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Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-85/018
August 1985

EPA

Superfund Record of Decision:

Old Mill, OH

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16. ABSTRACT

The Old Mill site is in the village of Rock Creek, Ashtabula County, Ohio. The site consists of two parcels of land; the Henfield property and the Kraus property. Land use in the vicinity of the site is represented by a mixture of residential, agricultural, and commercial/industrial developments. The Henfield property is approximately three acres, and includes four dilapidated wood buildings and four concrete silos. The Kraus property is approximately ten acres, partially covered with piles of railroad ballast, and has one empty abandoned bulk liquid tank. In 1979, the U.S. EPA and Ohio EPA found approximately 1,200 drums of toxic waste, including solvents, oils, resins and PCBs, stored on both the Henfield and Kraus properties. Superfund emergency removal activities and enforcement actions resulted in drum removal that began in November 1981 and was completed by October 1982. Today, contaminated soil and ground water remain on-site.

The selected remedial action includes: removal and off-site disposal of a select volume of contaminated soil; extraction and treatment of contaminated ground water; aquifer use restrictions; and providing alternate water supply. Total capital cost for the selected remedial alternative is estimated to be $3,917,000 with O&M costs approximately $45,000 per year.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Old Mill, OH Contaminated Media: soil, gw, sw, sediment Key contaminants: VOCs, solvents, oils, resins and PCBs		

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SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

OLD MILL SITE, ROCK CREEK, OHIO

SITE LOCATION AND DESCRIPTION

The Old Mill site is in the Village of Rock Creek, Ashtabula County, Ohio. The site consists of two parcels of land; the Henfield property and the Kraus property. The Henfield property is approximately 3 acres, and includes four dilapidated wooden buildings and four concrete silos. Surface water flow from the property drains to the southwest corner and then to a ditch which disharges to the Rock Creek. The Kraus property is approximately 10 acres, is partially covered with piles of railroad ballast, and has one empty abandoned bulk liquid tank. Surface water flow from the Kraus property drains toward the northwest to a ditch which discharges to Badger Run and to the Grand River. Land use in the vicinity of the site is represented by a mixture of residential, agricultural, and commercial/industrial developments. The site is in a rural village setting with the closest residences approximately 75 feet from the property boundary (Figure 1).

The site geology for both properties includes clayey silt over 10 feet of glacial till that overlies 2 feet of weathered shale. The groundwater surface is 3 to 5 feet below ground surface. Groundwater movement at the Henfield property is toward the west, and at the Kraus property is toward the northwest, and occurs principally in the glacial till and weathered shale above the bedrock. The area is considered poor for domestic well supply development. Although most residents are using an available municipal drinking water source, there are two identified downgradient residences using the groundwater. The estimated horizontal linear velocity of groundwater is 20 feet per year at the site.

SITE HISTORY

Response activity at the Old Mill site began in 1979 when U.S. EPA and Ohio EPA found approximately 1,200 drums of toxic waste, including solvents, oils, resins, and PCBs, stored on both the Henfield and Kraus properties. The Henfield property was considered to be an immediate hazard because a significant quantity of the drummed waste was flammable. Access to the site was not controlled. Superfund emergency removal activities and enforcement actions resulted in drum removal that began in November 1981 and was completed by October 1982. In addition, approximately 2 inches [80 cubic yards (yd^3)] of soil from the drum storage areas on the Henfield property were removed in November 1982. A six foot cyclone fence was installed around a portion of the Henfield property in April 1984 under the authority of Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), in order to minimize the potential for direct contact with the remaining soil contaminants.

CURRENT SITE STATUS

A remedial investigation (RI) was conducted at the Old Mill site from August 1983 to December 1984. The activities performed included installation of groundwater

Old Mill 2/23/85

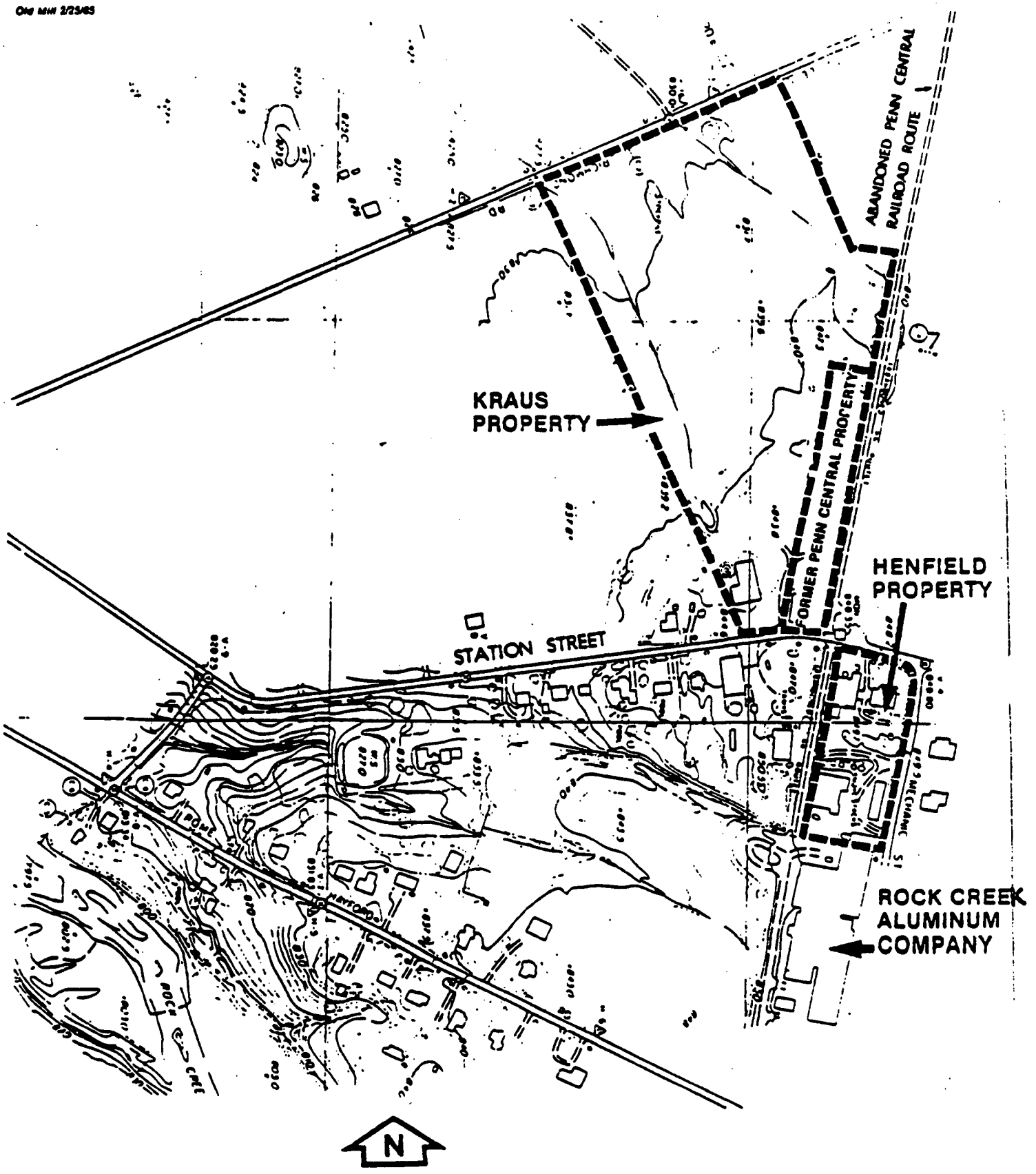

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Figure 1
SITE MAP
Old Mill Site

monitoring wells, and collection, analysis, and evaluation of private well water samples, soil and sediment samples, surface water and groundwater samples, railroad bed samples, and railroad ballast samples. In addition, geophysical studies were conducted, and topographic maps were prepared for both the Henfield and and Kraus properties.

Results of the RI are summarized according to environmental medium in Tables 1 and 2 and Figures 2 through 5. Concentration ranges are displayed for each contaminant detected.

Potential risks from contaminated soil and groundwater on the site are based on the assumption that the site would be used in the future for both residential and industrial/commercial development. These risks are theoretical quantifications, and are reported as excess lifetime cancer risks. Excess lifetime cancer risk is defined as the incremental increase in the probability of getting cancer compared to the probability if no exposure occurred. For example, a 10^{-6} excess lifetime cancer risk represents the exposure that could increase cancer by one case per million people exposed. The risk levels were calculated using U.S. EPA Carcinogen Assessment Group cancer potency values.

Soil Contamination

The Henfield property soil has elevated levels of organic and inorganic contamination. Organic contaminants were identified down to 6 feet below ground surface. Ingestion of 0.1 to 1 gram per day for seventy years of contaminated soil would result in a calculated excess lifetime cancer risk between 10^{-3} and 10^{-4}. The Kraus property soil has significantly lower levels of contamination with ingestion risk levels between 10^{-5} and 10^{-6}. The volume of contaminated soil is estimated to be 18,300 yd^3.

Groundwater Contamination

Groundwater at the Henfield property is contaminated with volatile organic compounds (VOCs), mainly trichloroethene, with lower concentrations of tetrachloroethene, trans-dichloroethene, 1,1-dichloroethene, vinyl chloride, and 1,1,1-trichloroethane. Ingestion of 1 to 2 liters per day for 70 years of contaminated groundwater on the Henfield property site would result in a calculated excess lifetime cancer risk greater than 10^{-3}.

Groundwater at the Kraus property is contaminated with VOCs, mainly ethylbenzene and xylene. The VOC plume appears confined to a small onsite area on the east side of the property. Ingestion of contaminated groundwater on the Kraus property would not result in a calculated excess lifetime cancer risk but would result in a toxic risk because the concentration of ethylbenzene exceeds the Acceptable Daily Intake value.

There are at least two residences within 1/4 mile of the site that presently use groundwater wells for a drinking water source. These wells are not presently affected by the site, however it is projected that local water supplies may be affected in the future by movement of contaminants offsite.

Table 1
RANGE OF CONTAMINANT CONCENTRATIONS AND DISTRIBUTION,
HENFIELD PROPERTY, OLD MILL SITE

Contaminant	Onsite Soil (mg/kg) Surface	Onsite Soil (mg/kg) >1'	Offsite Soil (mg/kg) Surface	Offsite Soil (mg/kg) >1'	Drainageway Sediment (mg/kg)	Drainageway Surface Water (ug/L)	Groundwater (ug/L) Offsite[a] Wells	Groundwater (ug/L) Onsite[a] Wells
ORGANIC								
PNAs	7.4-13,440	0.106-196	1.7-9.29	1.18-36.8	U	U	U	U
Phenols	13-180	2.7-5.4	2.65	U	U	U	U	U
PCBs	0.0025-0.0173	0.003-11	0.0088	0.0814-0.19	0.069-0.248	U	U	U
Phthalates	3.70-3,700	0.91-11.68	0.610	0.66-120	2.94	U	U	56
Pesticides	U	U	0.192-0.735	U	0.0057-7.955	U	U	U
Trichloroethene	1.56-1,220	0.017-570	0.414-3.3	0.0049-0.22	U	22-97	89.9-6,100	1,100
Acetone	U	U	U	0.0518-18	0.032	49-280	U	127- 1,000
Other Chlorinated Ethenes	0.405-554	U	0.005	0.016-0.099	U	7-135	14.9-490	U
Ethyl Benzene	0.019-1,420	U	U	U	U	U	22.2	U
INORGANIC								
Arsenic	102	31	*	*	*	U	122	U
Cadmium	0.47-152	8.7	0.99-1.93	0.57	0.63-1.54	1.1	U	1
Chromium	64-221	*	*	*	*	U	100	11
Lead	59-8,370	72-984	82-153	80	85.1	U	59	U
Nickel	22-353	24-59	21	26.3-29.5	24.7-26.6	U	U	40-45
Selenium	35	2.5-16	0.27-0.74	0.3-1.86	0.3-0.5	U	<2	2
Zinc	110-8,630	147-963	272	119-154	109-165	19-73	U	14-96

U = Undetected.
*Detected but not above background.
[a]Values reported are of dissolved contaminants.

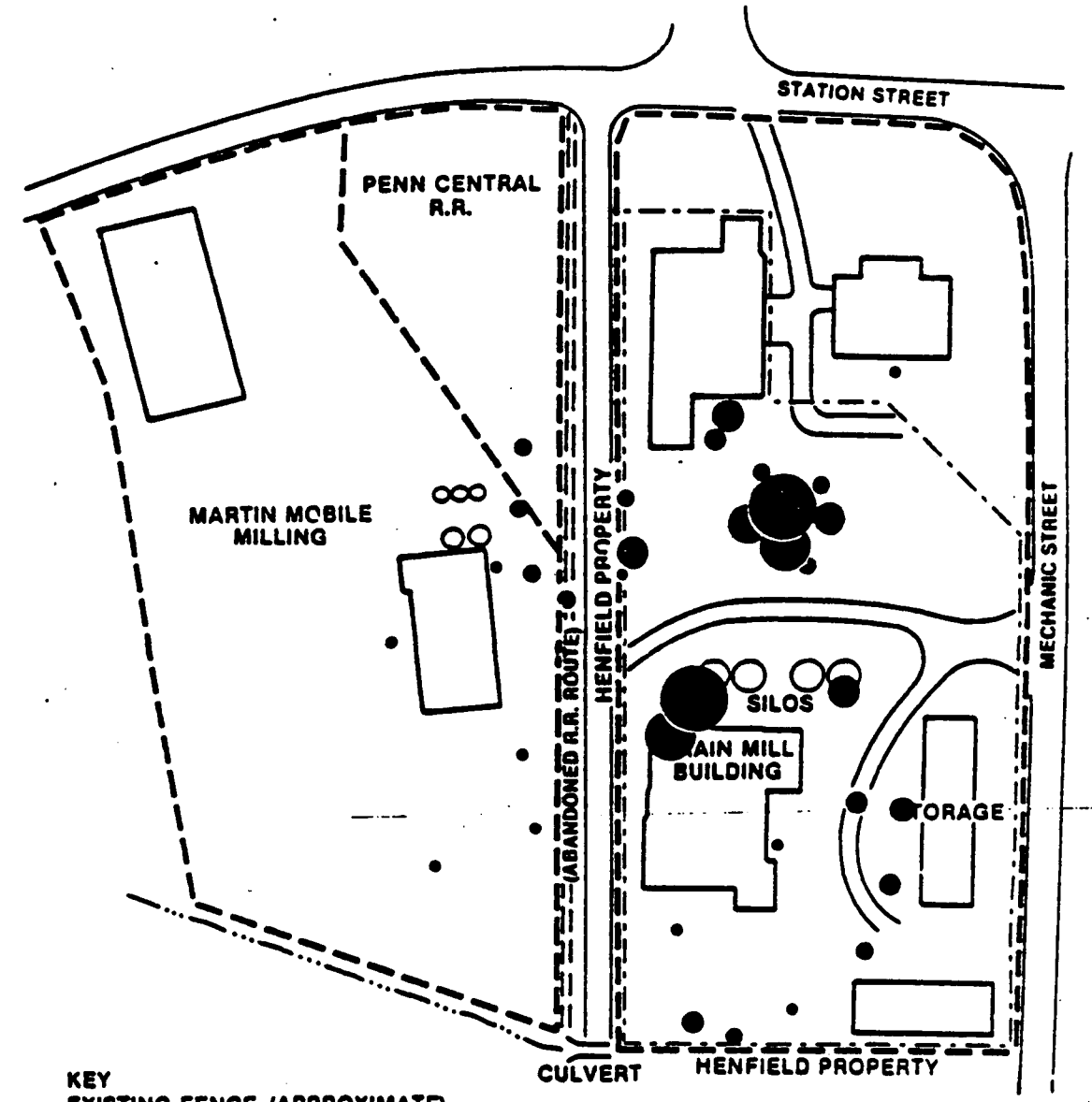
NOTE: Where only one value is given, contaminant was detected in only one sample above background or standard at the concentration shown. Contaminants are those that exceed the upper limit of the 95-percent confidence interval for background concentrations in soil or drinking water standards and criteria in water. Values for soil and sediment reported on a dry weight basis.

e 2

RANGE OF CONTAMINANT C ATIONS AND DISTRIBUTION,
KRAUS PROPERTY, OLD MILL SITE

Contaminant	Onsite Soil (mg/kg)[a] Surface	Onsite Soil (mg/kg)[a] >1'	Drainageway Sediment[a] (ug/kg)	Drainageway Surface Water (ug/L)	Ground-water[b] (ug/L)
ORGANIC					
PHAs	0.809-10	53.884	17.19-23.13	U	0.27-45.75
Phenols	5.5	U	U	U	10-580
PCBs	U	U	0.031	U	U
Phthalates	U	U	U	U	<0.2-<10
Pesticides	U	U	U	U	NA
Benzoic Acid	2.503	U	U	U	NA
Trichloroethene	<0.001	0.0068-0.11	U	U	<5-<100
Acetone	0.0055	0.003-0.125	U	U	<5-800
Chlorinated Ethenes	U	0.0465	U	U	<5-<100
Ethyl Benzene	U	0.0526-0.0686	U	U	<5-8,900
Total Xylenes	U	U	U	U	100-1,000
INORGANIC					
Arsenic	29	37-59	8.2-13.6	10	6-7
Cadmium	0.5-430	0.43	0.18-0.39	U	NA
Chromium	*	*	9.3-18.5	U	<20
Lead	64	110	13.3-20.8	U	<100
Nickel	23-27	24-48	18.8-47.1	U	NA
Selenium	0.25-1.0	0.5-0.7	0.14-0.36	U	<5-6
Zinc	115-274	300	74-138	11-35	8-37

*Detected but below background concentration.
[a]Values are reported on a dry-weight basis.
[b]Values reported are of dissolved contaminants.
K - Compound detected but below quantification limit.
U - Undetected.
NOTE: Value before K is quantification limit.
Where only one value is given, contaminant was detected in only one sample above background or standard at the concentration shown. Contaminants are those that exceed the upper limit of the 95-percent confidence interval for background concentrations in soil or drinking water criteria or standards in water.
NA - Not analyzed for.



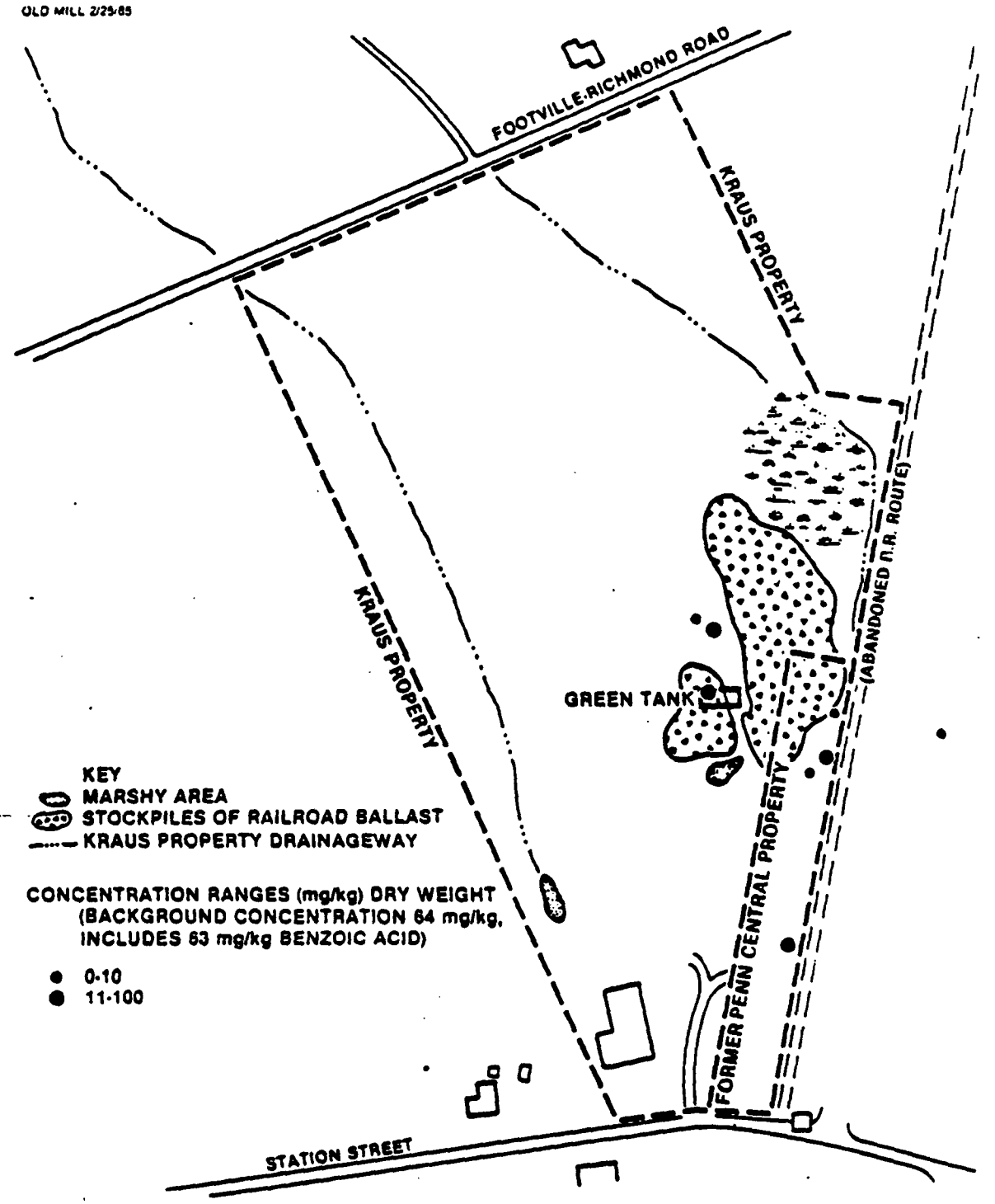
KEY
EXISTING FENCE (APPROXIMATE)
HENFIELD PROPERTY DRAINAGEWAY

CONCENTRATION RANGES (mg/kg) DRY WEIGHT
(BACKGROUND CONCENTRATION 64 mg/kg, INCLUDES 63 mg/kg BENZOIC ACID)

- 0-10
- 11-100
- 101-500
- 501-1,000
- 1,001-2,000
- 2,001-4,000
- 4,001-8,000
- >8,000

0 60 120
SCALE IN FEET
(PROPERTY BOUNDARIES ARE APPROXIMATE)

Figure 2
CUMULATIVE CONCENTRATION (mg/kg) OF VOLATILE AND SEMIVOLATILE ORGANICS IN ONSITE AND OFFSITE SURFACE SOIL
Henfield Property
Old Mill Site



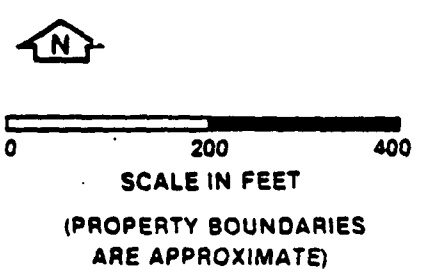
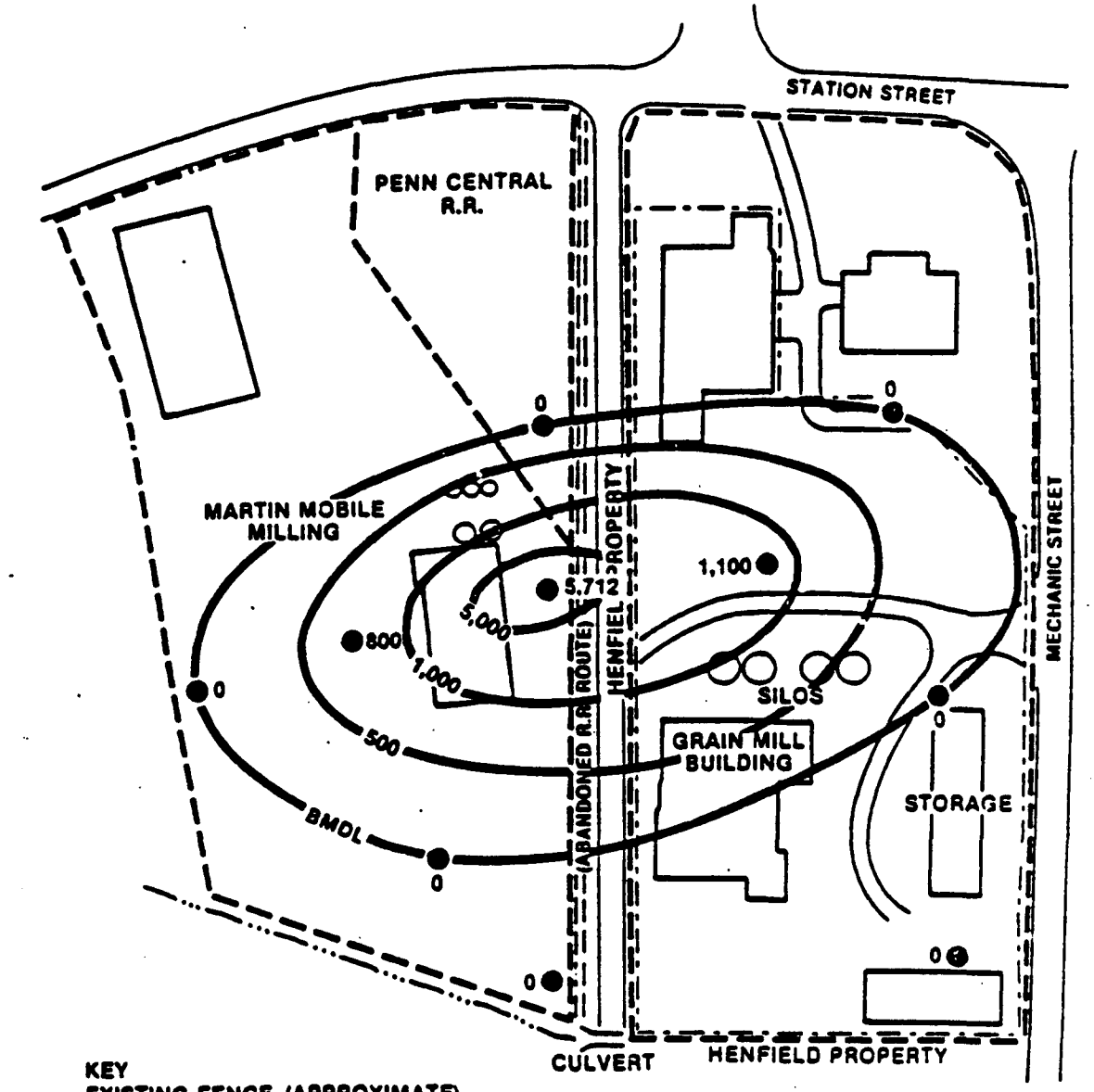


Figure 3
CUMULATIVE CONCENTRATION (mg/kg) OF VOLATILE AND SEMIVOLATILE ORGANICS IN SURFACE SOIL
Kraus Property
Old Mill Site

OLD MILL 2/25/85

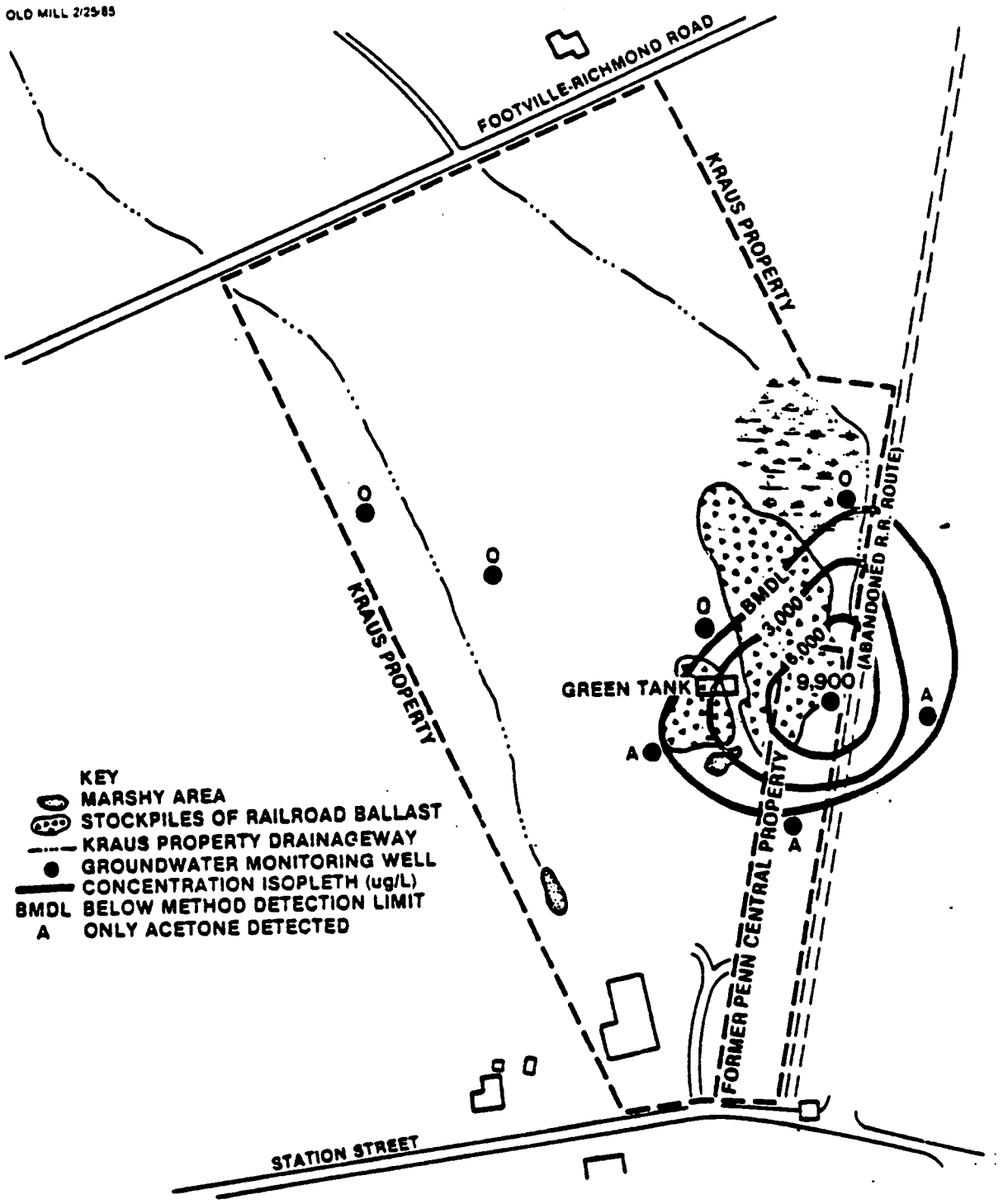


KEY
- EXISTING FENCE (APPROXIMATE)
- HENFIELD PROPERTY DRAINAGEWAY
- GROUNDWATER MONITORING WELL
- CONCENTRATION ISOPLETH (ug/L)

BMDL BELOW METHOD DETECTION LIMIT

0 60 120
SCALE IN FEET
(PROPERTY BOUNDARIES ARE APPROXIMATE)

Figure 4
CUMULATIVE CONCENTRATION OF VOLATILE ORGANICS IN SHALLOW WELLS, DECEMBER 1984
Henfield Property
Old Mill Site



(PROPERTY BOUNDARIES ARE APPROXIMATE)

Figure 5
CUMULATIVE CONCENTRATION OF VOLATILE ORGANICS IN SHALLOW WELLS, DECEMBER 1984
Kraus Property
Old Mill Site

Surface Water and Sediment Contamination

The drainageway originating at the southwest corner of the Henfield property has only limited organic contamination. In the Kraus property drainageway, low levels of organic contamination are present in the sediment. There is a low probability of human health risks from exposure to surface water because there are few potential receptors, and the drainageways only intermittently contain water. Ingestion of 0.1 to 1.0 grams per day for 70 years of contaminated sediment on the Kraus property would result in a potential excess lifetime cancer risk of about 10^{-4}.

ENFORCEMENT (See Attachment)

ALTERNATIVES EVALUATION

The major objective of the FS was to evaluate remedial alternatives using a cost-effective approach consistent with the goals and objectives of CERCLA. The National Oil and Hazardous Substances Contingency Plan (NCP), 40 CFR Part 300.68, defines a cost-effective remedial action as "the lowest cost alternative that is technologically feasible and reliable and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare or the environment". The NCP outlines the procedures and criteria to be used in selecting the cost-effective alternative.

An environmental assessment presented in Chapter 2 of the FS determined that both source control and offsite (management of migration) measures are necessary. A comprehensive list of appropriate remedial response technologies was identified for source and migration control, and these technologies were screened based on the characteristics of the site, the characteristics of the waste materials at the site, and the ability of the technology to address criteria such as adequate protection of human health and the environment and minimization of contaminant migration. These technologies were further screened on the basis of technical feasibility, including an assessment of performance, reliability, implementability and safety, and on the basis of order of magnitude costs. The following technologies were considered applicable to site conditions and problems.

- Soil/Sediment

  Multimedia cap
  Clay cap (non-infiltraton reduction cap)
  Landfill
  Incineration

- Groundwater

  Extraction system
  Carbon adsorption
  Publicly owned treatment works (POTW)
  Public water supply
  Direct discharge

Based on the applicable technologies that were carried forward from this initial screening, alternatives were developed to address the overall contamination at the site (see Table 3). This initial screening is consistent with 300.68(h) of the NCP. These alternatives were generally evaluated and compared to public health and environmental criteria. No alternatives were eliminated from further consideration based on this step.

DETAILED ANALYSIS OF ALTERNATIVES

All alternatives (except the limited and no-action alternatives) involve groundwater treatment (offsite measures) and soil removal or containment (source control measures). The effectiveness and ramifications of each alternative were evaluated on the basis of technical and environmental considerations.

For the technical analysis, each alternative was evaluated on performance, reliability, effectiveness, and implementability. For the environmental and public health analysis, each alternative was evaluated for compliance with Federal and State environmental laws and regulations, protection of human health and welfare, and effects on institutional parameters in order to screen out those alternatives which may not meet public health and environmental goals. The detailed cost analysis for each alternative includes estimates of operation and maintenance (O&M) costs, capital costs, and development of present worth costs (Tables 4 through 11). The expected accuracies for cost estimates are within +50 and -30 percent of the actual cost. This detailed analysis of a limited number of alternatives is consistent with Section 300.68(i) of the NCP.

Using the information developed in the detailed analysis, alternatives were compared within categories to eliminate those which were less cost-effective. Twelve of the twenty alternatives were eliminated from further consideration including:

Alternatives involving direct discharge or treatment of the groundwater at a POTW. Direct discharge of contaminated extracted groundwater to the drainageways at the site, to Rock Creek, and/or to the Grand River is unacceptable from an environmental, institutional, and public health viewpoint because of the effluent concentrations. Contaminants would be transferred from one environmental medium (groundwater) to another (surface water). Treatment of extracted groundwater would remove the contaminants from the environment, however, treatment at a POTW is more expensive than onsite treatment: annual O&M costs are about $340,000 per year for the POTW and only about $8,000 per year for onsite treatment. The transportation requirements of this technology are also a major disadvantage.

Alternatives involving offsite soil incineration. The capital cost to transport and incinerate the soil is much greater (order of magnitude greater) than all other alternatives. Although removal and subsequent destruction of organic contaminants is permanent and irreversible, the metals which may be physically bound to the ash may require that the ash be disposed of at a RCRA-licensed landfill. The only RCRA incineration facility identified within the geographical area (300 mile radius) of the site will only accept soil which is packed in drums. Also, the facility can process 160 drums per month (45 yd^3 per month), and has no storage capacity. To incinerate 95 percent (4,300 yd^3) or 100 percent

Table 3
ASSEMBLED ALTERNATIVES FOR OLD MILL SITE

Alternative Category	Number	Technology For: Soil/Sediment[a]	Groundwater[b]	Surface Water
1. Complete Removal	1A	Offsite landfill	RCRA treatment facility	No action
	1B	Offsite incineration	RCRA treatment facility	No action
2. Attains Standards	2A	Multimedia cap	Onsite treatment[c]	No action
	2B	Multimedia cap	Direct discharge	No action
	2C	Multimedia cap	POTW	No action
3. Exceeds Standards	3A	Onsite incineration	Onsite treatment[c]	No action
	3B	Onsite incineration	Direct discharge	No action
	3C	Onsite incineration	POTW	No action
	3D	Onsite landfill	Onsite treatment[c]	No action
	3E	Onsite landfill	Direct discharge	No action
	3F	Onsite landfill	POTW	No action
4. CERCLA	4A	Clay cap	Public water supply	No action
	4B	Clay cap	Direct discharge	No action
	4C	Clay cap	POTW	No action
	4D	Clay cap	Onsite treatment[c]	No action
5. Limited Action	5	Fence	Monitor	Monitor
6. No Action	6	No action	No action	No action

[a]Landfill and incineration technologies will be preceded by excavation of soil.
[b]Groundwater treatment will be preceded by installation of French drains and/or extraction wells.
[c]Onsite treatment technologies are air stripping and/or direct contact carbon adsorption.

Table 4 Cost Breakdown for Assembled Alternative 1A

Assembled Alternative 1A : Offsite RCRA Landfill, 100% Removal, Offsite RCRA Groundwater Treatment

Remedial Action	Cost Estimates			
	Construction	Capital (a)	Annual Operation and Maintenance	Present Worth (b)
Soil				
Surveying	$408,000	$563,000	$0	$563,000
Mobilization	$479,000	$662,000	$0	$662,000
Excavation	$385,000	$532,000	$0	$532,000
Transport/Manifest	$581,000	$802,000	$0	$802,000
Disposal	$3,123,000	$4,309,000	$0	$4,309,000
Backfill and Revegetate	$211,000	$291,000	$0	$291,000
Demolition	$433,000	$598,000	$0	$598,000
Closure	$10,000	$14,000	$0	$14,000
Groundwater				
Surveying	$94,000	$130,000	$0	$130,000
Mobilization	$26,000	$36,000	$0	$36,000
Construct Extraction System	$118,000	$163,000	$0	$163,000
Extraction System (O & M)	$0	$0	$2,000	$21,000
Transport/Manifest (O & M)	$0	$0	$6,728,000	$63,424,000
Groundwater Monitoring	$24,000	$32,000	$0	$32,000
Closure/Monitoring	$10,000	$14,000	$37,000	$363,000
SUBTOTAL	$5,903,000	$8,146,000	$6,767,000	$71,937,000
Replacement Costs (c)				$88,000
TOTAL				$72,025,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs. Indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 20 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.39, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 5 Cost Breakdown for Assembled Alternative 2A

Assembled Alternative 2A : Multimedia Cap, No Removal, Onsite Groundwater Treatment

Remedial Action	Cost Estimates			
	Construction	Capital (a)	Annual Operation and Maintenance	Present Worth (b)
Soil				
Surveying	$410,000	$565,000	$0	$565,000
Mobilization	$622,000	$859,000	$0	$858,000
Fencing	$9,000	$12,000	$0	$12,000
Contouring	$13,000	$19,000	$0	$19,000
Cap Construction	$224,000	$310,000	$4,000	$345,000
Demolition	$433,000	$598,000	$0	$598,000
Closure/Monitoring	$1,000	$1,000	$0	$1,000
Groundwater				
Surveying	$69,000	$95,000	$0	$95,000
Mobilization	$47,000	$65,000	$0	$65,000
Construct Extraction System	$118,000	$163,000	$0	$163,000
Extraction System (O & M)	$0	$0	$2,000	$21,000
Treatment System	$55,000	$76,000	$0	$76,000
Treatment System (O & M)	$0	$0	$6,000	$55,000
Groundwater Monitoring	$24,000	$32,000	$0	$32,000
Closure/Monitoring	$13,000	$18,000	$37,000	$367,000
SUBTOTAL	$2,038,000	$2,812,000	$49,000	$3,272,000
Replacement Costs (c)				$106,000
TOTAL				$3,378,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs, indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 20 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.39, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 6 Cost Breakdown for Assembled Alternative 2D

Assembled Alternative 2D : 95% removal, Offsite RCRA Landfill, Onsite Groundwater Treatment

Remedial Action	Cost Estimates			
	Construction	Capital (a)	Annual Operation and Maintenance	Present Worth
Soil				
Surveying	$408,000	$563,000	$0	$563,000
Mobilization	$479,000	$662,000	$0	$662,000
Excavation	$246,000	$340,000	$0	$340,000
Transport/Manifest	$140,000	$193,000	$0	$193,000
Disposal	$752,000	$1,037,000	$0	$1,037,000
Backfill	$44,000	$61,000	$0	$61,000
Fencing	$9,000	$12,000	$0	$12,000
Demolition	$433,000	$598,000	$0	$598,000
Closure/Monitoring	$1,000	$1,000	$0	$1,000
Groundwater				
Surveying	$69,000	$95,000	$0	$95,000
Mobilization	$47,000	$65,000	$0	$65,000
Construct Extraction System	$118,000	$163,000	$0	$163,000
Extraction System (O & M)	$0	$0	$2,000	$21,000
Treatment System	$55,000	$76,000	$0	$76,000
Treatment System (O & M)	$0	$0	$6,000	$55,000
Groundwater Monitoring	$24,000	$32,000	$0	$32,000
Closure/Monitoring	$13,000	$18,000	$37,000	$367,000
SUBTOTAL	$2,838,000	$3,917,000	$45,000	$4,341,000
Replacement Costs (c)				$98,000
TOTAL				$4,439,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs, indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 20 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.39, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 7 Cost Breakdown for Assembled Alternative 2F

Assembled Alternative 2F : 95% removal, Onsite Landfill, Onsite Groundwater Treatment

Remedial Action	Cost Estimates			
	Construction	Capital (a)	Annual Operation and Maintenance	Present Worth (b)
Soil				
Surveying	$408,000	$563,000	$0	$563,000
Mobilization	$479,000	$662,000	$0	$662,000
Fencing	$9,000	$12,000	$0	$12,000
Excavation	$246,000	$340,000	$0	$340,000
Transport/Manifest	$14,000	$20,000	$0	$20,000
Landfill Construction	$564,000	$779,000	$0	$779,000
Backfill	$44,000	$61,000	$2,000	$80,000
Demolition	$433,000	$598,000	$0	$598,000
Closure	$10,000	$14,000	$0	$14,000
Groundwater				
Surveying	$69,000	$95,000	$0	$95,000
Mobilization	$47,000	$65,000	$0	$65,000
Construct Extraction System	$118,000	$163,000	$0	$163,000
Extraction System (O & M)	$0	$0	$2,000	$21,000
Treatment System	$55,000	$76,000	$0	$76,000
Treatment System (O & M)	$0	$0	$6,000	$55,000
Groundwater Monitoring	$24,000	$32,000	$0	$32,000
Closure/Monitoring	$13,000	$18,000	$37,000	$367,000
SUBTOTAL	$2,535,000	$3,498,000	$47,000	$3,941,000
Replacement Costs (c)				$106,000
TOTAL				$4,047,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs. Indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 30 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.38, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 8 Cost Breakdown for Assembled Alternative 3D

Assembled Alternative 3D : Onsite Landfill, 100% Removal, Onsite Groundwater Treatment

Remedial Action	Cost Estimates: Construction	Capital (a)	Annual Operation and Maintenance	Present Worth (b)
Soil				
Surveying	$408,000	$563,000	$0	$563,000
Mobilization	$479,000	$662,000	$0	$662,000
Fencing	$9,000	$12,000	$0	$12,000
Excavation	$385,000	$532,000	$0	$532,000
Transport/Manifest	$59,000	$81,000	$0	$81,000
Landfill Construction	$2,340,000	$3,229,000	$0	$3,229,000
Backfill & Revegetate	$116,000	$160,000	$2,000	$184,000
Demolition	$433,000	$598,000	$0	$598,000
Closure	$10,000	$14,000	$0	$14,000
Groundwater				
Surveying	$69,000	$95,000	$0	$95,000
Mobilization	$47,000	$65,000	$0	$65,000
Construct Extraction System	$118,000	$163,000	$0	$163,000
Extraction System (O & M)	$0	$0	$2,000	$21,000
Treatment System	$55,000	$76,000	$0	$76,000
Treatment System (O & M)	$0	$0	$6,000	$55,000
Groundwater Monitoring	$24,000	$32,000	$0	$32,000
Closure/Monitoring	$13,000	$18,000	$37,000	$367,000
SUBTOTAL	$4,366,000	$6,300,000	$47,000	$6,748,000
Replacement Costs (c)				$106,000
TOTAL				$6,855,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs. Indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 20 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.39, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 9 Cost Breakdown for Assembled Alternative 4D

Assembled Alternative 4D : Clay Cap, No Removal, Onsite Groundwater Treatment

Remedial Action	Cost Estimates			
	Construction	Capital (a)	Annual Operation and Maintenance	Present Worth (b)
Soil				
Surveying	$410,000	$565,000	$0	$565,000
Mobilization	$622,000	$858,000	$0	$858,000
Fencing	$9,000	$12,000	$0	$12,000
Contouring	$13,000	$19,000	$0	$19,000
Cap Construction	$164,000	$226,000	$4,000	$261,000
Demolition	$433,000	$598,000	$0	$598,000
Closure/Monitoring	$1,000	$1,000	$0	$1,000
Groundwater				
Surveying	$69,000	$95,000	$0	$95,000
Mobilization	$47,000	$65,000	$0	$65,000
Construct Extraction System	$118,000	$163,000	$0	$163,000
Extraction System (O & M)	$0	$0	$2,000	$21,000
Treatment System	$55,000	$76,000	$0	$76,000
Treatment System (O&M)	$0	$0	$6,000	$55,000
Groundwater Monitoring	$24,000	$32,000	$0	$32,000
Closure/Monitoring	$13,000	$18,000	$37,000	$367,000
SUBTOTAL	$1,977,000	$2,728,000	$49,000	$3,188,000
Replacement Costs (c)				$106,000
TOTAL				$3,294,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs. Indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 20 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.39, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 10 Cost Breakdown for Assembled Alternative 5

Assembled Alternative 5 : Limited Action

Remedial Action	Cost Estimates			
	Construction	Capital (a)	Annual Operation and Maintenance	Present Worth (b)
Soil				
Surveying	$1,000	$2,000	$0	$2,000
Fencing	$9,000	$12,000	$0	$12,000
Surface Water Control	$0	$0	$0	$0
Safety	$4,000	$5,000	$0	$5,000
Groundwater Monitoring	$24,000	$32,000	$24,000	$259,000
SUBTOTAL	$38,000	$52,000	$24,000	$278,000
Replacement Costs (c)				$19,000
TOTAL				$297,000

(a) Capital cost is calculated as construction cost multiplied by 1.38 to include indirect capital costs, indirect capital costs include 13 percent for engineering and design, 5 percent for legal fees/permit costs, and 20 percent for contingencies.

(b) Present worth at 10 percent interest over 30 years. Uniform series present worth factor 9.4269.

(c) Replacement cost at 10, 20, and 30 years calculated by using present worth factors 0.39, 0.15, and 0.06 respectively. The cost of cap replacement at 30 years is included.

Table 11 Cost Breakdown for Assembled Alternative 6

Assembled Alternative 6 : No Action

Remedial Action	Cost Estimates			
	Construction	Capital	Annual Operation and Maintenance	Present Worth
Soil	$0	$0	$0	$0
Groundwater	$0	$0	$0	$0
TOTAL	$0	$0	$0	$0

(18,300 yd^3) of the soil contaminants would require 10 or 20 years. Therefore, although the long term effectiveness may be beneficial, the length of time for implementation of such action and the cost of incineration do not make this an acceptable alternative.

Alternatives involving on-site incineration. The capital cost is greater than twice the cost of all other on-site alternatives. The ash itself may be a hazardous substance, and may therefore have to be disposed of at a RCRA facility. The additonal cost of landfilling the resulting ash has not been included in this estimate. This cost will substantially increase the overall cost if landfilling is necessary. The effectiveness and availability of an on-site incinerator is questionable. Presently there are few mobile incinerators. It is estimated that incineration of 100 percent of the contaminated soil would require 32 months of continuous operation after the incinerator becomes available. Incineration of 95 percent of the soil contamination would require 16 months after the incinerator becomes available.

Treatment of groundwater on site was assessed for air stripping and activated carbon. Both are demonstrated, effective treatment technologies, both remove the contaminants of concern at the site, and both have comparable capital costs. Because the O&M cost and effort necessary to maintain the air stripper exceed that of the activated carbon system, the preferred treatment technology is activated carbon.

DETAILED DESCRIPTION/EVALUATION OF ALTERNATIVES

A comparative evaluation of the remaining alternatives is presented below and is summarized in Table 12. The environmental laws which may be applicable or relevant to the remedial alternatives are discussed in the section entitled Consistency With Other Environmental Laws.

Alternative 1A

This alternative consists of removal and off-site disposal of contaminated soil and groundwater. This alternative exceeds relevant and applicable standards.

To remove soil to background levels would require the removal of 18,300 yd^3 of soil over 2.3 acres down to an average depth of 5 feet. In addition, approximately 78 yd^3 of contaminated sediment would have to be removed. Approximately 760 million gallons of groundwater will be extracted over a period of 90 years to obtain groundwater background concentration levels. The buildings on the site will be demolished and transported to an appropriate offsite disposal facility. All excavated soil will be transported to a permitted hazardous waste landfill and contaminated groundwater will be extracted and transported to a permitted treatment facility. All contaminated soils will be placed in cells which meet RCRA requirements. (The cost estimate includes the incremental cost of construction of a double-lined versus a single-lined cell at a licensed landfill). The transportation costs of liquid and soil to off-site facilities are estimated by assuming the facility to be within a 300-mile radius of the site. There are at least three hazardous waste landfills within this area.

TABLE 12
FINAL COMPARISON MATRIX

Assembled Alternative	EVALUATION CRITERIA: TECHNICAL: Performance	TECHNICAL: Reliability	TECHNICAL: Implementability	TECHNICAL: Safety	ENVIRONMENTAL: Short Term (Construction)	ENVIRONMENTAL: Long Term (Operation)	ENVIRONMENTAL: Institutional	ENVIRONMENTAL: Public Health	Cost ($1,000): Present Worth	Cost ($1,000): Capital Cost	Cost ($1,000): O&M Cost
Complete Removal 1A: Offsite landfill; Offsite groundwater treatment	Contamination removed. Indefinite useful life. Removal to background levels.	Technologies demonstrated.	Short implementation for soil removal. Prolonged groundwater extraction to background. Possible spillage during transport.	Concern due to operation of onsite heavy equipment and building demolition. Normal safety procedures sufficient.	Noise and dust generated—effects mitigated. Increased truck traffic.	O&M required for prolonged period on groundwater extraction system. Aesthetics improved.	Environmental laws complied with. No permits required. No post closure land use restrictions. Contaminated materials transported across political jurisdictions.	All contaminants removed. Spillage may occur during transport. Contaminant migration halted.	12,020	8,145	6,362
Attains Standards 2A: Multimedia cap; Onsite groundwater treatment	Receptors isolated from soil contaminants. Groundwater removal to RBA contamination levels or background.	Technologies demonstrated. Proven performance. Minimal O&M.	Easy installation. Short implementation time for cap. Prolonged groundwater extraction time.	Concern due to building demolition and operation of onsite heavy equipment. Normal safety procedures sufficient.	Noise and dust generated—effects mitigated. Increased truck traffic.	Soil contamination remains. O&M required for extraction system, treatment system, and cap for prolonged period. Minimal O&M on cap. Aesthetics improved.	Permanent land use restrictions. NPDES permit required. Environmental laws complied with.	Receptors isolated from soil contaminants. Groundwater contaminants decreased to acceptable levels. Contaminant migration restricted.	3,375	2,800	49
Attains Standards 2B: 95% soil contaminant removal; Offsite landfill; Onsite groundwater treatment	Most contaminants removed from soil. Groundwater removal to RBA contamination levels or background.	Technologies demonstrated. Proven performance. Minimal O&M.	Easy installation. Prolonged groundwater extraction time. Possible spillage during transport.	Concern due to building demolition and operation of onsite heavy equipment. Normal safety procedures sufficient.	Noise and dust generated—effects mitigated. Increased truck traffic.	Some soil contamination remains. O&M required for extraction system and treatment system for prolonged period. Aesthetics improved.	Temporary aquifer use restrictions. Environmental laws complied with. Contaminated materials transported across political jurisdictions. NPDES and landfill permits required.	Soil contaminants decrease to de minimis (very low) levels. Groundwater contaminants decreased to acceptable levels. Contaminant migration restricted. Spillage may occur during transport.	4,440	3,920	45
Attains Standards 2F: 95% soil contaminant removal; Onsite landfill; Onsite groundwater treatment	Most contaminants removed from soil. Receptors isolated from remaining soil contaminants. Groundwater removed to RBA contamination levels or background.	Technologies demonstrated. Facilities available. Minimal O&M.	Short implementation period for landfill. Impeded by presence of Class 2 vulnerable aquifer. Groundwater extraction and treatment for prolonged time period.	Concern due to building demolition and operation of onsite heavy equipment. Normal safety procedures sufficient.	Noise and dust generated—effects mitigated. Increased truck traffic.	Some soil contamination remains. O&M required for extraction system, treatment system and landfill for prolonged period. Aesthetics improved.	Temporary aquifer use restrictions. Environmental laws complied with. Post-closure land use restrictions. NPDES and landfill permits required.	Soil contaminants decrease to de minimis (very low) levels. Groundwater contaminants decreased to acceptable levels. Contaminant migration restricted.	4,050	3,490	48
Exceeds Standards 3B: Onsite landfill; Onsite treatment	Soil contamination removed to background. Groundwater contamination treated to 10^{-7} or background.	Technologies demonstrated. Facilities available. Minimal O&M.	Short implementation period for landfill. Impeded by presence of Class 2 vulnerable aquifer. Prolonged groundwater extraction and treatment.	Concern due to building demolition and operation of onsite heavy equipment. Normal safety procedures sufficient.	Noise and dust generated—effects mitigated. Increased truck traffic.	O&M for extraction system, treatment system, cap, and landfill required for prolonged period. Aesthetics improved.	Environmental laws complied with. Permanent land use restrictions. NPDES and landfill permits required.	All contaminants removed to background or 10^{-7}. Receptors isolated from soil contaminants. Contaminant migration intercepted.	6,850	6,340	48
RCRA 4B: Clay cap; Onsite groundwater treatment	Receptors isolated from soil contaminants. Contaminated groundwater treated.	Technologies demonstrated. Facilities available. Minimal O&M.	Easy installation. Short implementation time for cap. Groundwater extraction and treatment for prolonged period.	Concern due to building demolition and operation of onsite heavy equipment. Normal safety procedures sufficient.	Noise and dust generated—effects mitigated. Increased truck traffic.	O&M for extraction system, treatment system, and cap required for prolonged period. Aesthetics improved.	Environmental laws may be complied with. NPDES permit required. Permanent land use restrictions.	Receptors isolated from soil contaminants. Groundwater contaminants decreased. Contaminant migration intercepted.	3,290	2,330	49
Limited Action 5: Fence/monitor	Contaminants remain. Limited direct contact with soil.	Technologies demonstrated.	Short implementation period.	No safety hazards due to implementation.	Limited noise and dust—effects mitigated.	Fence O&M required.	No environmental laws complied with. Permanent land use restrictions required.	No contaminants removed. Contaminant migration will continue.	390	46	32
No Action 6	Contaminants remain. Exposure not reduced.	No technologies implemented.	No implementation.	No implementation.	None.	None.	No environmental laws complied with. Permanent land use restrictions required.	Contaminants not removed. No hindrance to direct contact. Contaminant migration will continue.	0	0	0

Removal and disposal of all solids can be implemented quickly and easily with conventional construction methods. The technical feasibility of groundwater extraction and offsite disposal is well established, however, because the shallow aquifer at the Old Mill site exhibits low hydraulic conductivity and permeability, groundwater extraction will be a prolonged process. The length of time required to extract groundwater limits the implementability of this option.

The exposure pathways of direct contact and ingestion for soil and groundwater are eliminated through source control (removal and disposal of 18,300 yd^3 of contaminated soil) and offsite or management of migration measures (removal and treatment of 760 million gallons of contaminated groundwater). All contaminants will be removed to background levels. Because it entails the greatest amount of off-site hauling, this alternative presents the greatest possibility of human exposure during hauling. No post-closure institutional restrictions will be necessary.

Of the final alternatives evaluated, this has the highest cost (total estimated capital cost $8,145,000 and present worth cost $72,020,000). The greatest portion of this capital cost is associated with transportation and disposal of the contaminated materials ($5,934,000).

Alternative 2A

This alternative consists of construction of a multimedia RCRA compliant cap over the contaminated portions of the site, and extraction and on-site groundwater treatment using granular activated carbon (GAC). This alternative will comply with applicable and relevant standards.

The groundwater extraction system for this alternative is the same as for Alternative 1A. Contaminated groundwater will be pumped to a sump and then through a series of columns packed with GAC. Water leaving the bottom of the last column would flow by gravity to an offsite drainage ditch.

Following building demolition and disposal, offsite contaminated soil adjacent to the Henfield property and contaminated sediment in the drainageways will be excavated and consolidated on the site to fill the voids left by removal of the buildings. The site will be compacted and graded (both properties) to promote runoff from the finished cap, and to provide clearance so the edge of the four foot thick cap is approximately level with the surrounding ground surface. Site closure involves fencing the capped areas, setting land use restrictions on the properties, and installing post-closure monitoring wells. Capping contaminated soil in accordance with RCRA standards minimizes the potential for direct exposure. The cap will last indefinitely if properly maintained. However, contaminants would still be present for possible future release to groundwater. Carbon adsorption can effectively remove all the organic contaminants of concern found in groundwater at the Old Mill site. Contaminants are removed from the environment and are destroyed in the process of carbon regeneration.

The exposure pathway of direct contact and ingestion for soil and groundwater will be decreased by this alternative. The groundwater quality will not be restored to background or 10^{-6} levels, and the source of contamination and possible leaching of contaminants into the groundwater remains indefinitely. Because of the low transmissivity and yield of this aquifer, flushing occurs slowly. Infiltration through the cap and horizontal flow through the contaminated soil will slowly leach contaminants indefinitely. The groundwater seasonally rises to the ground surface and comes in contact with the contaminated soil. This causes leachate production from the unsaturated zone.

The present worth cost of this alternative is $3,375,000.

Alternative 2D

This alternative consists of removal and off-site disposal in a RCRA compliant facility of 95 percent of the contaminant mass in the soil, and extraction and on-site groundwater treatment using GAC. This alternative will comply with applicable and relevant federal standards.

The groundwater extraction and treatment system is the same as for Alternative 2A.

This option requires removal of 75 percent less soil as that removed in the complete soil removal alternative (4,300 yd^3), but this would effectively remove the majority of contaminant mass in the soil. The 5 percent contaminant mass remaining in the soil will produce no impact on groundwater cleanup during the extraction period, and is representative of background or 10^{-6} carcinogenic risk levels for soil ingestion.

The exposure pathway of direct contact and ingestion will be greatly reduced by this alternative. Removal of 95% of the soil contamination will effectively prevent exposure to hazardous material at the site.

The present worth cost of this alternative is $4,440,000.

Alternative 2F

This alternative consists of excavation and on-site containment of 95 percent of the contaminant mass in the soil, and extraction and on-site groundwater treatment using GAC. This alternative complies with applicable and relevant standards.

The groundwater extraction and treatment system is the same as for Alternative 2A.

This option requires the same soil excavation as Alternative 2D. The difference is that the soil will be fully contained in a landfill which will be constructed on the site (Kraus property). The landfill will be constructed to meet RCRA criteria including double-lined bottoms and sides, a double-leachate collection system and a multimedia cap. Collected leachate will be treated on-site using the GAC system. Site closure involves fence construction around the landfill, implementation of land use restrictions, and installation of monitoring wells.

On-site landfilling prevents the spread of and exposure to hazardous materials. The double liner and cap effectively contain contaminated materials. However, the presence of a Class 2 (groundwater currently used or potentially available for drinking water or other beneficial use) aquifer may limit the feasibility of locating such a landfill. Since the groundwater table seasonally rises to the ground surface, the integrity and effectiveness of an on-site landfill may become questionable. In addition, it is not recommended that a landfill be located in an area of fractured bedrock. The bedrock in the vicinity of the site is known to be fractured.

The present worth cost of this alternative is $4,050,000.

Alternative 3D

This alternative consists of removal and on-site containment of all contaminated soil, and extraction and on-site groundwater treatment using GAC. This alternative exceeds all applicable and relevant standards.

This alternative is the same as Alternative 2F except that 100 percent rather than 95 percent of the soil is removed and contained on the Kraus property.

The present worth cost of this alternative is $6,850,000.

Alternative 4D

This alternative consists of construction of a permeable cap over the contaminated portions of the site, and extraction and on-site groundwater treatment. Implementation of this alternative will meet the goals of CERCLA, but may not comply with applicable and relevant standards.

The environmental and public health aspects of this alternative are the same as Alternative 2A except that the cap does not reduce infiltration into the soil. This results in a greater infiltration rate and subsequently greater leachate produced to enter the groundwater. The groundwater must be extracted for over 700 years in order to restore groundwater quality to 10^{-6} levels for constituents of concern, and the source of contamination remains indefinitely.

The present worth cost of this alternative is $3,290,000.

Alternative 5

This alternative includes construction of a site fence, and installation of a groundwater monitoring system and is considered a limited action alternative.

Total fencing is estimated to be 1,400 linear feet. Migration of groundwater will be monitored. The rate and direction of migration will be determined, and an extensive pollutant fate analysis will be performed to determine the potential for adversely affecting receptors.

This alternative will temporarily minimize the direct contact threat. The contaminated groundwater will continue to migrate.

The present worth cost of this alternative is $390,000.

Alternative 6

Under this alternative no further remedial actions will be taken at the site. The threats to public health and the environment will remain.

COMMUNITY RELATIONS

There has been considerable public interest in the Old Mill site throughout the RI/FS. Several public meetings have been held, and there have been numerous letters and phone calls related to the site. Generally, the meetings have drawn about 50-75 people (Rock Creek has a population of about 650) and have lasted about three hours, with most of the time devoted to questions and answers. Media coverage has been in the county papers and on the local radio station.

The most intense concern has been expressed by the Rock Creek Hazardous Waste Committee. Three members (one is also a member of the town council) have generated the majority of inquiries, although other residents and local officials have occasionally inquired about the status of the RI/FS or about specific technical issues. The committee also directs numerous inquiries to the county health department, the county disaster services office, and the local office of the U.S. Congressional Representative.

Many issues of concern have evolved during the RI/FS, however, the quality of local drinking water has been and continues to be an issue of primary concern. In addition, many people have expressed frustration with the length of time required for the RI/FS.

Specifically, some residents have requested that immediate actions be taken to restrict access to the entire site, that the on-site buildings be demolished, that a tank on-site be removed (the site owner has since removed the tank), and that the site receive "no less than total cleanup." The last request was expressed as a demand for U.S. EPA action. Many people have also expressed concern about potential for future migration of contamination.

Many of these concerns were expressed during the public comment period for the RI/FS, and have been addressed by the U.S. EPA in the "Responsiveness Summary". The public comment period was extended to last over 4-1/2 weeks due to the high level of citizen concern and involvement. The citizens appear to still believe that this period was inadequate and indications are such that the community does not feel that the recommended cleanup will be adequate.

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

It is the recommendation of this document that the technical aspects of the remedial alternative implemented at the Old Mill site be consistent with other applicable and relevant environmental laws. Other environmental laws which may be applicable or relevant to the remedial alternatives evaluated in the FS are the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Safe Drinking Water Act and the National Environmental Policy Act (NEPA).

The provisions of RCRA applicable to remediation at Old Mill would be the 40 CFR Part 264 technical standards for closure, and the Subpart F, Groundwater Protection standards. RCRA requires that contaminated soil either be removed to background or other standard protective of human health and environment (closure as a storage unit by removal), or capped (closure in place as a landfill).

The capping alternatives evaluated in the FS are consistent with those actions which would be taken during "closure" of a RCRA land disposal facility. The alternatives which fully contain the contaminated soil on-site are consistent with those actions necessary to build a new hazardous waste landfill, and to close such a landfill. The complete soil removal alternative evaluated in the FS is consistent with those actions which would be taken during closure of a RCRA storage facility. The 95% removal alternative evaluated in the FS is also consistent with those actions which would be taken during closure of a RCRA storage facility, because even though all hazardous waste residues will not have been removed, they will have been removed to levels adequate to protect public health and the environment.

It has been determined that removal of 100 percent of the soil contaminant mass would constitute removal to background levels and that removal of 95 percent of the contaminant mass would constitute removal to levels adequate to protect public health and the environment. With the 95 percent removal option, for the volatile compounds, the average concentrations remaining are below the 10^{-6} carcinogenic risk value for soil ingestion and contact but above background values. For the base/neutral (B/N) compounds, the average concentrations remaining are within the range of the 10^{-4} to 10^{-5} carcinogenic risk levels depending on the compound. Background concentration in the near vicinity of the site (e.g. adjacent railroad bed) also fall within this range (1.1-1.7 mg/kg). For example, for Benzo(a)Pyrene, a B/N compound of concern, the average concentration remaining in the soil will be at background levels. This level is greater than the 10^{-6} risk level for soil ingestion. Although contamination will be removed to background, some risk remains for this compound. Benzo(a)Pyrene is an immobile compound and thus will not readily leach into the groundwater.

From a transport based approach, the 5 percent of contamination remaining in the soil is not expected to cause any discernable change in the groundwater quality during the first 30 years of operation. Overall, from both a risk and contaminant transport based approach, the levels remaining may be considered adequate to protect public heath and the environment.

The groundwater protection standards of RCRA will be applicable to the level of groundwater cleanup to be attained by a groundwater extraction system. 40 CFR Section 264.94 states that the concentration of a hazardous constituent must not exceed the background level of that constituent in the groundwater, or an alternate concentration limit (ACL) for that constituent which will not pose a substantial present or potential hazard to human health or the environment as long as that ACL is not exceeded. The hazardous constituents of concern are those hazardous substances which were detected in the groundwater and soils at the site during the RI. Although a variety of organics were found in the ground-

water, the compounds trichloroethene and tetrachloroethene are the constituents of concern because of the potential carcinogenicity and the high concentrations. From the leachate/soil model in the FS, it is estimated that Benzo(a)Pyrene will slowly leach from the soil into the groundwater over a very long period of time (5,000 years) and still not have exceeded levels of concern for drinking water. Any low levels of B/N compounds that may be in the groundwater will be removed by treatment using Granular Activated Carbon. Some low levels of other B/N compounds were found in the groundwater both upgradient of and on the Kraus property, indicating a source other than the Kraus site for these compounds.

It is proposed that the contaminant plume be contained by pumping and be treated to a risk based "target" ACL of 10^{-5} excess cancer risk value. It is estimated that this concentration can be attained in the aquifer after 30 years of extraction and treatment. Subsequent to this 30 year period, it is estimated that contaminant concentrations will eventually attenuate to the soil and disperse to levels that do not exceed 10^{-6} excess cancer risk levels. Institutional constraints on aquifer use will be necessary until the groundwater has reached 10^{-6} levels. The U.S. EPA has established that 10^{-6} is an acceptable level for groundwater remediation. This level is considered an acceptable level for human drinking water consumption. Under certain circumstances, levels other than 10^{-6} can be considered target ACLs. At the Old Mill site, reaching 10^{-6} levels is cost and time prohibitive. It is estimated that with complete source removal, to reach 10^{-6} levels will take about 90 years. For any alternative with less than complete removal, the time increases. The groundwater plume has migrated a short distance offsite (225 feet downgradient of the site).

Transport modeling of the groundwater plume through the aquifer at the Old Mill site has indicated that, between the site and a short distance downgradient (1/4 to 1/2 mile), if the plume (extraction and treatment to 10^{-5} level) were allowed to migrate, the concentration in the plume may exceed 10^{-6} values for about 100 years. After that time, at all places in the aquifer downgradient from the site, the aquifer would not be adversely affected by site activities. Aquifer restrictions will protect all potential future users until acceptable levels have been restored over the affected area. Although initially the levels of contaminants in the groundwater will be greater than 10^{-6}, by means of attenuation and dispersion, acceptable (10^{-6}) levels will eventually not be exceeded anywhere in the aquifer. Therefore, the proposed extraction and treatment scenario (10^{-5}) is considered to be equally and adequately protective of human health and the environment. Since full documentation of the aquifer characteristics has not been obtained, the effectiveness of this extraction and treatment system will be confirmed after operational performance data has been evaluated. At that time the actual determination of an ACL will be made. It is estimated that two to five years of operational performance data will be required to make such a determination.

Any discharge of extracted groundwater at the site to the offsite drainageway will comply with substantive requirements of the Clean Water Act. A National Pollution Discharge Elimination System (NPDES) permit will be issued by and to the State of Ohio. The provisions of the NPDES permit will be established by the Ohio EPA and U.S. EPA. During construction, care will be taken to avoid stormwater runoff from the site.

Under the Safe Drinking Water Act, Maximum Contaminant Levels for tetrachloroethene and trichloroethene will soon be proposed in the Federal Register. Depending on the results of this proposal, these levels may be met in the groundwater.

This alternative meets NEPA functional equivalency. The necessary and appropriate investigation and analysis of environmental factors as they specifically relate to the Old Mill site and the recommended alternative were considered and evaluated in the RI/FS. In addition, an opportunity for public comment on environmental issues was provided.

COMPARISON OF ALTERNATIVES

Using the information presented in Table 12, the relative advantages and disadvantages of each resulting alternative are compared in order to recommend a "cost-effective alternative" as defined in the NCP.

Since the no action (Alternative 6) and limited action (Alternative 7) alternatives do not adequately remediate present and future groundwater and soil contamination, and do not address the human health concerns of direct contact or ingestion of contaminated groundwater or soil, these alternatives are not recommended for implementation at the site.

The present worth cost of Alternative 1A (100 percent contaminant removal) is more than an order of magnitude greater (16 times) than Alternative 2D (95 percent contaminant removal). Implementation of either of these alternatives will achieve similar environmental benefits (groundwater remediation, soil removal). Contaminated soil removal and both offsite and onsite groundwater treatment will remove contamination from the site and reduce exposure risks. The time required to meet target groundwater cleanup levels of 10^{-6} is approximately the same for these alternatives. Therefore, Alternative 1A is not recommended, because it would not be cost-effective.

Alternatives 2F and 3D differ only in the amount of soil contaminants contained in an onsite landfill, 95 percent in Alternative 2F and 100 percent in Alternative 3D. As discussed earlier, the 95 percent removal effectively removes most of the contaminant mass in the soil to levels adequate to protect public health and the environment and requires removing only 25 percent as much soil as is necessitated in the complete soil removal alternative. Alternative 2F is more cost-effective (similar environmental protection and benefits at lower cost) than Alternative 3D. Therefore, Alternative 3D is not recommended.

Alternatives 2A and 4D will prevent direct exposure to contaminated soil through construction of a cap. The multimedia cap required by Alternative 2A is more effective at reducing infiltration and leachate production into the groundwater than is the cap required by Alternative 4D. The greater infiltration rate of the clay cap required by Alternative 4D results in an increase in groundwater contaminant concentration during the initial years of groundwater extraction. Although the present worth costs for the alternatives are similar, the environmental benefits, as measured by the leachate production during the initial operating years of Alternative 2A are greater than for Alternative 4D. Therefore, Alternative 4D is not recommended for implementation at the site.

Three alternatives remain for comparison. These are:

- 2A--Multimedia cap, groundwater extraction with onsite GAC adsorption treatment.
- 2D--95-percent contaminant removal, disposal in offsite RCRA-licensed landfill, groundwater extraction with onsite GAC adsorption treatment
- 2F--95-percent contaminant removal, disposal in onsite RCRA-licensed landfill (to be built on the Kraus property), groundwater extraction with onsite GAC adsorption treatment.

Alternative 2A will minimize the human contact exposure, and decrease the concentration of contaminants in the groundwater plume. The groundwater will not be restored to background or 10^{-6} levels because the source of contamination (contaminated soil) remains onsite, and slow leaching of contaminants into the groundwater will continue indefinitely. The contaminant plume will need to be contained and treated by operating and maintaining an active groundwater extraction system far into the future (hundreds of years). The reliability and implementability of maintaining such a system into the indefinite future are less than if the source of contamination is removed. Much of the contamination is adsorbed to the soil in the saturated zone (aquifer structure). Low transmissivity of the aquifer results in a slow rate of flushing. Even if a cap were placed on the site, a slow rate of infiltration would occur. Also, since the water table seasonally rises to the ground surface, contaminants are leached slowly into the groundwater. Therefore, both horizontal and vertical infiltration through the contaminated soil would occur at this site. Since the other remaining alternatives will eventually achieve a more effective level of groundwater cleanup and greater public health benefits, and since the reliability of this alternative is questionable because of the high water table and because of the indefinite containment and treatment time, this alternative, which does not far exceed the cost of the other remaining alternatives, is not recommended for implementation at the site.

Implementation of Alternatives 2D and 2F involves groundwater treatment and removal or onsite containment of soil (95 percent of the contaminant mass). The present worth cost of Alternative 2D, soil removal, is slightly higher than Alternative 2F, soil containment ($4,440,000 versus $4,050,000).

The environmental benefit as measured by groundwater remediation is the same for both assembled alternatives. The environmental benefit gained by removing the soil contamination from the site exceeds the benefit of containing the contaminated soil in an onsite landfill because there remains the possibility for release of contaminants at the site. If the contaminated soil is removed from the site, the possibility of exposure to the local community is eliminated at the site. If an onsite landfill is created, permanent institutional constraints will be needed at the site. The aquifer in the area of the site is presently being used for drinking water. It is considered a Class II, current use aquifer. Citing requirements discourage location of a landfill above this type of aquifer. Citing requirements also discourage locating above fractured bedrock. The shale in the area of the site is known to be fractured. Therefore, the long term reliability of removal is greater than that of on-site containment.

Therefore, since the environmental, institutional, and public health and welfare benefits of Alternative 2D are greater than those of Alternative 2F, and since the cost to implement either is essentially the same, Alternative 2D is recommended as the cost-effective remedial alternative for implementation at the site.

RECOMMENDED ALTERNATIVE

It is recommended that FS Alternative 2D be selected as the cost-effective remedial alternative in accordance with Section 300.68 of the National Contingency Plan (NCP). This alternative is not the lowest cost alternative which provides a minimally adequate remedy, but it is the cost-effective alternative which adequately protects public health and the environment from the risks of further exposure to contaminated soil and groundwater at the site. This alternative substantially complies with all other environmental laws, and has a total present worth cost of $4,440,000.

DESCRIPTION OF THE PROPOSED REMEDY

The recommended alternative involves offsite disposal of 4,300 yd^3 of contaminated soil and sediment; groundwater containment, extraction, and treatment using direct contact GAC; and the opportunity for connection of downgradient residences within 0.5 mile of the site to the currently available public water supply. Two downgradient residences have been identified. Although these wells are not presently affected by contamination from the site, as a precautionary measure it is recommended that these wells be taken out of service and that the residences be connected to the public water supply. This alternative will remove the source of contamination, and will reduce contaminant concentrations in groundwater to acceptable levels.

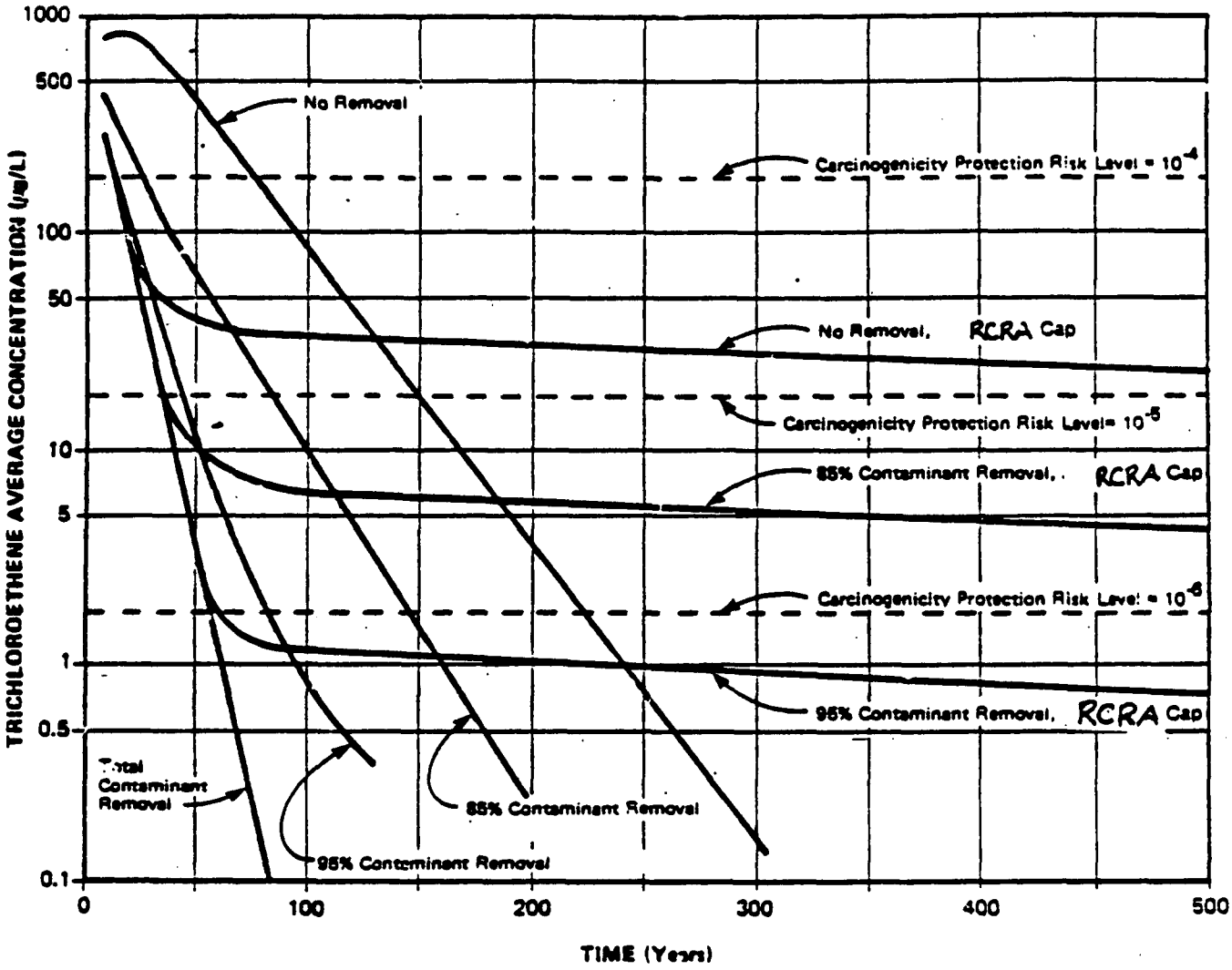
OFF-SITE REMEDIAL ACTION (FOR THE PROPOSED REMEDY)

(i) Groundwater Extraction System

A number of groundwater extraction wells will be placed downgradient from the site in order to capture the plume before further migration from the site. Each well will have a pumping rate of 1 gallon per minute to provide a capture zone of approximately 100 feet, and groundwater velocity of approximately 20 feet per year.

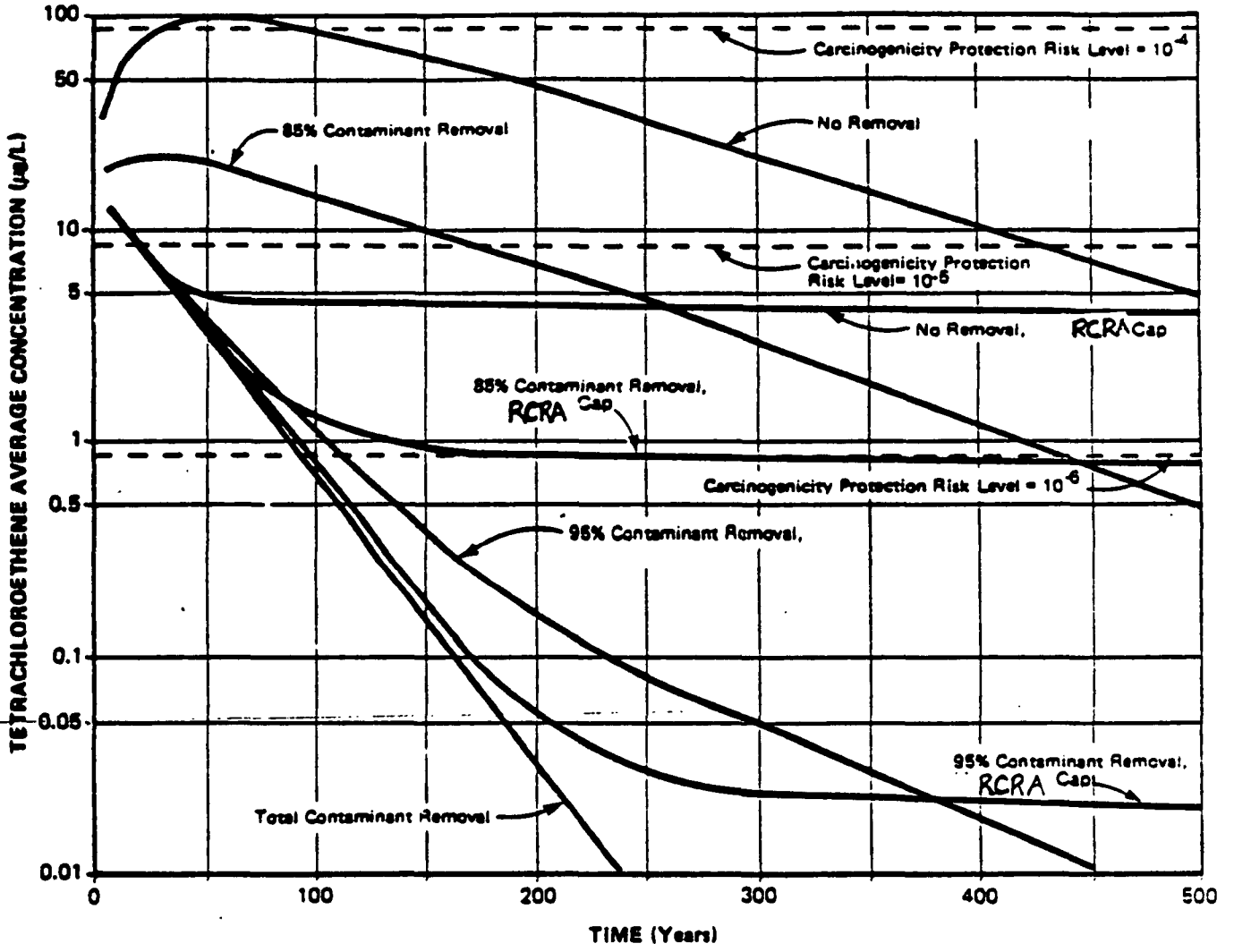
According to the analysis performed on the groundwater system, and as demonstrated in Figures 6 and 7, meeting a cleanup goal of 10^{-6} carcinogenic risk levels in groundwater is time prohibitive (about 100 years). In these figures, the line which corresponds to this alternative is the 95 percent contaminant removal. Thus, a cleanup risk based "target" concentration of 10^{-5} is proposed. It is estimated that the average concentration of contaminants in the plume can be reduced to this level within 30 years. The extraction wells will be placed to contain the contamination at concentrations greater than the 10^{-6} carcinogenic risk level isopleth.

The analysis in the FS, considering groundwater flow rates, flow-path lengths, porewater velocities, and retardation coefficients of the



NOTE: The analysis of leachate groundwater interaction involves estimation of recharge rates, the quantity of contaminants available for leaching, concentrations of those contaminants in water percolating through the unsaturated zone, rates of contaminant contribution to the groundwater or saturated zone and groundwater extraction rates. Estimates of this kind are tentative and limited in accuracy because of the uncertainties associated with sample data, site characterization, and the developmental nature of the science; however, they are presented here as a practical tool for assessing the relative impacts associated with various remedial actions.

FIGURE 6
IMPACT OF TARGET CLEANUP CRITERIA ON ESTIMATED DURATIONS OF GROUNDWATER EXTRACTION FOR TRICHLOROETHENE
HENFIELD PROPERTY
OLD MILL SITE



NOTE: The analysis of leachate groundwater interaction involves estimation of recharge rates, the quantity of contaminants available for leaching, concentrations of those contaminants in water percolating through the unsaturated zone, rates of contaminant contribution to the groundwater or saturated zone and groundwater extraction rates. Estimates of this kind are tentative and limited in accuracy because of the uncertainties associated with sample data, site characterization, and the developmental nature of the science; however, they are presented here as a practical tool for assessing the relative impacts associated with various remedial actions.

FIGURE 7
IMPACT OF TARGET CLEANUP CRITERIA ON ESTIMATED DURATIONS OF GROUNDWATER EXTRACTION FOR TETRACHLOROETHENE
HENFIELD PROPERTY
OLD MILL SITE

compounds detected at the Old Mill site, estimates that extraction of VOCs for approximately 30 years will be required to achieve to 10^{-5} cleanup levels in the entire plume. Any contamination present at lower levels when this cleanup level is attained will be allowed to migrate and disperse, and will naturally attenuate to the soil. Three contaminant transport models were used to estimate the fate of allowing the plume (10^{-5}) to migrate. It is estimated that, 1/4 to 1/2 mile downgradient from the site, after the extraction system is shut down, the contamination levels will not exceed the 10^{-6} carcinogenic risk level anywhere in the aquifer after about 100 years. Institutional constraints will need to be placed on the contaminated aquifer plume, and a short distance downgradient from the plume, until it is determined, through monitoring, that such constraints are no longer necessary.

(ii) Groundwater Treatment System

The treatment system for contaminated groundwater, prior to discharge to the offsite drainage ditch, consists of a series of GAC columns. Removal efficiency would be sufficient to meet discharge limitations set by the NPDES requirements. Limitations will call for an effluent which meets Water Quality Standards after the effluent mixes with existing flow (low flow is zero during parts of the year). The NPDES permit will be applied for and issued by the State of Ohio.

(iii) Aquifer Restrictions and Public Water Supply

Aquifer use restrictions will be required as long as concentrations in the plume are above 10^{-6} carcinogenic risk levels. Because of uncertaint. involved in extraction and containment of groundwater, those residences within 0.5 miles downgradient from the site, which may potentially be affected, will be given the opportunity to be connected to the currently available public water supply. These actions will adequately protect all current receptors. Since a comparatively small cost is involved in this particular aspect of the alternative ($12,000), and since the cost of a continuous monitoring program of these private wells would exceed the cost for a permanent connection, this action is both cost-effective and protective of public health.

SOURCE CONTROL REMEDIAL ACTION

(i) Building Demolition

The buildings at the site are known to have been used for storage of hazardous wastes. In addition, sampling and visual observations have identified a number of spills of hazardous substances inside the buildings. It is recommended that contaminated portions (assumed to be those portions which have come into contact with contaminated soil) of the buildings be demolished, and that contaminated waste materials be transported off-site to a U.S. EPA approved hazardous waste disposal

facility. Uncontaminated waste materials will be transported to a sanitary landfill. Sampling to confirm contamination will occur prior to or during the demolition of the buildings. The selection of an off-site RCRA facility will be made in coordination with the RCRA regional office where the facility is located.

(ii) Soil Removal

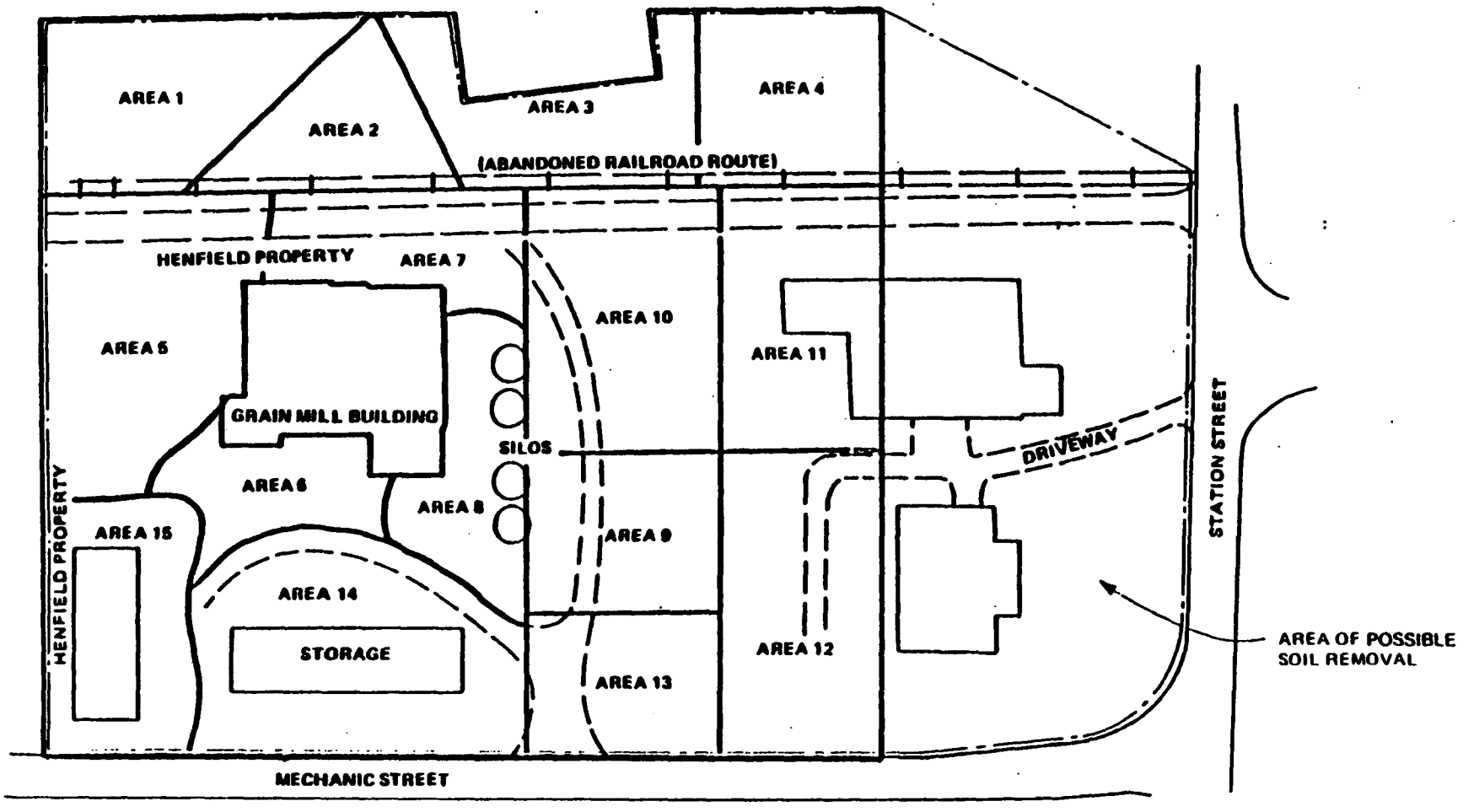
Soil contamination at the Old Mill site has been documented surficially over the majority of the site, and throughout portions of the unsaturated zone to the water table at a 5 foot depth. The results of the RI indicate that contamination of soils with base/neutral (B/N) and volatile organic compound (VOC) priority pollutants exists primarily within the top 2 feet of the soil profile. Selected areas of soil removal from the site would result in approximately 95 percent removal of both B/N and VOC contamination. This removal would result in residual concentrations that constitute levels which are adequate to protect public health and the environment in the soils. B/N compounds will be removed to U.S. EPA contract laboratory detection limits or background, and volatiles will be removed to 10^{-6} carcinogenic risk levels for ingestion of contaminated soil. The estimated areas of soil removal are shown on Figures 8 and 9.

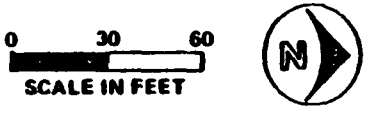
The leachate-groundwater analyses presented in Appendix G and Chapter 5 of the FS indicate that this soil removal scenario will substantially reduce the total amount of contaminants transported from soils (unsaturated zone) to the aquifer (saturated zone). This removal is also necessary to eventually restore the aquifer to 10^{-6} carcinogenic risk levels. Limited land use restrictions will be necessary to protect the monitoring and treatment system, and to restrict aquifer use in the plume. It will not be necessary to cap the site because the site will be closed as a storage unit [40 CFR Part 264 (k)] and the contamination will have been removed to levels adequate to protect public health and the environment. Confirmational soil testing will be done during the remedial action to assure that adequate cleanup levels are reached.

This remedial action will require use of an offsite land disposal facility. No hazardous substances from the Old Mill site will be taken to an offsite RCRA facility unless it is in compliance with the U.S. EPA "Procedures for Planning and Implementing Off-site Repsonse Actions". These procedures preclude use of a facility that has significant RCRA violations or other environmental conditions that affect the satisfactory operation of the facility. Among other things, the procedures also require that the facility have an applicable permit or interim status and have been inspected within six months prior to disposal. The land disposal facility will meet the minimum RCRA technical requirements. Three facilities within the geographical area (300 mile radius) of the site were considered for disposal in developing cost estimates.

OPERATION AND MAINTENANCE (O&M)

Each alternative was evaluated for O&M as shown in Tables 4 through 11. The O&M costs were estimated on an annual basis over 30 years. The O&M for the recommended





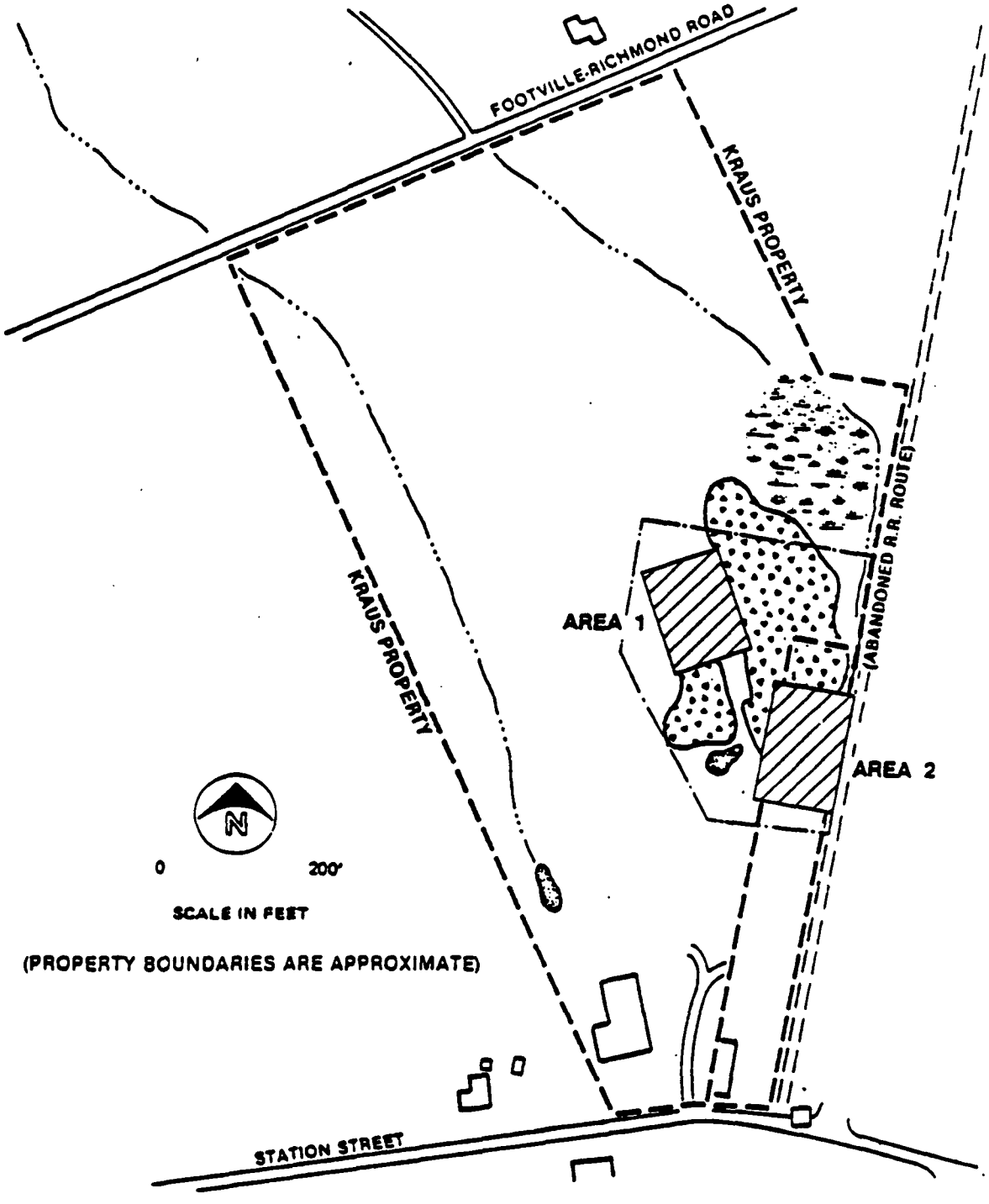
KEY

AREAS OF PROPOSED SOIL REMOVAL (4,000 yd³) (PROPERTY BOUNDARIES ARE APPROXIMATE.)

BOUNDARY OF PROPOSED CAPPING AND FENCED AREA

5 feet of soil removed in areas 8 and 10.
2 fe^t of soil removed in area 9
1 f soil removal in areas 2, 5, 6, 7, 11, 13, and '

FIGURE 8
AREAS DELINEATED FOR SOIL AND LEACHATE-GROUNDWATER ANALYSIS
HENFIELD PROPERTY
OLD MILL SITE



KEY

- MARSHY AREA
- STOCKPILES OF RAILROAD BALLAST
- KRAUS PROPERTY DRAINAGEWAY
- APPROXIMATE AREA OF PROPOSED SOIL REMOVAL AND/OR CAPPING (250 yd^3)
- PROPOSED FENCED AREA

FIGURE 9
LOCATION OF SOIL REMOVAL AND/OR CAPPING
KRAUS PROPERTY
OLD MILL SITE

alternative will require an offsite groundwater monitoring program consistent with RCRA closure regulations, and extraction and treatment of contaminated groundwater. The O&M period will last until such time as either applicable or relevant standards or ACLs are met. The period for O&M is expected to last for 30 years. The State of Ohio will assume responsibility for long term O&M of the remedial action. The U.S. EPA will enter into a State Superfund Contract with the State of Ohio to formalize this agreement.

SCHEDULE

MILESTONES	DATE
Approve Remedial Action (ROD)	7-31-85
Approve REM II Design Workplan	7-31-85
Amend REM II Work Assignment	7-31-85
Award IAG (design assistance)	7-31-85
Begin design	8-01-85
Complete design	9-09-85
Award Superfund State Contract (construction)	9-13-85
Award IAG (construction)	9-13-85

FUTURE ACTIONS

Uncertainty exists as to the contaminant removal efficiency physically attainable in the aquifer at the Old Mill site. Although our final remedial goal is to restore the groundwater to safe (10^{-6}) levels, the actual performance of the extraction system and the natural attenuation capacity of the aquifer must be monitored before an Alternate Concentration Level (ACL) can be set. A groundwater protection standard will be set with the goal of protecting the public health and the environment both now and in the future. Two major variables for setting a final cleanup standard are data adequacy and treatment reliability. Although the analytical data for the groundwater at the Old Mill site adequately defines the areal extent of contamination, information on the physical characteristics of the aquifer system is limited. This limits the assessment of the treatment reliability of the extraction system. It is predicted that the extraction time will be prolonged due to the low yield of the aquifer (30 years to attain 10^{-5} levels). It is further predicted that, if the treated plume (10^{-5}) is allowed to migrate and naturally attenuate, after about 100 years, 10^{-6} levels will not be exceeded in the aquifer. Thus, it is expected that after 130 years, the groundwater will be restored to acceptable (10^{-6}) levels. Therefore, the actual ACL determination will be deferred until operational data is available to make this determination. The U.S. EPA and Ohio EPA will monitor the performance of the extraction system. This will provide a greater certainty that the groundwater management objectives can be met within a reasonable period of time. After the performance of the extraction system is more fully assessed, and after consultation with the Ohio EPA, an actual ACL will be set. Therefore, this remedy will be considered an interim remedy until the ACL has been set. The State of Ohio will be responsible for assuring that institutional constraints will be honored for that portion of the aquifer which is contaminated until 10^{-6} levels are not exceeded, and for long term monitoring of the aquifer and O&M of the extraction and treatment system.

Specifics of the monitoring frequency and the mechanism for controlling ground-water use in contaminated portions of the aquifer will be defined in the O&M plan which will be developed during design and may be refined as operational data becomes available.