capital cost estimates for this alternative option range from $45,756,000 to $126,006,000. The total 30-year present worth for this alternative is expected to be between $50,027,000 and $130,877,000.

Alternative Trade-Off Matrix

The trade-off matrix presented in Table 8 summarizes: the technologies comprising the alternatives; technical, public health, and environmental advantages and disadvantages and institutional considerations.

EFFECTIVENESS EVALUATION

COSTS

A summary of the range of capital, annual O & M, and 30-year present-worth costs for the remedial alternatives are presented in Table 9. Present worth costs is the amount of investment needed today to finance operation and maintenance necessary for each alternative.

Consistency With Other Environmental Laws

The six alternatives presented in this ROD were evaluated to determine consistency with other environmental laws such as RCRA, TSCA, and Clean Water Act (CWA) §404.

Only alternatives 3,4,5 and 6 comply with RCRA requirements for offsite groundwater plume abatement. RCRA also requires soil contamination be isolated or excavated to background levels unless mathemetical models illustrate safe levels which require no action. Alternatives 5 and 6 remediate soil and are thus in compliance with RCRA. All alternatives should be in compliance with CWA §404 since no alternative recommends the filling in of a wetland.

Table 8

REMEDIAL ACTION ALTERNATIVE TRADE-OFF MATRIX
BLOSENSKI LANDFILL SITE

Alternatives:	Technical Considerations: Advantages	Technical Considerations: Disadvantages	Public Health Considerations: Advantages	Public Health Considerations: Disadvantages	Environmental Considerations: Advantages	Environmental Considerations: Disadvantages	Institutional Considerations:
I. No Action Alternative							
1. No Action with Monitoring.				- Mean groundwater contaminant concentrations associated with potential cancer risk of 10^{-2}.		- Continued migration via groundwater, surface water, and airborne transport.	
II. Alternatives That Attain CERCLA Goals But Do Not Attain Other Applicable or Relevant Standards							
2. Soil Cap, Alternate Water Supply, and Long-Term Monitoring.	- Relies on simple technology.		- Reduces potential risk associated with dermal contact, ingestion & inhalation.		- Reduces leachate generation. - Reduces surface soil erosion and airborne transport of contaminants.		- Requires approval from Coatesville Water Authority.
III. Alternatives Attaining All Applicable or Relevant Standards							
3. Multimedia Cap, Alternate Water Supply, Groundwater Extraction and Treatment, and Long-Term Monitoring.	- Relies on proven technologies.	- Efficiency of groundwater extraction is questionable due to fractured bedrock - Groundwater treatment entails extensive operation and maintenance.	- Same as above.		- Reduces surface soil erosion & airborne transport of contaminants - Reduces leachate generation - Reduces existing groundwater contamination.	- Potential transfer of volatile organics from groundwater to atmosphere.	- May require air pollution control equipment on air stripper to meet PADER requirements. - Requires permit for groundwater discharge. - Requires RCRA permit for capping of wastes. - Requires approval from Coatesville Water Authority.

TABLE B-2

Alternatives:	Technical Considerations: Advantages	Technical Considerations: Disadvantages	Public Health Considerations: Advantages	Public Health Considerations: Disadvantages	Environmental Considerations: Advantages	Environmental Considerations: Disadvantages	Institutional Considerations:
4. Onsite Landfill, Alternate Water Supply, Groundwater Extraction and Treatment, and Long-Term Monitoring.	- Relies on proven technologies.	- Efficiency of groundwater extraction is questionable due to fractured bedrock. - Effectiveness of landfill is dependent upon proper installation techniques. - Groundwater treatment entails extensive operation and maintenance.	- Reduces potential risk associated with dermal contact, ingestion, and inhalation.	- Increased exposure risk during implementation due to complete excavation.	- Eliminates future leachate generation. - Completely isolates the wastes from groundwater contact, surface water runoff, and airborne transport.	- Increased potential for airborne contaminants during implementation.	- Requires RCRA-permitted facility and comprehensive groundwater monitoring program. - Requires permit for groundwater discharge. - May require air pollution control equipment on air stripper to meet PADER requirements. - Requires approval from Coatesville Water Authority.
IV. Alternatives Exceeding Applicable or Relevant Standards							
5a. Onsite Incineration, Multimedia Cap, Alternate Water Supply, Groundwater Extraction and Treatment, and Long-Term Monitoring.	- Relies on proven technology.	- Onsite (mobile) units not widely available. - Available units have relatively low throughput, resulting in a relatively long implementation period (18 yrs). - Incineration entails considerable operation and maintenance. - Efficiency of groundwater extraction is questionable due to fractured bedrock. - Groundwater treatment entails extensive operation and maintenance.	- Organic contaminants completely destroyed. - Reduces potential risk associated with dermal contact, ingestion, and inhalation.	- Increased exposure risk during implementation due to complete excavation. - Potential exposure risk of nearby residences due to incinerator stackgas emissions.	- Reduces inorganic leachate generation and eliminates organic leachate generation. - Reduces surface soil erosion and airborne transport of contaminants. - Reduces existing groundwater contamination.	- Potential transfer of volatile organics from groundwater to atmosphere. - Increased potential for airborne contaminants during implementation due to excavation, and due to incinerator stackgas emissions during operation.	- Same as above, plus incinerator emissions must conform to NAAQS.

Table 3-3

Alternatives:	Technical Considerations: Advantages	Technical Considerations: Disadvantages	Public Health Considerations: Advantages	Public Health Considerations: Disadvantages	Environmental Considerations: Advantages	Environmental Considerations: Disadvantages	Institutional Considerations:	Community Considerations:
5b. Onsite Incineration, Stabilization of Residuals, Alternate Water Supply, Ground-water Extraction and Treatment, and Long-Term Monitoring.	- Same as above.	- Same as above.	- Same as above, plus: - Inorganic contaminants are "tied-up" in solid matrix.	- Same as above.	- Eliminates organic and inorganic leachate generation. - Reduces surface soil erosion and airborne transport of contaminants. - Reduces existing ground-water contamination.	- Same as above.	- Same as above, plus: - Solidified mass will need to be delisted as a hazardous waste under RCRA for disposal.	- Same as above.
V. Alternatives Specifying Off-site Storage, Destruction, Treatment or Disposal								
6. Excavation of Waste Deposits with Offsite Disposal in a RCRA-Approved Landfill, Alternate Water Supply, Groundwater Extraction and Treatment, and Long-Term Monitoring, plus:	- Relies on simple technologies.	- Efficiency of ground-water extraction is questionable due to fractured bedrock. - Groundwater treatment entails extensive operation and maintenance.	- Eliminates long-term potential risk due to dermal contact, ingestion, and inhalation.	- Increased exposure risk during implementation due to excavation and transport of materials.	- Same as above.	- Potential transfer of volatile organics from ground-water to atmosphere. - Increased potential for airborne contaminants during implementation.	- Requires finding a RCRA-permitted facility to receive this large quantity of materials. - Requires manifestation of materials in accordance with RCRA and DOT regulations. - Requires permit for ground-water discharge. - May require air pollution control equipment on air stripper to meet PADER requirements. - Requires approval from Coatesville Water Authority.	

Table 8

Alternatives:	Technical Considerations: Advantages	Technical Considerations: Disadvantages	Public Health Considerations: Advantages	Public Health Considerations: Disadvantages	Environmental Considerations: Advantages	Environmental Considerations: Disadvantages	Institutional Considerations:
Option A: Excavation and Offsite Disposal of Residual Soils.	- Relies on simple technologies.	- Efficiency of groundwater extraction is questionable due to fractured bedrock. - Groundwater treatment entails extensive operation and maintenance.	- Eliminates long-term potential risk due to dermal contact, ingestion, and inhalation.	- Increased exposure risk during implementation due to excavation and transport of materials.	- Same as above.	- Potential transfer of volatile organics from groundwater to atmosphere. - Increased potential for airborne contaminants during implementation.	- Requires finding a RCRA-permitted facility to receive this large quantity of materials. - Requires manifestation of materials in accordance with RCRA and DOT regulations. - Requires permit for groundwater discharge. - May require air pollution control equipment on air stripper to meet PADER requirements. - Requires approval from Coatesville Water Authority.
Option B: Install Multimedia Cap over Residual Soils.	- Relies on simple proven technologies.	- Efficiency of groundwater extraction is questionable due to fractured bedrock. - Groundwater treatment entails extensive operation and maintenance.	- Reduces potential risk associated with dermal contact, ingestion, and inhalation.	- Increased exposure risk during implementation due to excavation and transport of materials.	- Reduces surface soil erosion and airborne transport of contaminants. - Reduces leachate generation. - Reduces existing groundwater contamination.	- Potential transfer of volatile organics from groundwater to atmosphere.	- Requires finding a RCRA-permitted facility to receive this large quantity of materials. - Requires manifestation of materials in accordance with RCRA and DOT regulations. - Requires permit for groundwater discharge. - May require air pollution control equipment on air stripper to meet PADER requirements - Requires approval from Coatesville Water Authority. - Requires RCRA permit for capping of wastes

Table 6-5

Alternatives:	Technical Considerations: Advantages	Technical Considerations: Disadvantages	Public Health Considerations: Advantages	Public Health Considerations: Disadvantages	Environmental Considerations: Advantages	Environmental Considerations: Disadvantages	Institutional Considerations:
Option C: Excavation and Detoxification of Contaminated Soils.		- Efficiency of groundwater extraction is questionable due to fractured bedrock. - Groundwater treatment entails extensive operation and maintenance. - Effectiveness, reliability and implementability of soil washing is unknown.	- Reduces potential risk associated with dermal contact, ingestion, and inhalation.	- Increased exposure risk during implementation due to complete excavation.	- Reduces existing groundwater contamination. - Reduces leachate generation. - Reduces surface soil erosion and airborne contaminant transport.	- Potential transfer of volatile organics from groundwater to atmosphere. - Increased potential for airborne contaminants during implementation.	- May require air pollution control equipment on air stripper to meet PADER requirements. - Requires permit for groundwater discharge. - Requires approval from Coatesville Water Authority. - Requires finding a RCRA-permitted facility to receive this large quantity of materials. - Requires manifestation of materials in accordance with RCRA and DOT regulations. - Requires PADER approval for soil washing.

Table

REMEDIAL ACTION ALTERNATIVES COST SUMMARY ($1,000)
SLOGENSKI LANDFILL SITE

Remedial Action Alternative	Capital Costs			Annual Operation & Maintenance Costs Year No:				Present Worth Analyses (30 Yrs.)		
	Low	Base	High	1	2-5	6-16	17-30	Low	Base	High
1. No action with monitoring	80	100	130	187.7	187.7	187.7	187.7	1,953	1,973	2,003
2. Soil cap, alternate water supply and long-term monitoring	2,700	3,231	4,812	255	255	255	255	5,122	5,647	7,233
3. Multimedia cap, alternate water supply, groundwater extraction and treatment and long-term monitoring	8,401	8,560	13,837	825	816	278	278	13,150	14,228	17,708
4. Onsite landfill, alternate water supply, groundwater extraction and treatment and long-term monitoring	14,317	22,728	31,508	825	816	278	278	18,988	27,397	36,177
5a. Onsite incineration, multimedia cap, alternate water supply, groundwater extraction and treatment and long-term monitoring	28,113	28,424	32,207	1,503	3,184	2,654	234	47,858	51,169	53,952
5b. Onsite incineration, stabilization of residuals, alternate water supply, groundwater extraction and treatment and long-term monitoring	38,378	38,213	43,258	1,837	3,328	2,708	368	53,392	61,227	66,272
6. Excavation and offsite disposal of wastes in a RCRA-approved landfill, alternate water supply, groundwater extraction and treatment and long-term monitoring, plus:										
Option a: Excavation and offsite disposal of soils in a RCRA-approved landfill	89,388	173,285	257,583	804	785	255	255	83,858	177,735	261,873
Option b: Construction of multimedia cap over contaminated soils	44,815	84,118	123,782	825	816	278	276	49,484	88,787	128,451
Option c: Excavation and detoxification of contaminated soils	45,756	88,001	126,006	783	774	234	234	50,027	89,272	130,877

Recommended Alternative

Section 300.68(j) of the National Contingency Plan (NCP) [47 FR 31180; July 16, 1982] states that the appropriate extent of remedy shall be determined by the lead agency's selection of the remedial alternative which the agency determines is cost-effective (i.e. the lowest cost alternative that is technically feasible and reliable) and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare and the environment. In selecting a remedial alternative EPA consults other environmental laws that are applicable and relevant. Based on the evaluation of the cost-effectiveness of each of the proposed alternatives, the comments received from the responsible parties evaluation of the alternatives, the public comments, information from the Feasibility and Focused Feasibility Studies and information from the Pennsylvania Department of Environmental Resources, we recommend that the following alternative be implemented at the Blosenski Landfill site:

- Alternative Water Supply,
- Excavation and removal of buried drums,
- Groundwater remediation,
- Capping, and
- Monitoring

The concept of the Recommended Alternative is a combination and blend of Alternatives Three and Five. The Recommended Alternative includes the following:

1) Supply alternative water to affected and potentially affected residences, by installing a branched water line from an existing mainline (from Coatesville Water Authority). At this time, EPA estimates that at least 12 residences which reside directly south of the landfill along Route 340 (Kings Highway) and also reside adjacent to the landfill on the west will be provided this water service.

2) Excavate and remove buried drums found during a trenching operation of the landfill. Due to the number of pocketed areas of drums found during the EPA-funded Remedial Investigation and the associated hazardous material found in these areas, EPA will perform a trenching operation to identify, excavate and dispose of buried drums. This operation will ensure that highly contaminated materials in drums that are currently leaking into the subsurface soils and ground water are removed. In addition, unopened drums containing contaminated materials, that may eventually rupture and release their contents to the environment, will also be removed. EPA will employ geotechnical techniques to assist in isolating pocketed areas of drums.

Excavated drums will be initially characterized in the field to determine if the contents are of a hazardous nature. The characterization will be used to satisfy RCRA transportation requirements and also to provide information for consideration for any alternative technologies that could be performed on-site to decrease the volume for offsite shipment of drums to a RCRA approved facility and to also decrease the associated costs for such shipments.

3) Perform a pre-design study which will include the installation of additional monitoring wells and conduct pump testing to more fully delineate the extent and magnitude of the ground water contamination. This study will also be used to collect data for the design of an effective ground water pumping and treatment system. Residential wells, surface waters and sediments will also be sampled during design to assist in determining the extent of contamination from the site and its potential impact to the environment.

4) Based on the findings of the pre-design study, a source reduction program will be implemented involving pumping and treating of contaminated ground water that exceeds Alternate Concentration Levels (ACLs) developed by EPA, for a specified period of time determined during design, not exceeding two years. During this initial period, the ground water pumping and treatment program will be evaluated to determine the effectiveness and technical feasibilty of reducing the ground water contamination to the EPA developed ACLs. Based on this evaluation, a determination will be made to continue the pumping and treatment program for another specified period using the proposed or new ACLs or to discontinue with ground water monitoring. This process will continue cycling until EPA deems it appropriate to discontinue pumping. This strategy is necessary because the effectiveness of pumping to reduce VOC contaminants to low part per billion levels over a long time period, is unknown. The proposed ACLs for the first period are outlined in Table 7. These ACLs will be reevaluated during design to ensure technical feasibility and protection of human health and the environment.

The groundwater will be treated to levels established in a National Pollution Discharge Elimination System (NPDES) program implemented by PADER and either discharged into the intermittent tributary north of the site and/or reinjected into the ground. Ground water may be treated for inorganic and organic removal by precipitation, filtration, air stripping and granular activated carbon. The NPDES permit will consider technical feasibility of treatment and protection of aquatic life and humans or wildlife which may ingest aquatic life, using CWA and USEPA Aquatic Water Quality Criteria and/or Pennsylvania State Water Quality Criteria or Standards.

When the decision is made to discontinue the pumping and treatment program a closeout sequence will be initiated to decommission the pumping wells and treatment facilities in a manner to mitigate post closure maintenance requirements.

5) Installation of a low permeability cover on the landfill in accordance with requirements of RCRA. During the trenching and excavation operations on the landfill, additional soil samples will be collected and analyzed to assist in the design of an on site RCRA cover. The soil analysis will also be used for the evaluation of the need for development of 10^{-6} unit cancer risk criteria for target compounds remaining in the soil. The cover design may be reevaluated based on additional data to provide the necessary environmental protection that meets CERCLA goals and which may be more cost effective, than the cap in Alternative Three. The cost estimates in this ROD are for a RCRA cover detailed in Alternative Three.

6) Institute periodic monitoring for ground water and surface water contamination in the landfill area in compliance with RCRA closure regulations. This will include sampling of potentially affected residential wells in addition to surface water sampling.

7) Operation and Maintenance (O&M) will be implemented by the State of Pennsylvania on the landfill cap, gas venting, surface diversion system and monitoring program one year after construction of these systems. The ground water treatment system will be eligible for trust fund monies.

Costs

Design Cost

Additional sampling, monitoring wells, and pump testing (pre-design) has been costed as part of the design. Design is estimated to cost approximately $1,000,000. The pre-design study is estimated to cost $200,000. The pre-design and design costs will be funded 100% by Trust Fund monies.

Capital Cost

Capital cost estimates range from $11,000,000 to $15,000,000 with an estimated baseline of $13,000,000. For these estimates, capital costs included all costs associated with excavation, regrading, revegetation, capping, installation of the gas venting treatment system, and ground water pumping and treatment. Cost estimates for pumping and treament were based on a five year operational period. Trust fund monies will be used to pay for 90% of these costs and the State of Pennsylvania will finance 10% of these costs.

Operation and Maintenance (O & M)

O & M costs are estimated to be approximately $534,300 for the first two years.

The components of the recommended alternative that may require O & M are:

- Landfill Cap
- Surface Water Management Systems
- Gas Venting System
- Monitoring (excluding that necessary to monitor the effectiveness of the pumping and treatment program while it is being financed by the Trust Fund).

The above listed items will be considered normal operation and maintenance and will be the responsibility of the State of Pennsylvania one year subsequent to completion of construction.

The ground water pumping and treatment program will be considered part of the approved remedy for a period of at least two years. If targets are not reached after two years of remedial activity the Regional Administrator will determine if it is technically feasible to reach those targets. If further pumping and treatment are required, this will also be considered as part of the approved remedy and eligible for Trust Fund money up to ten years with 10% financed by State money.

Estimated Schedule *

Approve ROD	9/86
Start PreDesign	11/86
Complete PreDesign	5/87
Award Superfund IAG to US Corps of Engineers for Design	11/86
Start Design	5/87
Design Complete	10/87
Award Construction Contract	2/88
Start Construction	4/88

* Dependent upon CERCLA reauthorization

BLOSENSKI RESPONSIVENESS SUMMARY
SEPTEMBER, 1986

This community relations responsiveness summary is divided into the following sections:

Section 1. Overview. This section discusses EPA's preferred alternative for remedial action, and public reaction to this alternative.

Section 2. Background on Community Involvement and Concerns. This section provides a brief history of community interest and concerns raised during remedial planning activities at the Blosenski Site.

Section 3. Summary of Major Comments Received during the Public Comment Period and the EPA Responses to the Comments. Both written and oral comments are categorized by relevant topics. EPA responses to major comments are also provided.

Section 4. Remaining Concerns. This section describes remaining community concerns that EPA and the Pennsylvania Department of Environmental Resources should be aware of in conducting the remedial design and remedial action at the Blosenski Superfund site.

1. OVERVIEW.

On Thursday July 31, 1986 EPA conducted a public meeting to announce the Agency's preferred remedial action and to discuss the Remedial Investigation, Feasibility Study and the Focused Feasibility Study for the Blosenski Landfill Superfund Site. The documents were placed in the repository at the West Caln Township Building in June, 1986. An announcement of the public meeting was made by sending a press release to the local media, which includes West Chester and Coatesville. The public comment period closed on September 11, 1986.

The Agency's preferred alternative includes three phases:

Phase 1.: Install a public water supply provided by the Coatesville Water Authority to an estimated 12 residents.

Phase 2.: Excavate and remove buried drums in areas identified during EPA's Remedial Investigation and any material in intimate contact with the drums and free standing liquid, and dispose of these materials at a Resource Conservation and Recovery Act (RCRA) facility. In addition, EPA will perform trenching operations throughout other areas of the Site in order to identify, excavate and dispose of other buried drums.

Phase 3.: Perform a pre-design study which shall include sampling of residential wells, surface waters, and the installation of additional monitoring wells and conducting pump testing to more fully delineate the extent and magnitude of the groundwater contamination. This study will also be used to collect data for the design of an effective groundwater pumping and treatment system.

Phase 4.: Install a low permiability cover on the landfill in accordance with the requirements of RCRA. Construct appropriate surface water diversion systems. Construct a gas venting system to protect the cover. A monitoring program will be conducted at these gas vents and treatment of the off gases will be provided if needed. Institute periodic monitoring for ground water and surface water contamination in the landfill area in compliance with RCRA closure regulations. This will include sampling of potentially affected residential wells in addition to surface water sampling.

At the RI/FS public meeting, several questions relating to the EPA preferred alternative were raised. The following is a list of questions asked by the residents who attended the meeting. EPA responses to those questions are given as they were answered at the public meeting.

Phase 1, Water Line Installation

1. Have you decided which residences will receive water from the City of Coatesville?

Those homes whose water is already affected and those that adjoin the site will be connected to the line first. That is approximately 12 homes. During the predesign stage, additional evaluation will occur to better define the potential for contamination. If additional homes appear to be at risk, they will be connected to the line.

2. How long after the initial 12 residences are connected to the water supply line can other residences hook up. For instance, if a home is not affected now, but becomes affected 3 years from now, will the EPA still pay to connect it to the public water supply line?

   The EPA will evaluate with sufficient care to determine which homes are potentially affected either now or in the future. If the EPA believes that a home is potentially affected, based on the way the ground water is flowing or where the contamination is located, that home will be connected to the public water supply.

3. How far is the water line going to be extended and will it be a large enough diameter to serve additional people, after the first 12 homes are connected? Or, will the EPA have to replace the line with larger pipe when additional hook-ups are made?

   A water line approximately 3 1/2 miles from a water main will be installed directly to the site area and will service those residences which have been impacted by the ground water contamination.

4. Does the EPA have money for the pipeline?

   At this time no, not until Superfund is reauthorized.

5. Can people who have not been affected by the site hook-up to the new water line at their own expense?

   The EPA is focusing on the affected and potentially affected residences. There is no provision for the Agency to provide a connection to anyone else or even to provide a larger line to accomodate others.

6. If other members of the community living along the route that the water line extension will take want to hook-up, can they get action going in their behalf?

The EPA will not prevent anyone from connecting to the water line. The people should address that question to the Coatesville Water Authority. That means more customers for the water authority, and they would probably want to know that others are interested so that the line can be properly engineered.

7. Have the families who will be connected to the water line by the EPA been informed of this?

   The EPA does not know who all of the potentially affected families are at this time, but those families will be notified as soon as the determination is made.

8. How reliable have the EPA's predictions about potentially affected parties been in the past?

   Hopefully, enough monitoring wells will be installed to determine "potential" accurately. The EPA will be very conservative in its predictions and will look at it as a worst case senario and then act accordingly.

9. Wouldn't it be a good idea to put the water line in right away?

   The people whose wells are contaminated are already on bottled or filtered water, but as soon as money is available, the water line will be installed.

10. The EPA will extend the water line. Do individuals have to pay to run the pipe from the street to their homes?

    The EPA will pay for the initial connection.

<u>Phase 2, Drum Excavation</u>

1. In the landfill area, is it known how deep contamination has gone?

   The site is not homogeneous. In some areas, it has been excavated and backfilled. In other areas, the bedrock has been exposed. In some areas bedrock is 15 to 25 feet deep. The contamination that we have found is in pockets in the drum areas, and it is 12 to 15 feet deep.

2. Is there a way that you can dig a trench around the site and spray some material in it to keep contaminants from coming out of the site?

   What your talking about is a slurry wall or a grout curtain. The problem is that those are site specific techniques. It is unlikely that they would be successful here because the contamination gets right into the rock and is going through very small crevices. Those techniques work when contamination is moving through the soil. At this site there is very little contamination migrating through the soil.

3. How will Phase 2 work? How will you actually remove any drums you find, and how will you know when you dig a trench that there aren't any barrels just a few feet away?

   Trenches will be constructed very close together.

4. There are 4 to 6 tank trucks right on the surface that are now leaking. Is there any way that they can be removed right away?

   One thing that will be needed is money. Right now, there is no money to begin a cleanup here, or at any remedial site in the region. Congress has not yet agreed on the taxing authority for Superfund. Once Superfund is reauthorized the design stage for the cleanup will begin.

5. After the site contaminants are consolidated into one place, how will vertical migration be controlled?

   First of all the purpose of excavation is to remove any hot spots that may still be present, such as buried, leaking drums. Many of the organics deposited on-site in these areas may have already leached out. EPA will try to remove any remaining drums. The way that contaminants get into the groundwater is through infiltration. The purpose of the proposed cap is to limit infiltration.

<u>Phase 3, **Pre-design** Study</u>

1. Are **there** any plans to monitor beyond the homes adjacent to the site - **perhaps** on a cyclical basis?

   The EPA will determine if further monitoring is needed. Monitoring will be extended as far as potential risk is conceivable.

Health Concerns

1. What can you tell us about the specific health hazards of contaminants from the site?

The contaminants migrating from the site include trichloroethylene, trichloroethane, and dichloroethylene. These are all very similar compounds. They are basically just a 2 carbon molecule with double bonding between them and substitute chlorides on the carbons. They are all used as industrial degreasers. They are of concern to EPA because, in the long run, they can cause cancer. The ability of these compounds to cause cancer is not only a property of the chemical but is also a matter of how much of the compound is present.

2. Is the health risk only from drinking the water?

The risk is from drinking the water, from inhaling vapors from the water during showering, and from allowing the water to contact your skin. All of those risks exist but not at equal levels. Ingestion poses the greatest risk. The risk from showering is about 1/3 the risk of drinking, but of course, it depends on how long the shower is and how hot it is and also on how well ventilated the room is. The risk from dermal contact is about 1/10 the risk of drinking the water.

3. Are the aged or the very young more susceptible than a healthy, young person?

That's a very good question. The way the guidelines are set, the most sensitive members of the population are protected. So, if the entire nation was drinking trichloroethylene, at 2 ppb - say 200 million people - for a lifetime, the portion of that population that would most likely get cancer would be the aged and the young. That would still be only about 400 cases over a lifetime.

Enforcement

1. How long will it take for the PRPs to clean up? Isn't Blosenski the one who is responsible, and does EPA have to go through the process of suing the PRPs?

Negotiations are in progress now. Mr. Blosenski is one of the PRPs, but he is not the only PRP. Any generators or haulers of wastes at the site, as well as any past or present owners, are also PRPs.

EPA does not have to sue the PRPs. The Agency can go ahead with cleanup if the PRPs refuse, and then come back and recover costs from the PRPs, if necessary.

2. Will this negotiation with the PRPs become a long, drawn-out, legal affair?

   The way the law reads, the responsible parties must first be given an opportunity to perform the cleanup. If they do perform the remedial actions, there are very specific time constraints written into the agreement. A compliance schedule is part of the consent agreement.

3. If an agreement is reached with the PRPs and a consent decree is issued, what kind of teeth does the EPA have to enforce it?

   If the PRPs do not adhere to the consent decree, the EPA can take them to court and sue them for 3 times the cost of remediation.

4. Do the PRP's comments carry more influence than the public's?

   No, they are equal.

Community Involvement

1. Does the public have an opportunity to comment on the PRPs proposal for cleanup?

   Yes.

2. Can the public get a copy of the government guidelines for contaminant levels?

   There is a list, and it would be a good idea for the public affairs office to provide it for you. (Speaker offered to draft a list of contaminants and suggested public call public affairs officer to request it.)

3. If the general public doesn't provide written comments will the EPA go with the PRP's recommendations?

   This is not a competition. The EPA wants to hear from the public, but if it doesn't, that doesn't mean that the Agency will decide to do nothing. The EPA has come to the community to tell you what the Agency plans to do and to ask community members how they feel about this alternative. If you disagree with the alternative the EPA wants to know that. However, please include the reasons that you feel another alternative would be more effective. A complete investigation was performed to develop this alternative. This is the public's chance to put their words intothe final document, and the PRP's can also comment. In the end, though, it will be the EPA who makes the decision.

4. Who makes the decision on the final alternative selections? Is it a financial decision?

After public comments are received, a document known as a Record of Decision (ROD) will be written. The ROD will describe the preferred alternative, and it will be reviewed by several people at the EPA, including EPA headquarters personnel, and by the state. The final decision is delegated to the EPA Regional Administrator.

2. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS.

The Blosenski Superfund Site is a 13.6 acre landfill in rural West Caln Township, Chester County, Pennsylvania. Operating from the 1950's until it was closed by the Pennsylvania Department of Environmental Resources in 1979, the landfill was used as an open dump for municipal and industrial wastes. At the time of closure, the site was owned by Joseph M. Blosenski, Jr. who had purchased it during the 1960's from Perry Phillips, the site's original owner. The landfill was unlined and unpermitted throughout its operating history.

Private wells are the source of drinking water for the residents in West Caln Township. Land uses in the area are residential, commercial and agricultural. The southern border of the site along State Route 340 is a residential area. While the site was in operation, numerous citizens expressed concern, that the odors and airborne debris related to the open burning of waste at the site were responsible for various minor ailments, such as skin rashes. When the landfill was closed, the complaints decreased, but the citizens remained aware of environmental issues in the area. In December, 1982 the site was added to the National Priorities List.

In 1984, EPA conducted a community assessment around the site by going door to door to interview the residents. Although no organized citizens group is formed, the residents have a number of concerns. Among their main concerns, is the quality of groundwater in the area. Although remedial actions may stabilize groundwater quality, residents want to see the aquifer restored to an uncontaminated state. They are apprehensive of the long term effects of drinking even minimally contaminated water. They have also expressed concern about the safety of using their well water for laundry or bathing prior to the completion of remedial actions.

In December, 1984 during EPA's Remedial Investigation, trenching was conducted to see if drums were buried on-site, and where they were located. At that time, residents were visited by EPA. They were not concerned about the specific trenching operation, but they did project positive feelings that EPA was doing something to address the problem. However, they were apprehensive that EPA might decide on a remediation alternative based solely on cost effectiveness.

One family whose well is known to be contaminated has been using a carbon filter, and has been drinking bottled water. However, that family has had to haul water from a relative's home, and has had the added expense of installing and maintaining their carbon filter. They have repeatedly asked if EPA would reimburse them for all or part of the cost of the filter. Along that same line, several residents have asked that bottled water be provided by EPA until the Superfund Bill is reauthorized and a waterline could be installed.

Another major concern in the area, is property value. This concern is one that is not exclusive only to the residents who live within one mile of the site, but has been expressed at two public meetings by most of the participants. They feel that because a Superfund site exists in the township, a stigma has been attached to all the property in that township. Throughout the past two years EPA has received several calls from realtors and potential buyers, requesting information about the Blosenski site.

Finally, a big concern that has been expressed by everyone who lives near the Blosenski Superfund Site, is the reauthorization of Superfund. At the RI/FS public meeting, several residents announced that they were planning to write to their elected officials in hopes of expediting the bill's reauthorization. They were deeply concerned that if Superfund was delayed any longer, EPA would not consider the Blosenski site a priority. When that statement was made, EPA explained that the site's priority would not be changed by the delay, and that once funds were made available, the design stage of the project would begin. The EPA also explained that there is the chance that Superfund money might not be needed, if we reach an agreement with the potentially responsible parties (PRP's)to do the work. The residents said that they would like to see the PRP's pay for the work, however, they also said that they would continue to push for a strong Superfund Bill.

3. SUMMARY OF MAJOR COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES TO THE COMMENTS.

During the comment period which lasted from June,1986 through September 11, 1986, EPA received 7 letters from the general public, 1 letter from the Township Supervisors, and 2 letters from the PRPs.

A. COMMENTS FROM RESIDENTS.

1. Three residents commented that remedial alternative 5 or 6 would be a better choice.

   At the public meeting, EPA explained that we would not be able to excavate the entire landfill and dispose of it in an offsite facility. That choice would not be technically feasible, or cost effective.

2. Only one resident wrote that they were not in favor of the water line proposal. That resident suggested drilling a new well.

   EPA explained at the meeting, that the residents had the option of accepting the water line connection. Those who preferred to continue using well water would not be forced to connect to the water line.

3. Three comments agreed with the entire EPA alternative.

4. Four letters agreed with Phase 2 and Phase 3 of the EPA preferred alternative.

5. Six of the residents letters agreed with the water line extension, and two of those asked EPA to pay their water bills.

   EPA explained that the purpose of Superfund was to address abandoned toxic waste sites across the country, and if migration from a site causes a potentially health threatening situation, procedures will be taken to remediate the threat.

   The option to connect to the water line will be made available to the affected and potentially affected parties, but EPA does not have the authority to insist that they accept the water line.

B. COMMENTS FROM LOCAL OFFICIALS.

1. The West Caln Township Board of Supervisors commented that they thought the RI/FS was too lengthy an investigation, and that the projected cleanup operation should have a proposed time schedule.

   A time schedule for the clean-up will be detailed in the pre-design study.

2. The supervisors also commented that the water supply from the Coatesville Water Authority might be contaminated.

   The residents have an option to accept or not accept the water line. Water companies test the water quality regularly.

3. Their letter states that we might not extend the water line far enough for the entire township to connect.

   EPA is providing the water line to the highly contaminated wells and to those that have a potential for contamination.

C. <u>COMMENTS FROM POTENTIALLY RESPONSIBLE PARTIES.</u>

This section has been addressed on the following four pages.

C. Response to comments on the Remedial Investigation, Feasibility and Focused Feasibility Studies (RI/FS/FFS) for the Blosenski Landfill Site submitted by the following Potential Responsible Parties: Joseph M. Blosenski, Jr; Betz Laboratories, Inc.; The Budd Company; C & D Batteries; A. Johnson and Company, Inc.; ICI Americas, Inc; Delaware Container Corporation; and Jeanne and Perry Phillips, dated 9/11/86.

Comment: Failure to sufficiently identify the ground water flow system and the existence, extent and direction of a contamination plume; failure to document the mechanics of and the existence of contamination migration to off-site residential wells as well as a failure to correlate on and off-site compounds;

Response: The Agency does recognize the fact that further ground water investigation is necessary in order to more accurately define the extent and magnitude of ground water contamination before an effective ground water remediation system can be designed and implemented. As outlined in Phase 3 of EPA's Preferred Alternative, a pre-design study will be performed during which additional wells will be installed and sampled as well as other residential wells and surface waters. The information presented in the Remedial Investigation shows that the ground water underlying the Blosenski Landfill has been grossly contaminated with organic compounds that were deposited on or in the landfill. Many of the same contaminants found in the landfill's surface, subsurface and ground water samples (onsite) were found in ground water (monitoring wells), surface water, and residential well samples in offsite areas, as detailed in the RI. As the RI points out, the migration of these contaminants in the ground water are reflective of the hydraulic gradient of the site, but is difficult to predict due to the multiple onsite sources of contaminants, fracture influence in the rock densities of contaminants, cones of depression attributable to residential wells and depth of residential wells. Therefore, the concept of a well defined plume may not be applicable.

The Agency feels that information contained in the RI is adequate to characterize the release of hazardous substances into the environment and to direct our efforts toward remediation of the health and environmental threat posed by such release and the threat posed by potential releases into the environment. The commentors place a great deal of emphasis on the lack of evidence for contamination of the residential wells. The ground water data provide solid evidence that the ground water aquifer is contaminated, and while it is important from a health standpoint to know whether wells which are used for drinking and bathing are being affected or not, the fact that contamination exists in the ground water is significant in and of itself, since it presents a potential health and environmental threat to users of that aquifer.

EPA sees no reason to delay the Record of Decision to "precisely define the extent of contamination," when additional information can be provided during a pre-design phase, thus allowing other remedial actions to be initiated in a timely manner. EPA does not feel that information gathered during the pre-design study will significantly alter the concept of the remedial alternatives which have been selected, but will instead enhance EPA's remediation efforts.

Comment: Failure to identify and evaluate non-site potential sources of contamination and correlation of on- and off-site compounds;

Response: The correlation between contaminants found on site (in soils and in drums samples) with those found in ground water is strong and is sufficient to show the landfill to be the cause of ground water contamination in the area. The possibility of other sources being responsible for some of the contamination found in certain offsite wells has not been ruled out and will be investigated further during pre-design studies; however, this possibility would not significantly alter our conclusions based on the onsite ground water data contained in the RI. This correlation is made strong by the evidence of similar compounds being detected in different sample types, and by the concentrations of contamination found in waste, soil, and ground water samples. The contribution by other sources, therefore, becomes negligible in light of the gross contamination which has been shown to be a direct result of the disposal of hazardous substances in the Blosenski Landfill.

Comment: Inadequate soil contamination data to support a trenching program and the need for excavation of contaminated waste/soil;

Response: The EPA selected alternative specifically addresses removal of drums and contaminated material in intimate contact with the drums from the landfill during trenching operations and not contaminated waste/soil. Trenching operations performed on the site during the RI were successful in locating areas of buried drums and pooled liquids containing hazardous contaminants. Because the RI identified these source areas as containing high concentrations of contaminants, EPA feels that it is necessary to locate, excavate and dispose of these drums to ensure drums containing contaminated materials, that are currently leaking into the subsurface soils and ground water, are removed. In addition, unopened drums containing contaminated materials, that may eventually rupture and release their contents into the environment, will also be removed. EPA may evaluate alternative technologies to treat the contents of these drums after excavation. The trenching operation will attempt to employ geophysical techniques to assist in isolating pocketed areas of drums, however, some of these techniques were employed during the RI without much success.

Comment: Preferred alternative remedy of overlapping and unnecessary levels of remediation;

Response: The EPA selected alternative addresses multiple health and environmental concerns caused by the contamination from the landfill. Because of these concerns and the actual and potential threat to human health and the environment, EPA feels that a number of remedial measures are necessary at the site to (1) eliminate the public health threat posed by the use of contaminated ground water by area residents, (2) eliminate contamination source areas to the maximum extent possible, (3) reduce and/or eliminate the potential for infiltration of contaminants into the environment, and (4) reduce levels of existing ground water contamination.

Comment: The preferred alternative calls for ground water treatment in fractured bedrock, the necessity and feasibility of which is seriously questioned;

Response: The results of the RI show that the ground water underlying landfill and some offsite areas is grossly contaminated with a variety of volatile organic compounds, many of which are carcinogenic. In addition, results of surface water sampling during the RI and subsequent sampling episodes performed by EPA indicate that these same compounds are migrating offsite via ground water movement. As stated in the FS, ground water extraction and treatment provides a feasible means of removing contaminants from the ground water. However, the Agency recognizes the efficiency of extraction is subject to the uncertainty of localized well yields due to the fractured bedrock. Because of this situation, EPA has selected an approach in which the pre-design study will be used to assess the extent and magnitude of ground water contamination and assist in the development of a source reduction program that will be implemented to reduce ground water to Alternative Concentration Levels developed by the Agency, for a specified evaluation period.

Comment: Cost effectiveness of extending the waterline;

Response: As expressed in former comments, the ground water data provide solid evidence that the ground water aquifer is contaminated and presently affecting residential wells. At the present time, at least three residences that are in close proximity to the landfill have contamination in their wells that the Agency considers to be an immediate health threat. Preliminary indications from ongoing sampling of the residences around the landfill show that as many as 12 to 18 residences may have some type of volatile organic compounds in their wells. Based on the hydrogeology and contaminant information provided in the RI, the Agency feels that there exists a potential for other wells directly adjacent to the site and wells in close proximity to the site to become contaminated, if they have not been so already. EPA is continuing its efforts to identify and evaluate affected residential wells. Because of this situation, EPA has elected to provide affected residences with an alternative water supply that will eliminate their contact with contaminated ground water. As referenced in the FFS, a variety of alternatives were explored that would provide adequate protection for affected residential wells. The Agency reviewed the development of a new community well initially as a favorable alternative. However, the alternative was eliminated due to a number of uncertainties associated with this alternative such as: the ability of the fractured rock system to provide enough water to affected and potentially affected residences; the responsibility and cost of long term operation and maintenance of such a system; the possibility of future contamination of the well from the contaminated aquifer; responsibility and future costs of easement agreements and/or permits; and the overall hydrogeologic effect on the surrounding area or community.

Comment: <u>Need for a multimedia cap;</u>

Response: As presented in the RI, the surface and subsurface soils in the Blosenski Landfill contain a number of organic and inorganic contaminants. Because many of these contaminants are expected to remain in the soils after the trenching operation has been completed, the Agency must comply with the National Contingency Plan (NCP) of November 20, 1985 which specifies "The appropriate extent of remedy shall be determined by the lead agency's selection of a cost effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment....this will require selection of a remedy that attains or exceeds applicable or relevant and appropriate Federal public health and environmental requirements"... The requirements set forth in the NCP direct the Agency to satisfy the requirements of the Resource Conservation and Recovery Act (RCRA) in landfill closure such as the Blosenski landfill and post closure care. Specifically, the RCRA requires the cap or final cover to be designed to minimize infiltration of precipitation into the landfill after closure. It must be no more permeable than the liner system. It must operate with minimum maintenance and promote drainage from its surface while minimizing erosion. It must also be designed so that settling and subsidence are accommodated to minimize the potential for disruption of continuity and function of the final cover. The Agency believes that a three layer final cover (cap) will adequately minimize infiltration of precipitation, which is the primary purpose of the final cover. The final cover acts to minimize infiltration by causing precipitation to run off through use of slopes, drainage layers, and impermeable and slightly permeable barriers. By minimizing infiltration, the generation of leachate will also be minimized, thereby reducing long-term discharge of contaminants to a bare minimum at the Blosenski Landfill site. In order to satisfy the RCRA requirements, the Agency selected a multi-media cap as proposed in Alternative Three for the Blosenski Landfill. However, since a trenching operation will be performed at the site and additional sampling of the residual soils will be performed to determine if significant contamination remains, the Agency may reevaluate the cost effectiveness of the cap components during design.

4. REMAINING CONCERNS.

The community surrounding the Blosenski Superfund Site is concerned about the continuation of the Superfund Bill. They are fearful that EPA will be forced to walk away from the cleanup and the situation at the site will not be changed.

The more specific concern that remains in the community is whether or not the EPA can supply bottled water to the Bardsley family, (the family that has the most contaminated well). Mr. and Mrs. Bardsley have repeatedly requested that the EPA reimburse them for either part of or the total cost of their carbon filter. EPA is investigating the possibility of reimbursing the Bardsleys.

Finally, the concerns about property values will remain in the community until a remedial action is complete at the Blosenski site.

PENNSYLVANIA
DER

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Post Office Box 2063
Harrisburg, Pennsylvania 17120

Bureau of Waste Management

717-787-9871

September 26, 1986

Mr. Thomas Voltaggio
Chief, Superfund Branch
U. S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107

Dear Mr. Voltaggio:

The review of the draft Record of Decision for the selection of the alternative for the remediation of the Blosenski Landfill site has been completed. We concur with your assessment of the proposed alternatives and with the selection of the final remedial measures set forth in the draft ROD.

A branch water line will be installed from an existing mainline of the Coatesville Water Authority to supply alternative water to affected and potentially affected residences. A trenching operation of the landfill will be performed to excavate and remove the buried drums, any material in intimate contact with the drums, and the free-standing liquids for disposal at a RCRA facility. A low permeability cover will be installed on the landfill with appropriate surface water management and gas venting. Groundwater and surface water monitoring will be instituted in compliance with RCRA closure regulations. The remedial design, based on information obtained during trenching and excavation operations, will be in accordance with all applicable RCRA requirements, and will provide necessary environmental protection consistent with CERCLA goals.

A pre-design study will be performed to more fully delineate the extent and magnitude of the groundwater contamination and to collect data for the design of an effective groundwater pumping and treatment system. The groundwater contamination source reduction program will be implemented for a period of time determined during design but not to initially exceed two years. At the end of two years, an evaluation will be conducted to determine the effectiveness of the pumping and treatment system and the need, extent, and duration of future groundwater remediation.

Pre-design and design costs will be funded 100 percent by trust fund monies. The groundwater pumping and treatment program will be considered part of the approved remedy and will be eligible for trust fund money and 10 percent financed with State money. Operation and maintenance will be implemented by the State of Pennsylvania on the landfill cap, gas venting, surface diversion system, and monitoring program (excluding that necessary to monitor the effectiveness of the pumping and treatment program while it is being financed by the trust fund) one year subsequent to completion of construction.

We recommend that the installation of the public water supply and performance of the pre-design study proceed as quickly as possible.