United States Environmental Protection Agency

Office of Emergency and Remedial Response

EPA/ROD/R05-86/035
September 1986

EPA

Superfund Record of Decision:

Fields Brook Sediment, OH

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA/ROD/R05-86/035	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE SUPERFUND RECORD OF DECISION Fields Brook, OH		5. REPORT DATE September 30, 1986 6. PERFORMING ORGANIZATION CODE
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9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460		13. TYPE OF REPORT AND PERIOD COVERED Final ROD Report 14. SPONSORING AGENCY CODE 800/00
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

Fields Brook is located in the City of Ashtabula, Ohio and drains a 5.6-square mile watershed (defined as the "site"). The 3.5 mile main channel of Fields Brook flows through an industrial area that is one of the largest and most diversified concentrations of chemical plants in Ohio. The brook empties into the Ashtabula River which subsequently flows into Lake Erie 8,000 feet downstream of its confluence with Fields Brook. Industrial sources have contaminated the sediment in Fields Brook with a variety of organic and heavy metal pollutants, including TCE, PCE, chlorobenzene, vinyl chloride, arsenic, zinc, mercury and chromium. Base-neutral compounds including hexachloroethane, toluenediamine and toluene diisocyanate also have been detected in Fields Brook sediments. Sediments taken from the Ashtabula River in the vicinity of Fields Brook are contaminated with PCBs. The U.S. EPA believes that the amount of contamination entering the brook at this time has been substantially reduced due to the recent development of pollution control laws and discharge permitting requirements.

The selected remedial action for the Fields Brook site includes: provisions for the excavation of contaminated sediment from Fields Brook, the temporary storage and dewatering, and the thermal treatment of a portion and the solidification and onsite landfilling of the remainder. Based on criteria presented in the ROD, approximately 36,000 cy of contaminated sediments will be solidified, and 16,000 cy will be thermally (See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Fields Brook, OH Contaminated Media: sediments Key contaminants: VOCs, TCE, PCE, base-neutral compounds, PCBs, arsenic, chromium, zinc, mercury		

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EPA/ROD/R05-86/035
Fields Brook, OH

16. ABSTRACT (continued)

treated. The remedy also includes treatment of waste water from the dewatering process, and provision of O&M costs for one year. The estimated capital cost of the remedy is $35,100,000 with annual O&M costs of $72,000.

RECORD OF DECISION
Remedial Alternative Selection

Site: Fields Brook Sediment Operable Unit, Ashtabula, Ohio

Documents Reviewed:

I am basing my decision on the following documents describing the analysis of the cost-effectiveness of remedial alternatives for the Fields Brook Sediment Operable Unit, Ashtabula, Ohio:

- Remedial Investigation - Fields Brook Site, Ashtabula, Ohio, CH_2M Hill, March 1985.

- Feasibility Study - Fields Brook Sediment Operable Unit, Ashtabula, Ohio, CH_2M Hill, July 1986.

- Summary of Remedial Alternative Selection.

- Responsiveness Summary, September 1986.

Description of Selected Remedy:

- Provisions for the excavation of contaminated sediment from Fields Brook, the temporary storage and dewatering, and the thermal treatment of a portion and the solidification and landfilling of the remainder. The breakdown is based on criteria in the Summary of Remedial Alternative Selection. Subsequent water treatment is also included.

- First year Operation and Maintenance costs to provide for long-term monitoring after the remedy has been completed.

Declarations:

Consistent with the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the excavation and thermal treatment/landfilling of Fields Brook Sediment is a cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of Ohio has been consulted and agrees with the approved remedy. In addition, the action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action and eligible for Trust Fund monies for a period of one year.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust fund monies for a period of one year.

The U.S. EPA will undertake additional remedial investigations/feasibility studies to address any ongoing sources of contamination to Fields Brook and in the Ashtabula River (if deemed appropriate) and evaluate proposed remedies. If additional remedial actions are determined to be necessary a Record of Decision will be prepared for approval of the future remedial action.

September 30th, 1986
Date

Valdas V. Adamkus
Valdas V. Adamkus
Regional Administrator

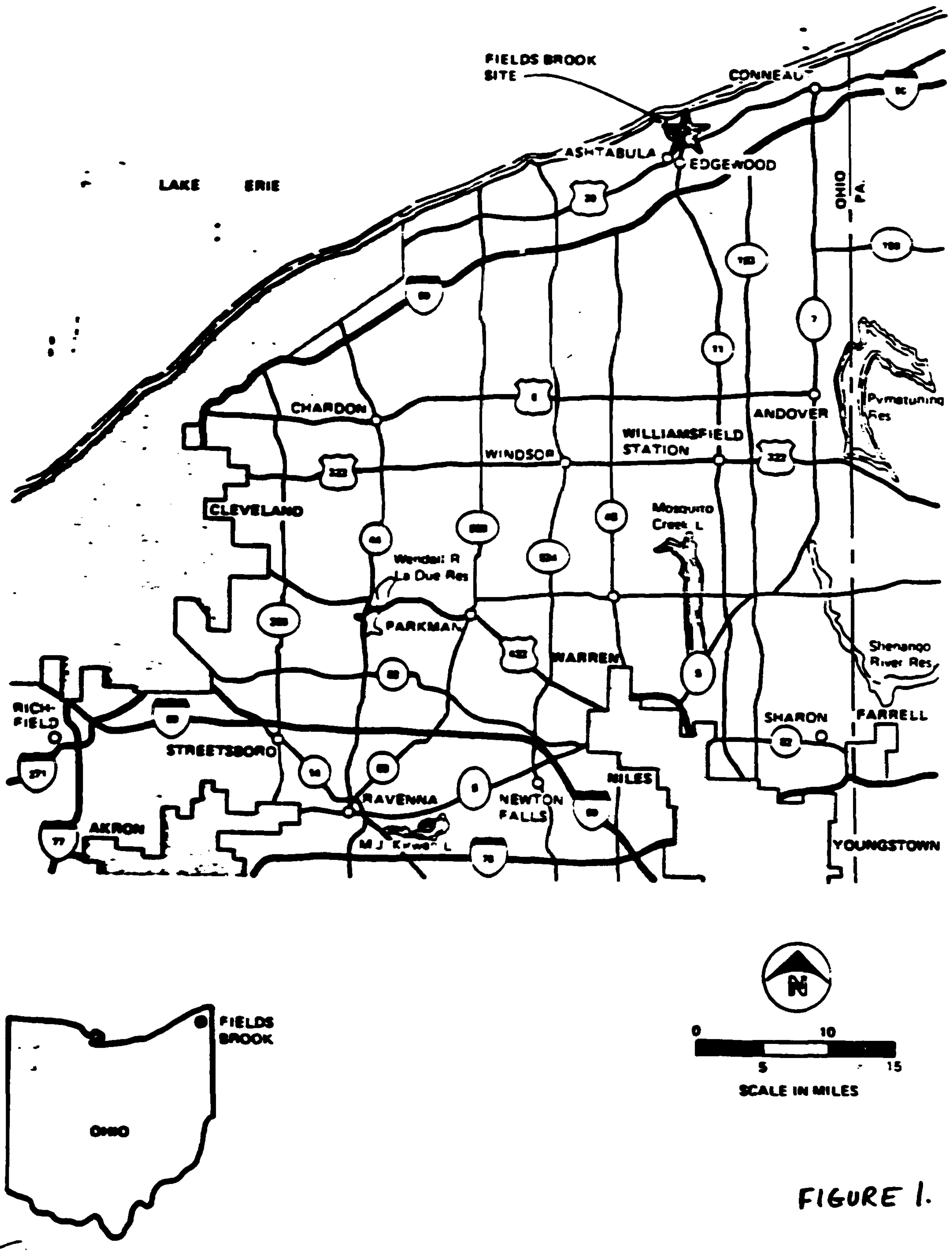
SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
FIELDS BROOK SEDIMENT OPERABLE UNIT, ASHTABULA, OHIO

SITE LOCATION AND DESCRIPTION

Fields Brook is located in the City of Ashtabula, Ashtabula County in Northeastern Ohio (Figure 1). The brook drains a 5.6 square mile watershed (defined as the "site" for the purpose of this study), the eastern portion draining Ashtabula Township and the western portion draining the City of Ashtabula (Figure 2). The 3.5 mile stretch of main channel begins just south of U.S. Highway 20, about a mile east of State Highway (STH) 11. From this point the stream flows northwesterly, under U.S. Highway 20 and Cook Road, to just north of Middle Road. Then the stream flows westerly to its confluence with the Ashtabula River. From Cook Road downstream to STH 11, the stream flows through an industrial area that is one of the largest and most diversified concentrations of chemical plants in Ohio. Downstream of STH 11, to near its confluence with the Ashtabula River, the brook flows through a residential area in the City of Ashtabula (population, 24,449 in 1980). Fields Brook is considered a navigable body of water which varies greatly in width and depth. Some of the areas surrounding the brook are thickly covered with vegetation. The Ashtabula River empties into Lake Erie about 8,000 feet downstream of its confluence with Fields Brook. The City of Ashtabula's drinking water intakes are located within Lake Erie.

SITE HISTORY

Industrial sources have contaminated the sediment in Fields Brook with a variety of organic and heavy metal pollutants. Organic compounds reported in sediment


FIELDS BROOK SITE
LAKE ERIE
CONNEAUT
ASHTABULA
EDGEWOOD
OHIO
PA.
CHARDON
ANDOVER
Pymatuning Res
WILLIAMSFIELD STATION
WINDSOR
CLEVELAND
Mosquito Creek L
Wendell R La Due Res
PARKMAN
WARREN
Shenango River Res
RICH-FIELD
STREETSBORO
SHARON
FARRELL
NILES
RAVENNA
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SCALE IN MILES
FIELDS BROOK
OHIO

FIGURE 1.

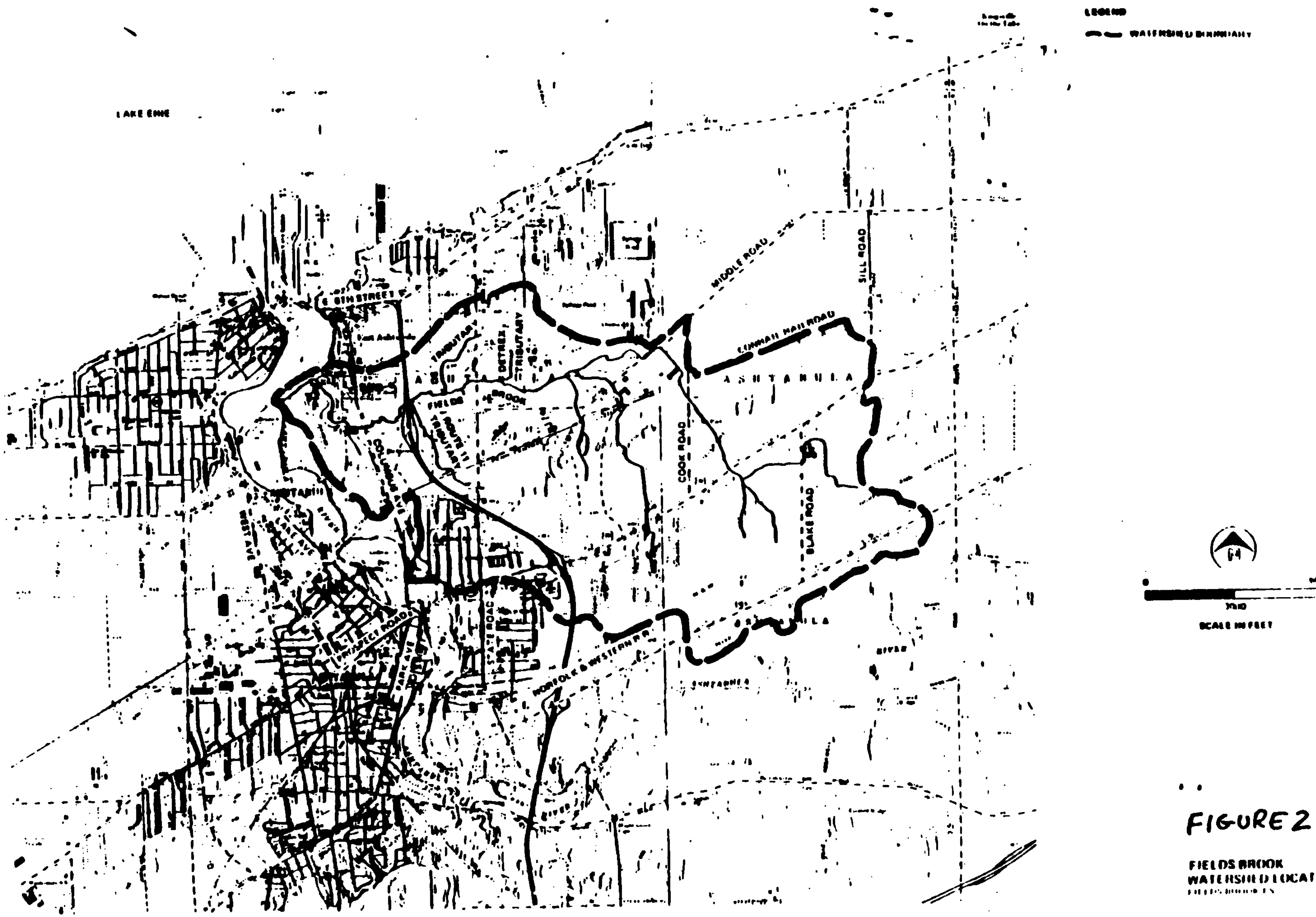


FIGURE 2.

FIELDS BROOK
WATERSHED LOCATION MA

sampled during previous studies of Fields Brook include volatile organic compounds: chlorobenzene, 1,1,1 - trichloroethane, 1,1,2-trichloroethane, 1,1,-dicloroethene, tetrachloroethene, trichloroethene, and vinyl chloride; base-neutral compounds: hexachloroethane, hexachlorobutadiene, toluenediamine, and toluene diisocyanate; chlorinated benzene compounds: 1,2,4-trichlorobenzene, hexachlorobenzene; and polychlorinated biphenyls (PCBs). Metals (zinc, mercury, chromium, lead, and titanium) have also been found in the sediment at concentrations reported by the United States Environmental Protection Agency (U.S. EPA) in the Toxic Summary Report (April 1982) to be above background. The Agency believes the amount of contamination entering the brook at this time has been substantially reduced due to the recent development of pollution control laws and discharge permitting requirements.

Chemical analysis of sediment core samples, collected by the U.S. Army Corps of Engineers (COE) in 1982, indicated sediment in the Ashtabula River in the vicinity of Fields Brook may be regulated under the Toxic Substance Control Act (TSCA) because of the presence of PCBs.

Analysis of tissue from fish caught in Fields Brook and the Ashtabula River prior to 1982 indicated the presence of chlorinated organic compounds such as PCBs, hexachlorobenzene, and hexachlorobutadiene. Because of possible fish contamination with PCBs and other organic chemicals, on March 1, 1983, the Ohio Department of Health and Ohio EPA issued a health advisory recommending that people not eat fish caught in a 2-mile reach of the Ashtabula River from Lake Erie to the 24th Street Bridge.

The Fields Brook site was first proposed for inclusion on the National Priorities List (NPL) in October of 1981. It was included on the NPL in September of 1983, with a Hazard Ranking System (HRS) score of 44.95.

CURRENT SITE STATUS

The U.S. EPA conducted a remedial investigation (RI) at the Fields Brook site beginning in 1983. Sampling was conducted in two phases, during the summers of 1983 and 1984, and included sediment, surface water, industrial effluent, macroinvertebrate, and fish samples. Results of the RI are summarized according to environmental medium in Tables 1 and 2 and Figures 3 through 8.

EVALUATION OF PUBLIC HEALTH RISK

Potential risks from contaminated sediment, surface water and fish from Fields Brook are based on the assumption that the site would be used in the future for both residential and industrial/commercial development. These estimated risks are theoretical quantifications, and are presented separately. For carcinogens, the potential risks are reported as excess lifetime cancer risks, which 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 the U.S. EPA Carcinogen Assessment Group cancer potency values.

For noncarcinogens, those substances with EPA published acceptable chronic daily intakes (AICs), the daily chemical intake was calculated depending on the exposure route and then compared to the AIC. An AIC is the dose that is anticipated to be without lifetime risk when taken daily.

FIGURE 3

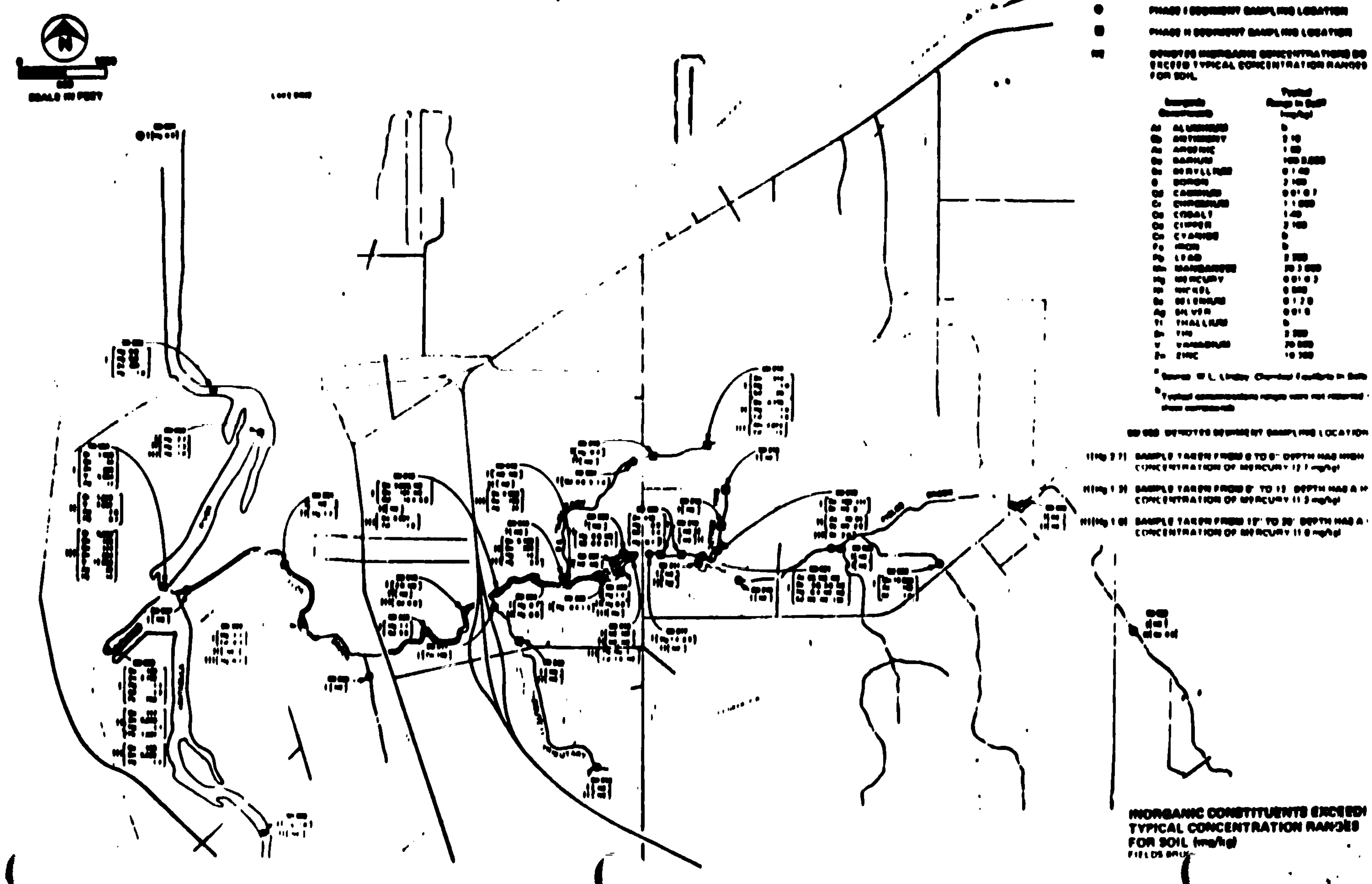
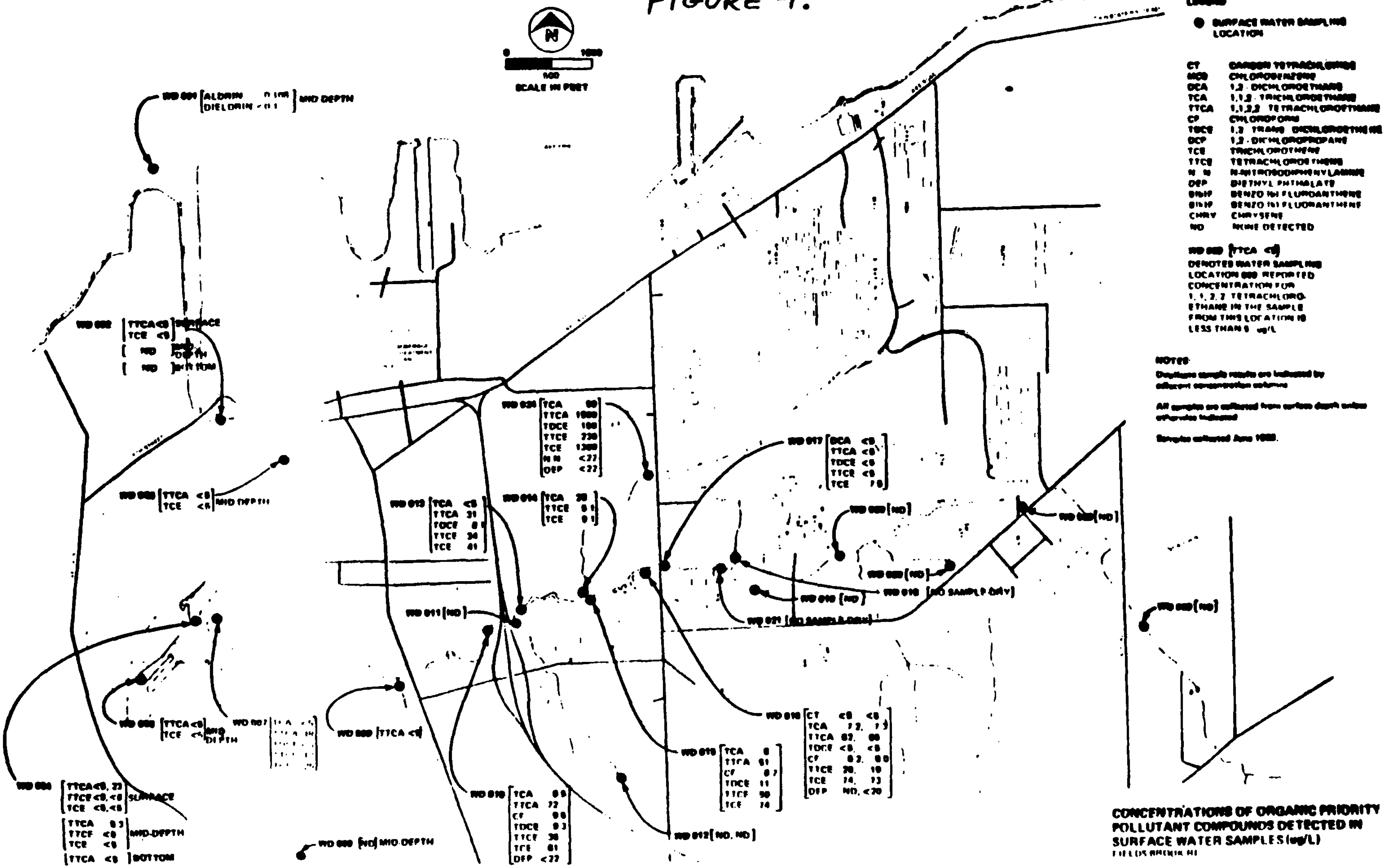
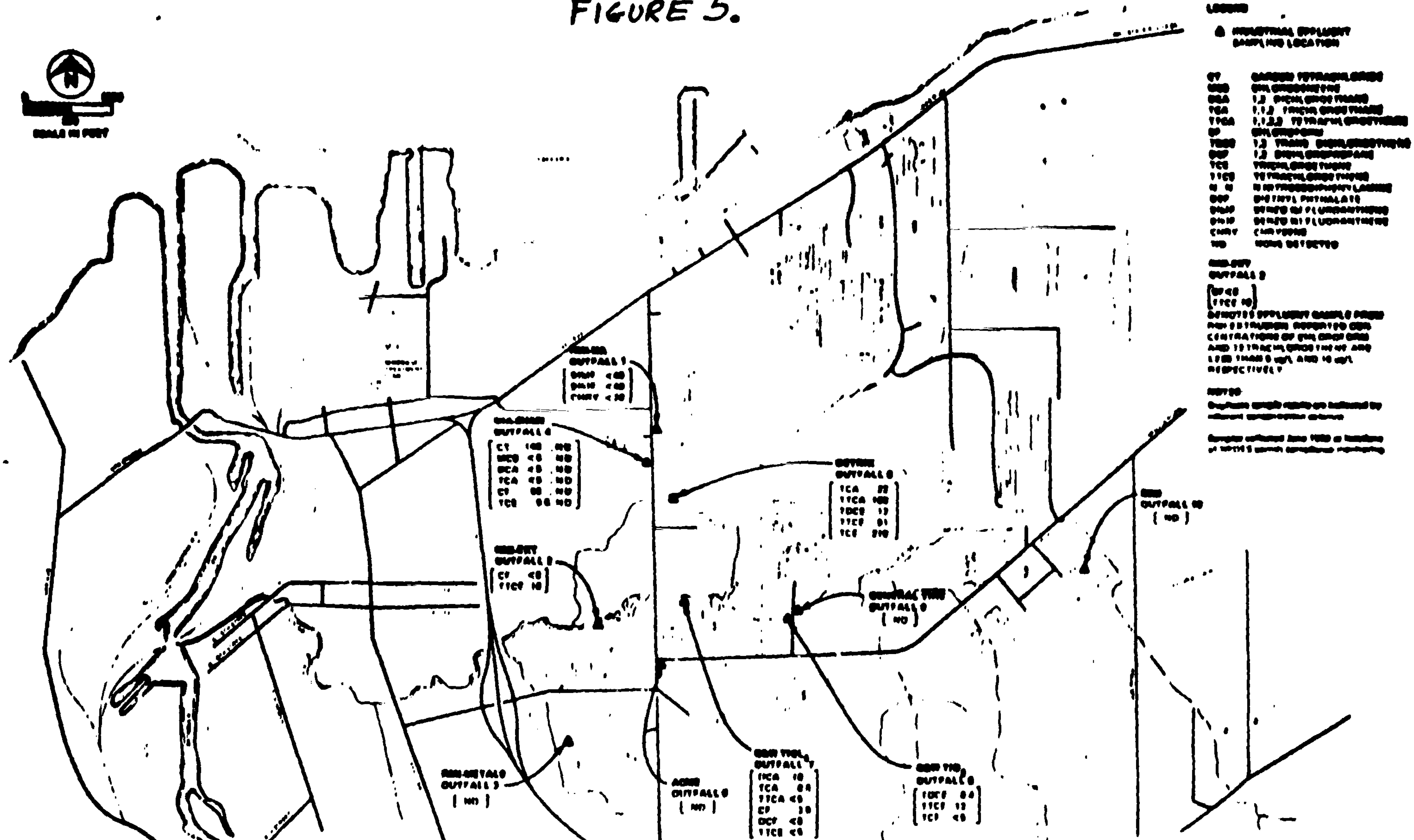

PHASE I SEDIMENT SAMPLING LOCATION
PHASE II SEDIMENT SAMPLING LOCATION
INORGANIC CONSTITUENTS EXCEEDI
TYPICAL CONCENTRATION RANGES
FOR SOIL (mg/kg)

FIGURE 4.



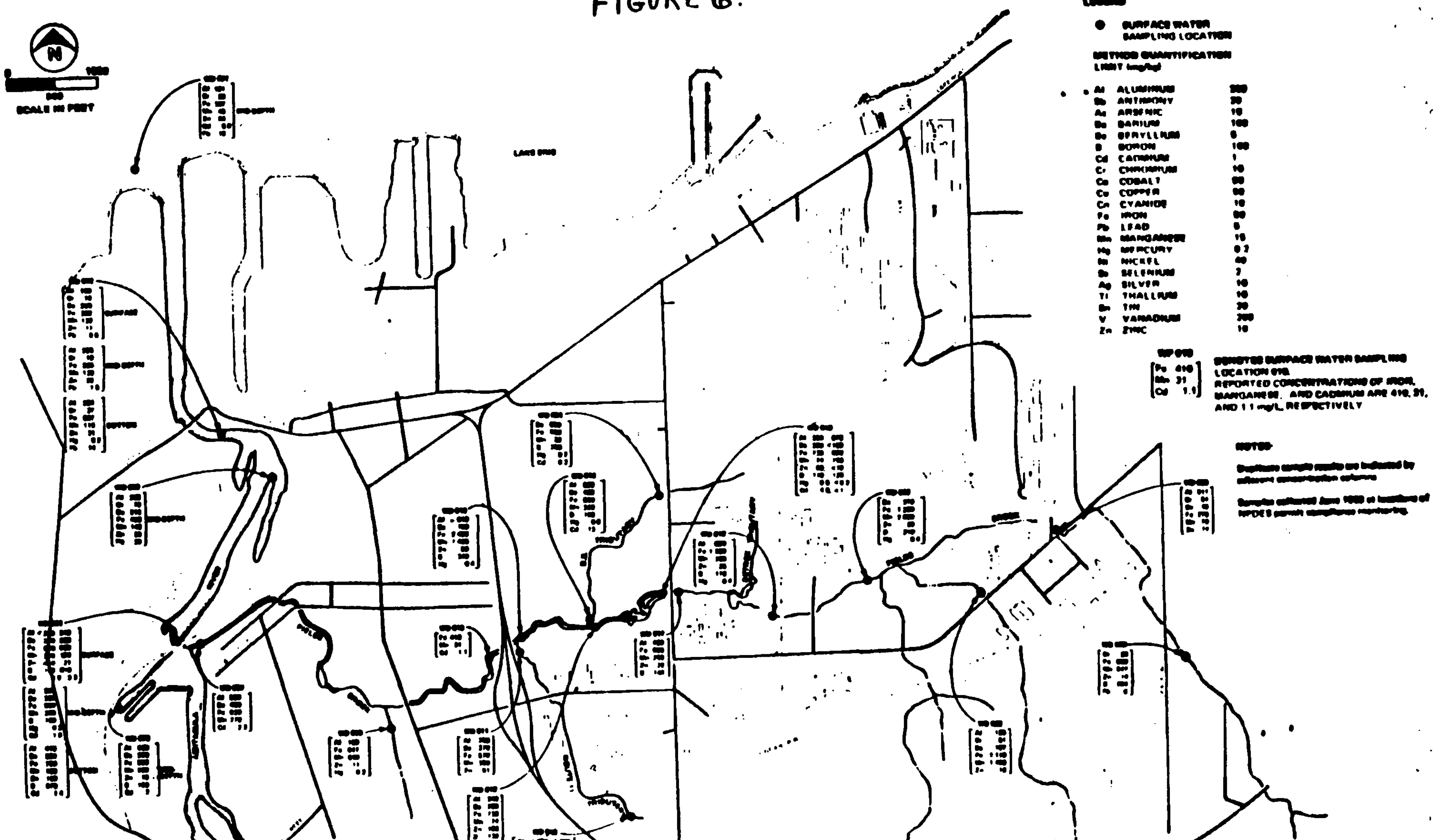
CONCENTRATIONS OF ORGANIC PRIORITY POLLUTANT COMPOUNDS DETECTED IN SURFACE WATER SAMPLES (ug/L)

FIGURE 5.



CONCENTRATIONS OF ORGANIC PRIORITY POLLUTANT COMPOUNDS DETECTED IN INDUSTRIAL EFFLUENT SAMPLES (ug/L)

FIGURE 6.



CONCENTRATIONS OF INORGANIC CONSTITUENTS REPORTED ABOVE QUANTITATION LIMITS IN SURFACE WATER SAMPLES (mg/L)

FIELDS BROOK RI

FIGURE 7.

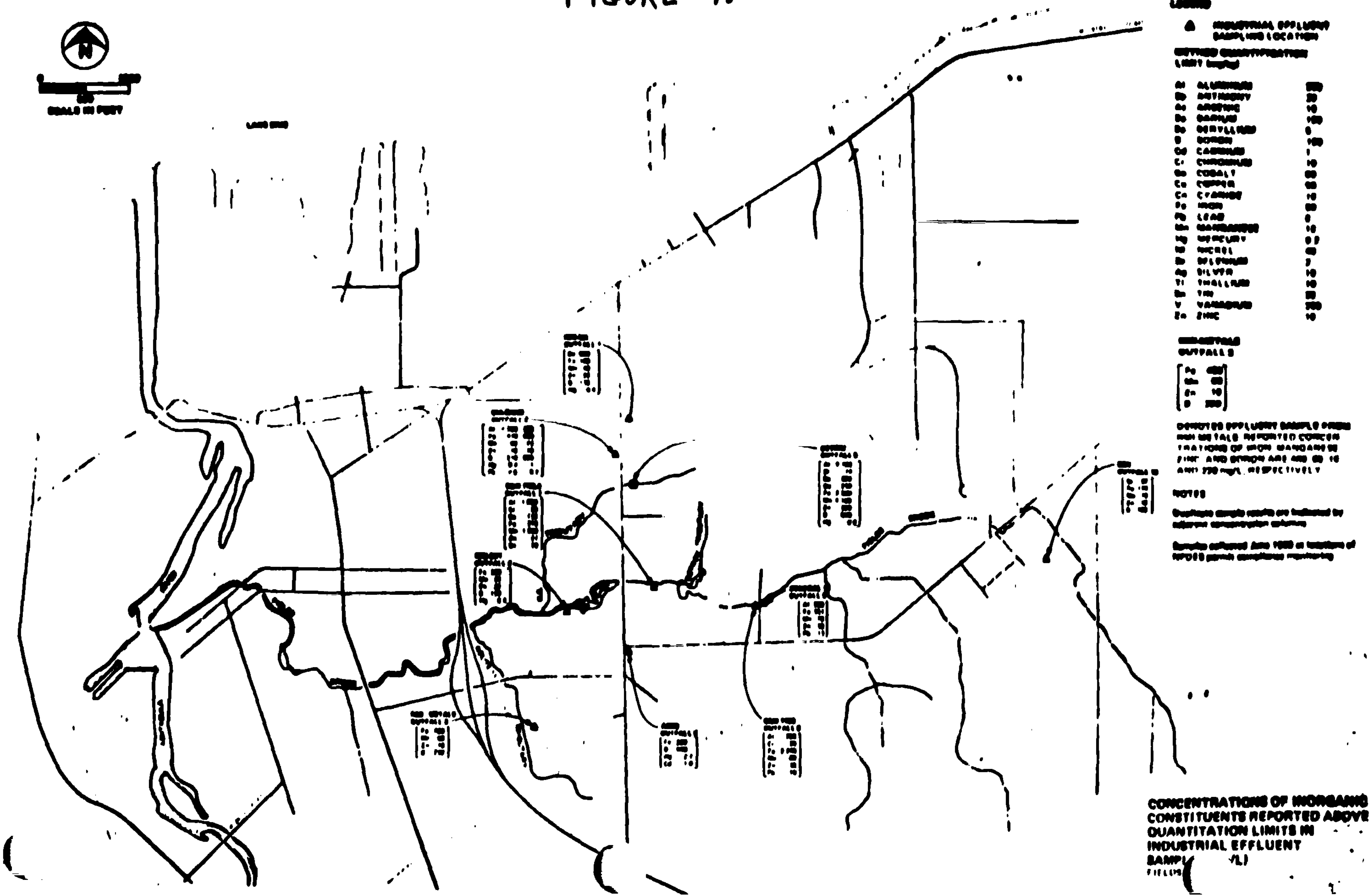

CONCENTRATIONS OF INORGANIC
CONSTITUENTS REPORTED ABOVE
QUANTITATION LIMITS IN
INDUSTRIAL EFFLUENT

TABLE 1.

CONCENTRATION RANGES OF ORGANIC COMPOUNDS MORE FREQUENTLY DETECTED IN SEDIMENT SAMPLES

Reach	Stationing Along Fields Brook[b]	Range[a] (ug/kg)					
		Total Polychlorinated Biphenyl Compounds (PCB's)	Total Hexachloro-butadiene	Total Volatile Organic Compounds (VOC)	Total Polynuclear Aromatic Compounds (PNA)	Total Chlorinated Benzene Compounds	Total Phthalate Compounds
Detrex Tributary	10600	ND	1,716-389,300	ND-24,987	ND-2,408	1,320-387,000	ND-1,699
DS Tributary	7900	ND	250-140,000	22-466,000	ND-46,194	300-815,400	ND-2,547
Route 11 Tributary	6500	ND-1,544	ND	3-202	ND-2,300		
Unnamed Tributary (Location 9)	3600	57	ND	7.5	ND	ND	806
Unnamed Tributary (Location 22)	13000	ND	ND	34.5	ND	ND	532
Fields Brook above Detrex Tributary	10600 to 19900	ND	ND	4-144,000	ND-188,265	ND-330	ND
Fields Brook from STH11 to Detrix Tributary	6400 to 10600	ND-518,300	ND-600,000	23-820,000	ND-47,204	ND-322,712	ND-29,730
Fields Brook from Ashtabula River to STH11	0 to 6400	ND-11,450	ND-2,700	ND-797	ND-5,400	ND-5,880	ND-2,700
Ashtabula River	--	ND-63,125	ND	5-4,825	ND-78,892	ND-9,360	ND-156,250

Note: The ranges of concentration shown in this table are for sediment samples taken from 0 to 20 inches in depth.

[a] Totals are calculated using concentrations reported in Appendix E. Compounds detected at concentrations below the quantitation limit have been included in the totals assuming a value equal to the quantitation limit.
[b] See Figure 3-1 for stream stationing of the tributaries from the confluence with Fields Brook.
ND indicates "none detected."

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TABLE 2.

SUMMARY OF LABORATORY ANALYSIS RESULTS FROM FISH TISSUE SAMPLES COLLECTED DURING [illegible] REMEDIAL INVESTIGATION

Sample No.	Fish Species	Length (mm)	Mass (g)	% Lipids	Organic Compounds (mg/kg): Chloro-benzene	1,1,2,2-Tetrachloro-ethane	Tetrachloro-ethene	Trichloro-ethene	Poly chlorinated Biphenyls[a]	Hexachloro-benzene	Fluor-anthene	Inorganic Compounds (mg/kg): Arsenic	Beryllium	Copper	Lead	Mercury[b]	Selenium	Silver	Zinc
Fillets:																			
FI 001 016	Carp	503	2,700	3.69					1.62									16.3	
FI [illegible] 006	Rock Bass	253	332	2.19		.006	.020		0.023								0.34		10
[illegible] 002	Carp	470	1,550	4.78		.011	.026	.007	3.09							0.30	0.21		40
[illegible] 021	Brown Bullhead	294	319	1.44	.006	.440	.298	.141	1.36	0.81							0.24		13
[illegible] 001	Carp	450	1,250	1.15		.007	.016										0.44		16
[illegible] 011	Largemouth Bass	241	219	0.74					0.90						0.25	0.06	0.40		9
[illegible] 001	Largemouth Bass	175	65	1.07		.012	.007		0.22				0.25			0.10	0.40		17
Whole Fish:																			
[illegible] 017	Carp	545	2,350	5.42		.080	.066	.013	12.30	1.96				1.30			0.11		18
[illegible] 007	Rock Bass	252	370	8.50		.008	.025		0.49								[illegible]		11
[illegible] 004	Carp	446	1,550	17.3		.259	.223	.079	1.66	1.44							0.22		[illegible]
[illegible] 022	Black Bullhead	321	476	8.25			.016		1.97					1.40		0.24			31
[illegible] 002	Carp	396	850	3.75		.015	.011		4.90	1.30	1.38	4.0		1.50					[illegible]
[illegible] 013	Largemouth Bass	195	101	2.00			.013		10.33										[illegible]
FI [illegible] 008	Largemouth Bass	187	55	1.98		.010	.009									0.38			24

[a] U.S. FDA recommends against consumming fish with concentrations of PCB's greater than 2.0 mg/kg in edible portions of the fish.
[b] U.S. FDA recommends against consumming fish with concentrations of mercury greater than 1.0 mg/kg in edible portions of the fish.

[illegible]

Sediment

Two groups can incur health risks resulting from exposure to contaminated sediment, residents and adult workers in the area. Residents near the streams could ingest contaminated sediment during outside activities, and sediment may be transported into the houses on hands, clothing, footware, or by pets. Lifetime ingestion rates were estimated to be about 15 ounces of sediment per year. Risks were calculated using both average and maximum concentrations of contaminants in the sediment based on a 70 year lifetime.

Adult workers whose place of work may be adjacent to the streams could ingest about 1/10 of an ounce of sediment per year. Risks for workers were assumed to occur over a 40 year working lifetime with an average of 8 hours per working day, and were also calculated using both average and maximum concentrations.

The results of this assessment concluded that in most reaches of Fields Brook and its tributaries, excess lifetime cancer risks greater than the 10^{-6} level could occur due to sediment ingestion. For example, the excess lifetime cancer risk for residents near the Detrex Tributary is estimated to be $5x10^{-2}$ for maximum concentrations and $2x10^{-2}$ for average concentrations. In this same tributary, the excess lifetime cancer risk for workers is estimated to be $5x10^{-4}$ for maximum concentrations and $1x10^{-4}$ for average concentrations. The primary chemicals contributing to the risk are 1,1,2,2-tetrachloroethane, tetrachloroethene, PCB, hexachlorobenzene, and hexachlorobutadiene.

The assessment also concluded that estimated daily chemical intakes for cadmium, thallium, silver, and mercury approach or exceed the published AIC in a number of reaches of Fields Brook and its tributaries.

It was also expected that dermal absorption or dust inhalation of sediment could further increase cancer risks.

Surface Water

Residents and casual visitors can be exposed to volatile chemicals in surface water by wading in Fields Brook and its tributaries. For example, at maximum observed volatile contaminant concentrations, the excess lifetime cancer risk due to dermal absorption from wading 5 to 10 times per year in the DS tributary is 1×10^{-4}.

Exposure to vapors released from surface water could occur for both residents and workers. Because vapor concentrations are not available from the site, only the qualitative statements can be made that exposure to volatile chemicals would increase.

Fish Consumption

Fillets from bass, perch, catfish, and carp (edible portions) were considered to assess exposure to contaminants via ingestion of fish. The health risks were estimated based on a 70-year lifetime during which 6.5 grams of fish per day from Fields Brook or the Ashtabula River are consumed.

The estimated excess lifetime cancer risk for the ingestion of contaminated fish fillets from the Fields Brook area is as high as 1×10^{-3} although the brooks contribution is uncertain. The major chemicals contributing to this risk are 1,1,2,2-tetrachloroethane, hexachlorobenzene, and PCBs.

ENFORCEMENT (CONFIDENTIAL) (See Attachment A)

ALTERNATIVES EVALUATION

The major objective of the feasibility study (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 (i), identifies the procedures and criteria used to select a cost-effective remedial alternative that effectively mitigates and minimizes threats to, and provides adequate protection of, public health and welfare and the environment. The selection should attain or exceed applicable, relevant and appropriate Federal public health and environmental requirements that have been identified for the specific site.

The scope of the Fields Brook Sediment Operable Unit Feasibility Study has been defined as a management of migration measure to prevent or minimize the release of contaminants from the sediment of Fields Brook and its tributaries, and therefore eliminate or reduce the risks to public health and the environment. A remedial action selection and the operable unit approach is warranted because a permanent remedy to the contaminated sediment in Fields Brook (and to the exposure resulting from it) is achieved. Therefore, it is consistent with a permanent remedy and the NCP.

The first step in the evaluation process was to consider the feasibility or site specific implementability of technologies. The technologies considered, but were eliminated due to site specific inappropriateness are listed in Table 3.

Table 3-5 (Page 1 of 5)
INAPPLICABLE TECHNOLOGIES FOR THE FIELDS BROOK SITE SEDIMENT

General Response Action	Technology/ Technology Option	Comments
Access Restriction	Fencing	Does not prevent the migration of contaminants.
In Situ Containment	In situ stabilization	
	Injection grouting	Not appropriate for fine sediments.
	Vitrification	Not proven for application to large volumes of wet sediment in place.
	K20 process	Not proven for application to large volumes of wet sediment in place.
In Situ Treatment/ Extraction	Ultraviolet/Ozonation	Pilot stage, closed system only. Unable to penetrate deeply into sediments, not available for in-place use, end products may have toxic effect.
	Biodegradation	Not proven for sediments or wide variety of contaminants identified at the site.
	Chemical Oxidation	Not generally suited for heterogeneous waste, applications limited, may have environmental impact by nature of treatment method.
	Radiation	Not feasible for in-place applications
	Bioharvesting	Conceptual, limited effectiveness, slow, experience limited to liquid waste streams, ponds.
	Solvent Extraction	Some solvents are toxic, conceptual, no field tests with fine sediment and the variety of contaminants identified at the site.
	Soil Aeration	Not appropriate for fine sediments in place

INAPPLICABLE TECHNOLOGIES FOR THE FIELDS BROOK SITE SEDIMENT

General Response Action	Technology/ Technology Option	Comments
	Retrievable Sorbents	Conceptual, no field tests, may be ineffective with high concentrations.
Removal: Removal Methods	Mechanical Dredging (clamshell, dragline, dipper, bucket, ladder, sauerman)	The narrow width, shallow water depth, and irregular stream bed characteristics of Fields Brook and its tributaries are inappropriate for barge based mechanical dredging operations.
	Hydraulic Dredging (hopper, cutterhead, dust pan, sidecaster)	The narrow width, shallow water depth, and irregular stream bed characteristics of Fields Brook and its tributaries are inappropriate for these barge based hydraulic dredging operations. Inapplicable for materials above the water line.
	Pneumatic Dredging (airlift, pneuma, namtech, oozer)	The narrow width and shallow water depth are inappropriate for barge based pneumatic dredging operations. Also, the shallow water column may limit the effectiveness of these pneumatic methods. Inapplicable for materials above the water line.
Sediment Treatment (following removal)	Onsite: Thermal	
	Pyromagnetics	Conceptual, more tests needed, solvent extraction required for soil.

Table 3-5 (Page 3 of 5)
INAPPLICABLE TECHNOLOGIES FOR THE FIELDS BROOK SITE SEDIMENT

General Response Action	Technology/ Technology Option	Comments
	Wet air oxidation	More applicable to aqueous wastes, solids must be ground. Catalytic reagents needed for destruction of chlorinated organics.
	Multiple Hearth	Tiered hearths usually have some relatively cold spots which inhibit even and complete combustion.
	Fluidized Bed Combuster	Limited applicability due to difficulties in handling of ash and residuals.
	Molten Salt Reactor	No commercial unit currently available. Difficulties with handling and disposing of ash-contaminated salt.
	Plasma Arc Reactor	Conceptual. Limited throughput.
	Dechlorination processes	
	Acurex	Conceptual, solvent extraction required for soils.
	Hydrothermal	Conceptual; not demonstrated for the wide variety of compounds detected in sediment at the site.
	KOHPEG	Conceptual; not demonstrated for the wide variety of compounds detected in sediment at the site.
	NaPEG	Conceptual; not demonstrated for the wide variety of compounds detected in sediment at the site.

INAPPLICABLE TECHNOLOGIES FOR THE FIELDS BROOK SITE SEDIMENT

General Response Action	Technology/ Technology Option	Comments
	PCB X	Conceptual; not demonstrated for the wide variety of compounds detected in sediment at the site.
	Goodyear	Conceptual; not demonstrated for the wide variety of compounds detected in sediment at the site.
	Aeration	Conceptual, not applicable for wide range of compounds found in the sediment.
	Ultraviolet/ozonation	Conceptual, shallow penetration depth.
	Radiation	Conceptual.
	Solvent extraction	Some solvents are toxic and may be left at residual levels.
	Retrievable sorbents	Conceptual.
	Air Stripping	Questionable application for limited group of compounds and not demonstrated for large volumes of sediment.
	Steam Stripping	Questionable application for limited group of compounds and not demonstrated for large volumes of sediment.
	Biodegradation	Not demonstrated for the wide variety of compounds detected in sediment at the site.

Table 3-5 (Page 5 of 5)
INAPPLICABLE TECHNOLOGIES FOR THE FIELDS BROOK SITE SEDIMENT

General Response Action	Technology/ Technology Option	Comments
	Offsite:	
	Thermal	
	Pyromagnetics	Facility with ability to process large quantities of sediment unavailable.
	Wet air oxidation	Facility with ability to process large quantities of sediment unavailable.
Water Treatment	Onsite Chemical/Physical	
	Activated aluminum	Not applicable to treatment of low volume aqueous waste streams.
	Solar evaporation ponds	Climate at Fields Brook is not appropriate.
	Spray evaporation	Climate at Fields Brook is not appropriate.

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The next step in the process was to consider general response actions for the Fields Brook site. The following general response actions were considered but eliminated during the initial screening process using the NCP criteria of cost, acceptable engineering practice, and effectiveness at addressing site problems.

1. Sediment collection by means of downstream sedimentation basins or sediment traps. These traps or basins would collect contaminated sediment transported naturally by Fields Brook. Contaminated sediment would have to be periodically removed from the basins and either be treated or disposed of. This alternative was screened out for several reasons. First, it would take approximately 800 years for all the contaminated sediment to be removed. Secondly, since the sediment would remain in place, the current risks due to direct contact and sediment ingestion would remain. Lastly, sediment removal effectiveness is considered unpredictable, and should a major flood occur, contaminants could by-pass the structures, with their movement uncontrolled.

2. Sediment containment by means of capping. Four different capping scenarios were evaluated. They were: 1) capping with new channel excavation, 2) capping integrated with existing brook location, 3) capping with in-channel conduit, and 4) capping with external conduit. In general, capping was not considered to be a reliable long-term solution. It has not been previously demonstrated to be effective in a flood plain, and should the cap fail potential exposure of contaminated sediment to the environment could occur. For these reasons sediment containment by capping was screened out.

3. <u>Mechanical excavation of sediment from Fields Brook to the defined 10^{-4} risk level with temporary diversion</u>. In this alternative, approximately 99% of the sediment contaminant mass would be removed. It was screened out because a source of contamination would be left in Fields Brook, primarily in areas where potential exposure is greatest (residential areas). The incremental cost increase of removing the additional contaminated sediment to the defined 10^{-6} risk level was not significant compared to the benefit.

The initial screening concluded that the appropriate general response action for the Fields Brook Sediment Operable Unit would require the mechanical excavation of sediment from Fields Brook and its tributaries to the defined 10^{-6} risk level or background (whichever concentration is greater), with the temporary diversion of Fields Brook during excavation. Thus, the assembled alternatives for detailed analysis would all be similar in terms of sediment removal from Fields Brook and its tributaries. They only differ in what would be done with the sediment once it is removed.

DETAILED ALTERNATIVES ANALYSIS

After the initial screening phase was completed, the following alternatives were developed and examined in detail:

1) Excavation of sediment with offsite RCRA/TSCA landfilling;
2) Excavation of sediment with onsite RCRA/TSCA landfilling;
3) Excavation of sediment with complete thermal treatment;
4) Excavation of sediment with partial thermal treatment;
5) No action.

1) Excavation of Sediment with Offsite RCRA/TSCA Landfilling (AA-1)

AA-1 includes excavation of contaminated sediment in stream reaches with a calculated 10^{-6} or greater risk level (10^{-6} risk level removal option). Following excavation of contaminated sediment, gravel-filled gabions would be placed in the disturbed streambed to prevent erosion and promote repopulation by aquatic species. The estimated volume of excavated sediment is 39,000 cubic yards. Additional estimated volumes of 3,900 cubic yards of material are expected to be generated during the site work and onsite sediment hauling, 3,600 cubic yards of sand and gravel from the uppermost layer of the interim storage facility, and 2,900 cubic yards of clay and concrete from the uppermost layer of the curing cell. It is assumed that onsite solidification of the excavated sediment would increase the excavated volume (39,000 cubic yards) by another 10 percent. Thus this alternative would require the disposal of about 53,000 cubic yards.

Excavated and solidified sediment and waste material would be landfilled offsite in RCRA- and TSCA-approved landfills. Sediment and waste with a PCB concentration of 50 mg/kg or greater would be disposed of in a TSCA-approved facility, and remaining sediment and waste would be disposed of in a RCRA-permitted facility. Water generated during onsite dewatering at an interim sediment storage facility would be collected and hauled offsite to a RCRA-permitted treatment facility. The total present worth for this alternative is $30.6 million. More detailed costs are shown in Table 4.

2) Excavation of Sediment with Onsite TSCA Landfilling (AA-2).

AA-2 incorporates the same sediment excavation plan as AA-1, i.e., removal of contaminated sediment in stream reaches with a calculated 10^{-6} or greater risk

TABLE 4.

COST ESTIMATE SUMMARY (a)
REMEDIAL ALTERNATIVE NO. [illegible]
FIELDS BROOK FS

COST COMPONENT		CONSTRUCTION COSTS	ANNUAL O & M COSTS
1. SEDIMENT EXCAVATION TO 10^{-6} ESTIMATED RISK (BACKGROUND)			
A. GENERAL CONDITIONS		$[illegible]	$0
B. HEALTH AND SAFETY CONSIDERATIONS		$[illegible]	$0
C. SITE PREPARATION		$[illegible]	$0
D. DIVERSION OF STREAM		$[illegible]	$0
E. MECHANICAL EXCAVATION		$1,520,000	$0
F. CHANNEL RESTORATION		$463,000	$0
2. INTERIM ONSITE SEDIMENT STORAGE			
A. SITE PREPARATION		$11,000	$0
B. CELL CONSTRUCTION		$151,000	$0
C. FACILITIES		$334,000	$0
D. CLOSURE BY CAPPING		$157,000	$0
E. SEDIMENT FIXATION		$1,200,000	$0
3. OFFSITE DISPOSAL OF SEDIMENT			
A. LOADING AND HAULING		$4,160,000	$0
B. TSCA LANDFILL FACILITY		$2,640,000	$0
C. RCRA LANDFILL FACILITY		$4,700,000	$0
4. OFFSITE WATER TREATMENT			
A. ONSITE COLLECTION FACILITY		$50,000	$0
B. TRANSPORTATION		$233,000	$0
B. TREATMENT		$219,000	$0
CONSTRUCTION AND O&M SUBTOTAL		$18,700,000	$0
BID CONTINGENCIES	(15%)	$2,810,000	
SCOPE CONTINGENCIES	(20%)	$3,740,000	
CONSTRUCTION AND O&M TOTAL		$25,300,000	
PERMITTING AND LEGAL (b)	(3%)	$759,000	
SERVICES DURING CONSTRUCTION	(7%)	$1,770,000	
TOTAL IMPLEMENTATION COST		$27,800,000	
ENGINEERING DESIGN COST (c)	(10%)	$2,780,000	
TOTAL CAPITAL COST (d)		$30,600,000	
PRESENT WORTH FACTOR		1.0	
PRESENT WORTH (e)		$30,600,000	
TOTAL PRESENT WORTH		$30,600,000	

NOTES:
(a) Costs are shown to 3 significant figures or the nearest thousand dollars. See Appendix M for detailed cost estimates.
(b) Includes environmental and nonenvironmental permits, and community relations.
(c) Includes the siting study.
(d) Land acquisition not included in cost estimate.
(e) Present worth at 10% interest over 30 years.

level (10^{-6} risk level sediment removal option). Following excavation of contaminated sediment, gravel-filled gabions would likewise be placed in the disturbed streambed to prevent erosion and to promote repopulation by aquatic species. Disposal volumes are also the same as AA-1.

AA-2 includes sediment solidification and related waste material disposal at an onsite RCRA/TSCA-type landfill. Sediment and wastes with a PCB concentration of 50 mg/kg or greater would be disposed of in a separate onsite cell.

Water generated during onsite work would be collected and treated onsite for removal of suspended solids and dissolved organic compounds by activated carbon adsorption. Treated water would be discharged to the Ashtabula POTW or directly to Fields Brook taking into consideration National Pollutant Discharge Elimination System (NPDES) requirements. The total present worth for this alternative is $18.6 million. More detailed costs are shown in Table 5.

3) Excavation of Sediment and Complete Thermal Treatment (AA-3).
AA-3 incorporates the same sediment excavation plan as AA-1 and AA-2, i.e., removal of contaminated sediment in stream reaches with a calculated 10^{-6} or greater risk level (10^{-6} risk level sediment removal option). Following excavation of contaminated sediment, gravel-filled gabions would likewise be placed in the disturbed streambed to prevent erosion and promote repopulation by aquatic species.

AA-3 includes construction of an onsite RCRA/TSCA-type landfill. The onsite RCRA/TSCA-type landfill would be used to temporarily store excavated sediment during the siting, permitting, design, construction and operation of an onsite

TABLE 6-5
COST ESTIMATE SUMMARY (a)
ASSEMBLED ALTERNATIVE NO. 2
FIELDS BROOK FS

COST COMPONENT		CONSTRUCTION COSTS		ANNUAL O & M (YEAR 1-30)		REPLACEMENT (YEAR 30)
1. SEDIMENT EXCAVATION TO 10^{-6} ESTIMATED RISK (BACKGROUND)						
A. GENERAL CONDITIONS		$354,000		$0		$0
B. HEALTH AND SAFETY CONSIDERATIONS		$363,000		$0		$0
C. SITE PREPARATION		$389,000		$0		$0
D. DIVERSION OF STREAM		$959,000		$0		$0
E. MECHANICAL EXCAVATION		$1,500,000		$0		$0
F. CHANNEL RESTORATION		$469,000		$0		$0
2. INTERIM ONSITE SEDIMENT STORAGE						
A. SITE PREPARATION		$11,000		$0		$0
B. CELL CONSTRUCTION		$161,000		$0		$0
C. FACILITIES		$384,000		$0		$0
D. CLOSURE AND CAPPING		$191,000		$1,000		$0
E. SEDIMENT FIXATION		$1,920,000		$0		$0
3. ONSITE LANDFILL						
A. SITE PREPARATION		$400,000		$0		$0
B. BERM CONSTRUCTION		$623,000		$0		$0
C. CELL CONSTRUCTION		$600,000		$0		$0
D. FACILITIES AND MONITORING		$645,000		$22,000		$0
E. CAP CONSTRUCTION AND MAINTENANCE (b)		$694,000		$32,000		$694,000
4. ONSITE WATER TREATMENT						
A. TREATMENT FACILITY		$306,000		$0		$0
B. OPERATION OF SYSTEM		$273,000		$0		$0
C. DISCHARGE		$9,000		$0		$0
CONSTRUCTION AND O&M SUBTOTAL		$10,500,000		$55,000		$694,000
BID CONTINGENCIES	(15%)	$1,500,000	(10%)	$6,000	(15%)	$104,000
SCOPE CONTINGENCIES	(20%)	$2,100,000	(15%)	$8,000	(20%)	$139,000
CONSTRUCTION AND O&M TOTAL		$14,200,000		$69,000		$937,000
PERMITTING AND LEGAL (c)	(6%)	$852,000	(2%)	$1,000	(6%)	$56,000
SERVICES DURING CONSTRUCTION	(7%)	$994,000	(3%)	$2,000	(7%)	$66,000
TOTAL IMPLEMENTATION COST		$16,000,000		$72,000		$1,060,000
ENGINEERING DESIGN COST (d)	(12%)	$1,920,000	(0%)	$0	(6%)	$64,000
TOTAL CAPITAL COST (e)		$17,900,000		$72,000		$1,124,000
PRESENT WORTH FACTOR		1.0		9.4269		0.0573
PRESENT WORTH (f)		$17,900,000		$679,000		$64,000
TOTAL PRESENT WORTH		$18,600,000				

NOTES:
(a) Costs are shown to 3 significant figures or the nearest thousand dollars. See appendix N for detailed cost estimates.
(b) Replacement of landfill cap at year 30.
(c) Includes environmental and nonenvironmental permits, and community relations.
(d) Includes the siting study and bench or pilot scale studies for solidification.
(e) Land acquisition not included in cost estimate.
(f) Present worth at 10% interest over 30 years.

thermal treatment facility. Sediment with a PCB concentration of 50 mg/kg or greater would be contained in a separate onsite cell. Solidified sediment contaminated with only arsenic (3,000 cubic yards) would be disposed of in a separate compartment within one of the cells of the new onsite RCRA/TSCA-type landfill. An estimated total of about 41,500 cubic yards of contaminated material would be thermally treated (See Attachment C for thermal treatment eval.).

Ash resulting from thermal treatment of the sediment would be considered a hazardous waste and disposed of in the onsite RCRA/TSCA-type landfill unless it is demonstrated through testing that the ash could be managed as a nonhazardous waste. If conditions require it, permanent landfilling of the ash from thermal treatment at an offsite RCRA/TSCA-approved facility may also be considered.

Water generated during onsite work would be collected and treated onsite for removal of suspended solids and dissolved organic contaminants by activated carbon adsorption. Treated water would be discharged to the Ashtabula POTW or directly to Fields Brook taking into consideration NPDES requirements. The total present worth of this alternative is $61.7 million. More detailed costs are shown in Table 6.

4) Excavation of Sediment and Partial Thermal Treatment (AA-4).
AA-4 is the combination of AA-2 (complete onsite landfill) and AA-3 (complete onsite thermal treatment). AA-4 incorporates the same sediment excavation plan as the three previous alternatives, i.e., removal of contaminated sediment in stream reaches with a calculated 10^{-6} or greater risk level

TABLE 6-6
COST ESTIMATE SUMMARY (a)
ASSEMBLED ALTERNATIVE NO. 3
FIELDS BROOK FS

COST COMPONENT		CONSTRUCTION COSTS		ANNUAL REMEDIAL COSTS (YEAR 1-6)		ANNUAL O & M (YEAR 1-30)		REPLACEMENT (YEAR 30)
1. SEDIMENT EXCAVATION TO 10^{-6} ESTIMATED RISK (BACKGROUND)								
A. GENERAL CONDITIONS		$354,000		$0		$0		$0
B. HEALTH AND SAFETY CONSIDERATIONS		$363,000		$0		$0		$0
C. SITE PREPARATION		$389,000		$0		$0		$0
D. DIVERSION OF STREAM		$959,000		$0		$0		$0
E. MECHANICAL EXCAVATION		$1,500,000		$0		$0		$0
F. CHANNEL RESTORATION		$469,000		$0		$0		$0
2. ONSITE LANDFILL								
A. SITE PREPARATION		$400,000		$0		$0		$0
B. BERM CONSTRUCTION		$623,000		$0		$0		$0
C. CELL CONSTRUCTION		$2,000,000		$0		$0		$0
D. FACILITIES AND MONITORING		$500,000		$0		$22,000		$0
E. TEMPORARY COVER		$542,000		$0		$0		$0
F. CAP CONSTRUCTION AND MAINTENANCE (b)		$620,000		$0		$32,000		$694,000
G. SOLIDIFICATION OF ARSENIC WASTE		$94,000		$0		$0		$0
3. ONSITE THERMAL TREATMENT (ROTARY KILN)								
A. SITE PREPARATION		$200,000		$0		$0		$0
B. EQUIPMENT		$6,330,000		$0		$0		$0
C. INSTALLATION AND START UP		$2,000,000		$0		$0		$0
D. OPERATION OF FACILITY (c)		$0		$4,830,000		$0		$0
4. ONSITE WATER TREATMENT								
A. TREATMENT FACILITY		$306,000		$0		$0		
B. OPERATION OF FACILITY		$269,000		$0		$0		$0
C. DISCHARGE		$9,000		$0		$0		$0
CONSTRUCTION AND O&M SUBTOTAL		$18,000,000		$4,830,000		$54,000		$694,000
BID CONTINGENCIES	(15%)	$2,700,000	(10%)	$483,000	(10%)	$5,000	(15%)	$104,000
SCOPE CONTINGENCIES	(25%)	$4,500,000	(15%)	$725,000	(15%)	$8,000	(20%)	$139,000
CONSTRUCTION AND O&M TOTAL		$25,200,000		$6,040,000		$67,000		$937,000
PERMITTING AND LEGAL (d)	(7%)	$1,760,000	(2%)	$121,000	(2%)	$1,000	(6%)	$56,000
SERVICES DURING CONSTRUCTION	(8%)	$2,020,000	(3%)	$181,000	(3%)	$2,000	(7%)	$66,000
TOTAL IMPLEMENTATION COST		$29,000,000		$6,342,000		$70,000		$1,060,000
ENGINEERING DESIGN COST (e)	(15%)	$4,350,000	(0%)	$0	(0%)	$0	(6%)	$64,000
TOTAL CAPITAL COST (f)		$33,400,000		$6,342,000		$70,000		$1,120,000
PRESENT WORTH FACTOR		1.0		4.3553		9.4253		0.057
PRESENT WORTH (g)		$33,400,000		$27,600,000		$660,000		$64,000
TOTAL PRESENT WORTH		$61,700,000						

NOTES:
(a) Costs are shown to 3 significant figures or the nearest thousand dollars. See appendix M for detailed cost estimates.
(b) Replacement of landfill cap at year 30.
(c) Total operational expenses during clean up activities based on a unit cost of $700 per cubic yard. This unit cost could range between $500 and $1,500 per cubic yard.
(d) Includes environmental and nonenvironmental permits, and community relations.
(e) Includes the siting study and bench or pilot scale studies for solidification and thermal treatment.
(f) Land acquisition not included in cost estimate.
(g) Present worth at 10% interest over 30 years.

(10^{-6} risk level removal option). Following excavation of contaminated sediment gravel-filled gabions would likewise be placed in the disturbed streambed to prevent erosion and to promote repopulation by aquatic species.

AA-4 includes construction of an onsite RCRA/TSCA-type landfill. Portions of this onsite RCRA/TSCA-type landfill would be used to temporarily store about 16,000 cubic yards (approximately 40%) of excavated sediment during the siting, permitting, design, construction and operation of an onsite thermal treatment facility. This 16,000 cubic yards of sediment would be subject to thermal treatment. The remaining portions of the landfill would contain about 36,000 cubic yards of solidified sediment and other material.

Ash resulting from thermal treatment of the sediment will be considered a hazardous waste and disposed of in the onsite RCRA/TSCA-type landfill unless it is demonstrated through testing that the ash could be managed as a nonhazardous waste. If conditions require it, permanent landfilling of the ash from thermal treatment at an offsite RCRA/TSCA approved facility may also be considered.

Water generated during onsite work would be collected and treated onsite to remove suspended solids and dissolved organic contaminants by activated carbon adsorption. Treated water would be discharged to the Ashtabula POTW or directly to Fields Brook taking into consideration NPDES requirements. The total present worth of this alternative is $48.4 million. More detailed costs are shown in Table 7.

5) <u>No Action (AA-5)</u>.

AA-5 is the no action alternative. Under AA-5, no further action of any kind would be done at the site. There are no costs associated with this alternative. It is presented as a baseline for comparison.

TABLE 6-7
COST ESTIMATE SUMMARY (a)
ASSEMBLED ALTERNATIVE NO. 4
FIELDS BROOK FS

COST COMPONENT		CONSTRUCTION COSTS		ANNUAL REMEDIAL COSTS (YEAR 1-3)		ANNUAL O & M (YEAR 1-30)		REPLACEMENT (YEAR 30)
1. SEDIMENT EXCAVATION TO 10^{-6} ESTIMATED RISK (BACKGROUND)								
A. GENERAL CONDITIONS		$354,000		$0		$0		$0
B. HEALTH AND SAFETY CONSIDERATIONS		$365,000		$0		$0		$0
C. SITE PREPARATION		$389,000		$0		$0		$0
D. DIVERSION OF STREAM		$959,000		$0		$0		$0
E. MECHANICAL EXCAVATION		$1,500,000		$0		$0		$0
F. CHANNEL RESTORATION		$469,000		$0		$0		$0
2. INTERIM STORAGE FACILITY								
A. SITE PREPARATION		$11,000		$0		$0		$0
B. CELL CONSTRUCTION		$161,000		$0		$0		$0
C. FACILITIES		$304,000		$0		$0		$0
D. CLOSURE BY CAPPING		$167,000		$0		$1,000		$0
E. SEDIMENT FIXATION		$1,230,000		$0		$0		$0
1. ONSITE LANDFILL								
A. SITE PREPARATION		$400,000		$0		$0		$0
B. BERM CONSTRUCTION		$623,000		$0		$0		$0
C. CELL CONSTRUCTION		$1,230,000		$0		$0		$0
D. FACILITIES AND MONITORING		$624,000		$0		$22,000		$0
E. TEMPORARY CAP		$357,000		$0		$0		$0
F. CAP CONSTRUCTION AND MAINTENANCE (b)		$628,000		$0		$32,000		$654,000
3. ONSITE THERMAL TREATMENT (ROTARY KILN)								
A. SITE PREPARATION		$800,000		$0		$0		$0
B. EQUIPMENT		$5,330,000		$0		$0		$0
C. INSTALLATION AND START UP		$2,800,000		$0		$0		$0
D. OPERATION OF FACILITY (c)		$0		$3,850,000		$0		$0
4. ONSITE WATER TREATMENT								
A. TREATMENT FACILITY		$306,000		$0		$0		$0
B. OPERATION OF FACILITY		$274,000		$0		$0		$0
C. DISCHARGE		$9,000		$0		$0		$0
CONSTRUCTION AND O&M SUBTOTAL		$18,900,000		$3,850,000		$55,000		$654,000
BID CONTINGENCIES	(15%)	$2,840,000	(10%)	$385,000	(10%)	$6,000	(15%)	$104,000
SCOPE CONTINGENCIES	(25%)	$4,730,000	(15%)	$578,000	(15%)	$8,000	(20%)	$135,000
CONSTRUCTION AND O&M TOTAL		$26,500,000		$4,810,000		$69,000		$937,000
PERMITTING AND LEGAL (d)	(7%)	$1,860,000	(2%)	$96,000	(2%)	$1,000	(6%)	$56,000
SERVICES DURING CONSTRUCTION	(8%)	$2,120,000	(3%)	$144,000	(3%)	$2,000	(7%)	$66,000
TOTAL IMPLEMENTATION COST		$30,500,000		$5,050,000		$72,000		$1,060,000
ENGINEERING DESIGN COST (e)	(15%)	$4,580,000	(0%)	$0	(0%)	$0	(6%)	$64,000
TOTAL CAPITAL COST (f)		$35,100,000		$5,050,000		$72,000		$1,120,000
PRESENT WORTH FACTOR		1.0		2.4869		9.4269		0.0573
PRESENT WORTH (g)		$35,100,000		$12,600,000		$679,000		$64,000
TOTAL PRESENT WORTH		$48,400,000						

NOTES:
(a) Costs are shown to 3 significant figures or the nearest thousand dollars. See appendix N for detailed cost estimates.
(b) Replacement of landfill cap at year 30.
(c) Total operational expenses during clean up activities based on a unit cost of $700 per cubic yard. This unit cost could range between $530 and $1,500 per cubic yard.
(d) Includes environmental and nonenvironmental permits, and community relations.
(e) Includes the siting study and bench or pilot scale studies for solidification and thermal treatment.
(f) Land acquisition not included in cost estimate.
(g) Present worth at 10% interest over 30 years.

ALTERNATIVE SCREENING PROCESS

The detailed screening process used to select the remedy was performed consistent with the NCP, 40 CFR Part 300.68(h), U.S. EPA's most recent guidance concerning the selection of off-site remedial alternatives, and other Agency guidance as appropriate. The NCP criteria used in the detailed alternatives analysis were:

1. Consideration of established technology and innovative alternative technology as appropriate.
2. Detailed cost estimation, including operation and maintenance (O & M) costs, and distribution of costs over time.
3. Evaluation in terms of engineering implementation, reliability, and constructability.
4. An assessment of the degree of protection provided by a given alternative, including the attainment of relevant and appropriate Federal standards.
5. An analysis of whether destruction or other advanced technologies is appropriate to reliably minimize present or future threats.
6. An analysis of adverse environmental impacts.
7. Consistency with the final remedy.

A summary of the alternatives with respect to the above criteria is presented in Table 8.

COMPARISON OF ALTERNATIVES

ASSEMBLED ALTERNATIVE AA-5

The no action assembled alternative is ineffective in preventing further contaminant migration and does not mitigate or minimize the existing threats to

	ASSEMBLED ALTERNATIVE 1		ASSEMBLED ALTERNATIVE 2		ASSEMBLED ALTERNATIVE 3		ASSEMBLED ALTERNATIVE 4		ASSEMBLED ALTERNATIVE 5	
ORDER OF MAGNITUDE COST ESTIMATES[a] Total Capital[b] Present Worth[c]	$30,600,000 $30,600,000		$17,900,000 $18,600,000		$33,400,000 $61,700,000		$36,100,000 $48,400,000		$0 $0	
TECHNICAL CRITERIA[f] Performance Reliability Implementability Safety	+ + + −	Excavation of sediment removes contaminants to background or 10^{-6} risk level concentrations (whichever is greater). Approximately 53,000 cubic yards disposed of. Sediment solidified and disposed of offsite in RCRA and/or TSCA landfill. Water extracted from sediment disposed of offsite at RCRA facility. Sediment excavation performed during dry summer months and may require up to 3 years to complete.	+ + O −	Excavation of sediment removes contaminants to background or 10^{-6} risk level concentrations (whichever is greater). Approximately 53,000 cubic yards disposed of. Sediment solidified and disposed of in an onsite RCRA/TSCA type landfill requiring ongoing maintenance and monitoring with separate cell for PCB contaminated sediment. Water extracted from sediment and collected from landfill treated onsite and discharged to POTW or directly to surface water. Sediment excavation performed during dry summer months and may require up to 3 years to complete.	++ + − −	Excavation of sediment removes contaminants to background or 10^{-6} risk level concentrations (whichever is greater). Approximately 41,000 cubic yards thermally treated. Arsenic contaminated sediment solidified and disposed of in separate cell of onsite landfill. Thermal treatment of sediment onsite eliminates organic contaminants and destroys 99.9999 percent of PCBs. Ash disposal in onsite RCRA/TSCA type landfill. Water extracted from sediment and collected from landfill and thermal treatment facility would be treated onsite and discharged to POTW or directly to surface water.	++ + − −	Excavation of sediment removes contaminants to background or 10^{-6} risk level concentrations (whichever is greater). About 16,000 cubic yards of contaminated sediment containing the most mobile contaminants with at least a 10^{-6} sediment ingestion risk or PCB's concentrations greater than 50 mg/kg are thermally treated. The remaining contaminated sediment will be solidified. About 36,000 cubic yards of solidified sediment and other material will be disposed of in an onsite RCRA/TSCA type landfill along with the residual from the thermal treatment facility. Water extracted from sediment and collected from the landfill or thermal treatment facility would be treated onsite and discharged to POTW or directly to surface water.	NA NA NA NA	
INSTITUTIONAL CRITERIA[f] Standards Permits[d] Land Use/Zoning	+ O ++	Will require generator ID. Should attain surface water standards because contaminants are removed. Rehabilitation of brook should enhance public use of area. No zoning or land use changes required. CERCLA requires that offsite disposal of contaminated sediment be taken to permitted hazardous waste management facilities in compliance with RCRA. Assumes solidification can be demonstrated to reduce the mobility of contaminants.	+ − −	Will require generator ID. Should attain surface water standards because contaminants are removed. Rehabilitation of brook should enhance public use of area. Landfill area would need to be rezoned, designated as hazardous waste landfill, constructed, and continuously monitored in accordance with RCRA. The exact location and engineering feasibility of the landfill needs to be determined. Assumes solidification can be demonstrated to reduce the mobility of contaminants.	+ − −*	Will require generator ID. Should attain surface water standards because contaminants are removed and treated. Rehabilitation of brook should enhance public use of the area. Landfill area would need to be rezoned and designated as hazardous waste landfill, unless incinerator/reactor ash is determined to be a nonhazardous waste. Arsenic contaminated sediment solidified and disposed of in separate cell of onsite landfill. Thermal treatment facility will involve greater siting and permitting effort than other alternatives. Over 5 years are estimated to site, permit, bid, design, construct and operate an onsite thermal treatment facility.	+ − −*	Will require generator ID. Should attain surface water standards because contaminants are removed and treated. Rehabilitation of brook should enhance public use of the area. Landfill area would need to be rezoned and designated as hazardous waste landfill, unless incinerator/reactor ash is determined to be a nonhazardous waste. Arsenic contaminated sediment solidified and disposed of in separate cell of onsite landfill. Thermal treatment facility will involve greater siting and permitting effort than other alternatives. Over 5 years are estimated to site, permit, bid, design, construct and operate an onsite thermal treatment facility. Assumes solidification can be demonstrated to reduce the mobility of contaminants.	− O −	Area would continue to be uncontrolled hazardous waste site
ENVIRONMENTAL CRITERIA[f] Biological Human	+ +	Contaminants removed and transferred to offsite landfill, habitat rehabilitated, no adverse effects anticipated. Short-term disturbance due to excavation and truck traffic. Rehabilitated brook would become asset to community.	+ +	Contaminants removed and contained in onsite landfill, habitat rehabilitated, no adverse effects anticipated. Short-term disturbance due to excavation and truck traffic. Rehabilitated brook would become asset to community. Landfill may detract from community.	++ ++	Contaminants are removed and organic contaminants are destroyed, habitat rehabilitated, no adverse effects anticipated. Short-term disturbance due to excavation and truck traffic. Rehabilitated brook would become asset to community. Potential for managing the ash as a nonhazardous waste	++ ++	Contaminants are removed and mobile organic contaminants are destroyed. Immobile contaminants are contained. Habitat rehabilitated, no adverse effects anticipated. Short-term disturbance due to excavation and truck traffic. Rehabilitated brook would become asset to community. Potential for management of ash as a nonhazardous waste	−− −−	Migration of contaminants continues. Potential adverse impact on wildlife. Bioaccumulation of contaminants may be occurring. Potential for human ingestion of contaminated fish.
PUBLIC HEALTH CRITERIA[f] Short-term Long-term	− +	May be some exposure to fugitive dust and volatiles; exposure can be mitigated. Contaminants removed and estimated finished sediment ingestion risk less than 10^{-6}.	− +	May be some exposure to fugitive dust and volatiles, exposure can be mitigated. Contaminants removed and estimated finished sediment ingestion exposure risk less than 10^{-6}.	− +	May be some exposure to fugitive dust and volatiles, exposure can be mitigated. Contaminants removed and estimated finished sediment ingestion exposure risk less than 10^{-6}. Organic contaminants are destroyed	− +	May be some exposure to fugitive dust and volatiles, exposure can be mitigated; contaminants removed and estimated finished sediment ingestion exposure risk less than 10^{-6}. Highly mobile organic contaminants and PCBs are destroyed	− −−	Unlimited site assesses current estimated lifetime excess sediment ingestion exposure risk of 10^{-2}.

NOTES

[a]The American Association of Cost Engineers defines an Order-of-Magnitude Estimate as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type is accurate within +50% to -30%. Sources of cost information include the U.S. EPA's "Compendium of Cost of Remedial Technologies at Hazardous Waste Sites," the Means Site Work Cost Data Guide, Cost Reference Guide for Construction Equipment and vendor estimates.

[b]Total Capital Cost include indirect cost for engineering services, legal fees, administration costs and cost contingencies. Refer to tables 6-4 through 6-7 for a summary of the cost estimate for each alternative.

[c]Total Present Worth Cost is based on 30-year period and 10 percent interest. Present worth costs includes replacement costs for landfill caps in Assembled Alternatives No. 2 and 4.

[d]According to the National Contingency Plan and current U.S. EPA policy, environmental permits are not required for onsite Fund-financed CERCLA actions, however, the technical requirements necessary to obtain a permit are required to be fulfilled.

[e] [illegible] taken to an offsite facility for disposal, the land use/zoning rating becomes 0.

[f] [illegible] ...ndix D for definitions of criteria.

LEGEND

−− EXTREMELY NEGATIVE EFFECTS EVEN WITH MITIGATING MEASURES, CAPABLE OF ELIMINATING AN ALTERNATIVE

− NEGATIVE EFFECTS BUT NOT STRONG ENOUGH OR CERTAIN ENOUGH TO BE THE SOLE JUSTIFICATION FOR ELIMINATING AN ALTERNATIVE, OR OF ONLY MODERATE SIGNIFICANCE

O OF VERY LITTLE APPARENT POSITIVE OR NEGATIVE EFFECTS, BUT INCLUSION CAN BE JUSTIFIED FOR SOME SPECIAL REASON, OR NO CHANGE FROM EXISTING CONDITIONS

+ A POSITIVE OR MODERATELY POSITIVE BENEFIT

++ AN EXTREMELY POSITIVE BENEFIT

• ANALYSIS NOT COMPLETE OR INAPPROPRIATE TO DRAW CONCLUSIONS AT THIS TIME

NOT APPLICABLE

public health and welfare and the environment. The Exposure Assessment concludes that there is a potential for exposure of the public to contaminants at the site at levels that may adversely affect public health and welfare. Therefore, remedial action is required to mitigate or minimize this exposure. Thus, the no action assembled alternative is not appropriate and is not recommended by U.S. EPA.

ASSEMBLED ALTERNATIVES AA-1, AA-2, AA-3, AND AA-4

Assembled alternatives AA-1, AA-2, AA-3 and AA-4 all involve mechanical excavation of contaminated sediment in Fields Brook and its tributaries to the level defined for the 10^{-6} excess lifetime cancer risk. Excavated sediment would be solidified and disposed of at an offsite RCRA/TSCA facility (AA-1), solidified and disposed of in a RCRA/TSCA-type landfill constructed onsite (AA-2), thermally treated at an onsite facility with the resulting ash landfilled onsite (AA-3), or a combination of onsite thermal treatment and onsite landfill (AA-4).

Water generated from sediment excavation, sediment dewatering, sediment solidification, or construction and operation of onsite landfill facilities would be treated either offsite (AA-1) or onsite (AA-2, AA-3, and AA-4).

The extent of sediment removal for these four assembled alternatives would be the same; therefore, the environmental and public health benefits from sediment removal at the site would be similar. U.S. EPA believes that the risk associated with exposure to or ingestion of contaminated sediment would be reduced by sediment removal to levels that are protective of public health and welfare and the environment. Onsite and offsite water treatment also have similar environmental benefits. Thus, these four assembled alternatives differ primarily in respect to the treatment and disposal of the excavated sediment.

Assembled alternative AA-1 (offsite disposal) has similar long-term environmental and public health benefits as AA-2 (onsite disposal); however, its present worth is greater. Thus, on the basis of present worth cost only, AA-2 is preferred over AA-1. Assembled alternative AA-1 has a shorter time frame to implement, however, there is no assurance that there would be available RCRA/TSCA landfill capacity, that these landfills would accept the solidified Fields Brook sediment and that these landfills would be in compliance with the applicable environmental regulations. Assembled altenative AA-1 also depletes existing landfill capacity that could be used for disposal of other hazardous wastes, while AA-2 creates its own landfill capacity. Alternative AA-1 does not require resolution of issues relating to siting a RCRA/TSCA-type landfill at the Fields Brook site, while AA-2 does. However, based upon the cost and the uncertainty of landfill capacity and availability, U.S. EPA does not recommend AA-1.

U.S. EPA believes AA-3 has greater long-term environmental and public health benefits than AA-2 and AA-4, because organic contaminants present in the sediment would be destroyed through thermal treatment. U.S. EPA also believes that AA-4 would have greater long-term environmental benefits than assembled alternative AA-2 because the more mobile and higher risk organic contaminants in about 40 percent of the contaminated sediment would be destroyed through thermal treatment. Assembled alternative AA-2 solidifies all of the sediment and disposes of the solidified sediment at a new onsite RCRA/TSCA-type landfill.

AA-4, sediment that contains organic contaminants with higher mobilities s (soil-water partition coefficients) less than 2,400 ml/g) and greater .(greater than the 10^{-6} excess lifetime cancer risk for sediment ingestion), .hat contain PCB's greater than 50 mg/kg, would be thermally treated (See achment B). The organic contaminants in the remaining 60 percent of the ıtaminated sediment would be treated through solidification to further reduce e mobility of the remaining organic contaminants before disposal in an onsite :RA/TSCA-type landfill. It is expected that this 60% of the contaminated ediment could be successfully solidified and landfilled with long-term reliability. .f is not the case, this sediment may also be subject to thermal treatment.

All three of these assembled alternatives (AA-2, AA-3 and AA-4) require resolution of issues related to the technical requirement of the permitting process and the siting of a RCRA/TCSA-type disposal facility at the Fields Brook site. In AA-3, it is possibile that the ash may not be considered a hazardous waste, if, after thermal treatment the ash is shown to be nonhazardous. The ash would then be managed as a nonhazardous solid waste, and disposal at a RCRA/TSCA-type landfill would not be required.

Both AA-3 and AA-4 also require resolution of siting and permitting issues related to construction of temporary thermal treatment facilities at or near the site. This would include demonstrating that operation of the thermal treatment facility is in compliance with air quality regulations. Construction of a portable thermal treatment facility for AA-3 and AA-4 would create additional nationwide thermal treatment capacity. This new capacity could be utilized at other CERCLA sites by transporting and reassembling the portable thermal treatment facility at another site after the contaminated sediment at Fields Brook has been treated.

Because destruction of hazardous substances possesses greater environmental and public health benefits and permanent reduction of the potential risk of landfill failure, it is considered more reliable in the long term. Consequently, U.S. EPA believes AA-3 and AA-4 are preferred over AA-2.

While AA-3 destroys all of the organic contaminants by thermal treatment, AA-4 destroys those organic contaminants that are more mobile and have higher risks associated with them or the sediment with PCB concentrations greater than 50 mg/kg, leaving the relatively less mobile and lower risk contaminants to be landfilled after solidification. Thus, AA-4 combines the best features of AA-2 and AA-3, thermal destruction of organic contaminants with higher mobilities and higher risk, while using lower cost landfill disposal for the less mobile or lower risk contaminants. Assembled alternative AA-4 is therefore recommended by U.S. EPA for implementation as the cost-effective alternative for the Fields Brook Sediment Operable Unit.

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

In determining appropriate remedial actions at CERCLA sites, consideration must be given to the requirements of other federal environmental laws in addition to CERCLA. Primary consideration is given to attaining or exceeding applicable or relevant and appropriate environmental and public health laws, regulations, standards, and guidelines.

The applicable or relevant environmental and public health standards are reviewed for each alternative examined in detail and summarized in Table 9.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE
LAWS, REGULATIONS, POLICIES, AND STANDARDS
FOR THE FIELDS BROOK ASSEMBLED ALTERNATIVES

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
FEDERAL			
Resource Conservation and Recovery Act (RCRA)	RCRA Subtitle C, 40 CFR 260	RCRA regulates the generation, transport, storage, treatment, and disposal of hazardous waste. CERCLA specifically requires (in Section 104(c)(3)(B)) that hazardous substances from removal actions be disposed of at facilities in compliance with Subtitle C of RCRA.	AA-1 through AA-4. In accordance with the NCP, excavated sediment will be managed as though it is a hazardous waste.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	RCRA Section 3004, 40 CFR 264 and 265	Regulates the construction, design, monitoring, operation, and closure of hazardous waste facilities. Subparts N and O specify technical requirements for landfills and incinerators, respectively.	Landfill design requirements apply to the interim storage facilities of AA-1, and AA-4 along with the onsite landfills of AA-2, AA-3, and AA-4. The incinerator design requirements of RCRA apply to AA-3 and AA-4.
Interim RCRA/CERCLA Guidance on Non-Contiguous Sites and Onsite Management of Waste and Treated Residue	U.S. EPA Policy Statement March 27, 1986	If a treatment or storage unit is to be constructed for onsite remedial action, there should be clear intent to dismantle, remove, or close the unit after the CERCLA action is completed. Should there be plans to accept commercial waste at the facility after the CERCLA waste has been processed, it is EPA policy that a RCRA permit be obtained before the unit is constructed.	AA-2 through AA-4. The onsite thermal treatment facilities will be dismantled, and landfill and storage facilities will be capped for closure following processing of Fields Brook waste. This FS assumes that the technical requirements of RCRA will be met. Thus, the onsite facilities would not be required to obtain RCRA permits.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
Standards Applicable to Transporters of Hazardous Waste	RCRA Section 3003, 40 CFR 262 and 263, 49 CFR 170 to 179	Establishes the responsibility of offsite transporters of hazardous waste in the handling, transportation, and management of the waste. Requires a manifest, recordkeeping, and immediate action in the event of a discharge of hazardous waste.	AA-1. This alternative may involve interstate transport of contaminated sediment to RCRA/TSCA disposal facilities.
EPA Administered Permit Programs: The Hazardous Waste Permit Program	RCRA Section 3005, 40 CFR 270, 124	Covers the basic permitting, application, monitoring, and reporting requirements for offsite hazardous waste management facilities.	AA-1. CERCLA requires that offsite disposal of hazardous substances (contaminated sediment) will be taken to permitted and inspected hazardous waste management facilities in compliance with RCRA.
EPA Interim Policy for Planning and Implementing CERCLA Offsite Response Actions	50 FR 45933 November 5, 1985	Discusses the need to consider treatment, recycling, and reuse before offsite land disposal is used. Prohibits use of a RCRA facility for offsite management of Superfund hazardous substances if it has significant RCRA violations.	AA-1 through AA-4. Requirements for selecting offsite storage, treatment, or disposal facilities apply to AA-1. AA-2 through AA-4 consider solidification or thermal treatment of contaminated sediment in accordance with this policy.
Hazardous and Solid Waste Amendments of 1984 (1984 amendments to RCRA)	PL 98-616, Federal Law 71:3101	Specific wastes are prohibited from land disposal under the 1984 RCRA Amendments. This includes a ban on the placement of wastes containing free liquids. Also, solvent-containing wastes are prohibited from land disposal, effective November 1986. EPA is also required to set treatment levels or methods, exempting treated hazardous wastes from the land disposal ban. To date, these treatment standards have not	AA-1 through AA-4. If treatment standards are not promulgated, landfilling of "banned" waste would not be acceptable without a successful demonstration that land disposal is protective of human health and welfare and the environment.. Incineration of the sediment (assuming it is to be managed as though it is a RCRA waste) may be the only applicable treatment method.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
		been promulgated. The RCRA amendments will also restrict the landfilling of most RCRA-listed wastes by 1991 unless treatment standards are specified.	
Toxic Substances Control Act (TSCA)	40 CFR Part 761	Applies to the disposal of liquid wastes containing PCB concentrations at or greater than 50 ppm and PCB's that have migrated from the original source of contamination. PCB concentrations greater than 500 ppm must be incinerated in an incinerator that complies with 40 CFR 761.70. PCB concentrations less than 500 ppm and greater than 50 ppm may be disposed of in a landfill that complies with 40 CFR 761.75.	AA-1 through AA-4. Sediment will be sampled and analyzed during excavation. Based upon the data in the RI report, PCB levels are between 50 and 500 mg/kg for approximately 12,000 cu yd of sediment. For purposes of evaluation in this feasibility study, it has been assumed that sediment concentrations are below 500 mg/kg. If PCB levels are found to exceed 500 mg/kg, these sediments must be incinerated in a TSCA-type facility.
Permits for Discharges of Dredged or Fill Material Into Waters of the U.S. (Section 404 permit)	33 CFR 320 to 330, Section 404 of the Clean Water Act	Part 323 requires permits to discharge dredged or fill materials into navigable waters or their tributaries, including wetlands adjacent to such waters. Part 322 requires permits for structures or work in or affecting navigable waters.	AA-1 through AA-4. The temporary diversion of portions of Fields Brook during excavation may be subject to the authorization procedures of these regulations.
Great Lakes Water Quality Agreement of 1978	International Joint Commission, Canada and the United States	This intergovernmental Agreement sets specific water quality objectives and develops monitoring and control programs to eliminate or reduce the discharge of pollutants into the Great Lakes basin ecosystem.	AA-1 through AA-4. Fields Brook is in the Great Lakes drainage basin since it feeds into the Ashtabula River which feeds into Lake Erie. Sediment excavation and discharge of treated water to surface water shall consider the specific objectives of this agreement including the control of toxic substances entering the Great Lakes waters.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
Statement of Procedures on Flood Plain Management and Wetland Protection	Appendix A to 40 CFR 6, Executive Order 11988, and 11990	Requires federal agencies to avoid wherever possible adversely affecting flood plains or wetlands and to evaluate potential effects of planned actions in these designated areas.	AA-1 through AA-4. Precautions will be taken during excavation of sediment to minimize the impacts on the flood plain and for the protection of wetlands. Removal of the contaminated sediment and restoration after excavation will improve the brook conditions. Onsite facilities must be constructed consistent with standards established under the National Flood Insurance Program. Landfilling of wetlands is not anticipated.
Clean Air Act (CAA)	40 CFR 1 to 99	Applies to major stationary sources that have the potential to emit significant amounts of pollutants such as NO_x, SO_2, CO, lead, mercury, and particulates. Regulations under CAA do not specifically regulate emissions from hazardous waste incinerators, but it is likely that Prevention of Significant Deterioration (PSD) provisions would apply to an onsite thermal treatment facility.	AA-3 and AA-4. These regulations may apply to emissions from the thermal treatment facility.
National Environmental Policy Act (NEPA)	NEPA Section 102(2)(c)	CERCLA actions are exempted from the NEPA requirements to prepare an environmental impact statement (EIS) because US EPA's decisionmaking processes in selecting a remedial action alternative are the functional equivalent of the NEPA analysis.	AA-1 through AA-5. The functional equivalent of a NEPA review is carried out in U.S. EPA's regulatory activities for CERCLA actions.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
Intergovernmental Review of Federal Program	Executive Order 12372 and 40 CFR 29. (Replaces state and areawide coordination process required by OMB Circular A-95.)	Requires state and local coordination and review of proposed EPA assisted projects. The EPA Administrator is required to communicate with state and local officials to explain the project, consult with other affected federal agencies, and provide a comment period for state review.	AA-1 through AA-5.
Relocation Assistance and Property Acquisition	Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1979, 40 CFR 4	Requires that property owners be compensated for property acquired by the federal government.	AA-1 through AA-4. Land acquisition may be required for the interim storage facility, onsite landfill, onsite thermal treatment facility, and/or onsite water treatment facility.
National Pollutant Discharge Elimination System (NPDES) Permit	Clean Water Act Section 402, 40 CFR 122, 123, 125 Subchapter N	Regulates the discharge of water into public surface waters.	AA-2 through AA-4. These alternatives may include discharge from the onsite water treatment facility to Fields Brook.
Pretreatment Regulations for Existing and New Sources of Pollution	40 CFR 403 Subchapter N, FWPCA	Regulates the quality of water discharged into publicly owned treatment works (POTW).	AA-2 through AA-4. These alternatives may include discharge from the onsite water treatment facility to the Ashtabula POTW.
Toxic Pollutant Effluent Standards	40 CFR 129	Regulates the discharge of the following pollutants: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, and PCB's.	AA-2 through AA-4. These pollutants are not expected to be present in the discharge from the onsite water treatment plant.
US EPA Groundwater Protection Strategy	U.S. EPA Policy Statement August 1984	Identifies groundwater quality to be achieved during remedial actions based on the aquifer characteristics and use.	AA-1 through AA-5. It is not known at present if contaminants from Fields Brook affect groundwater quality.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
Conservation of Wildlife Resources	Fish and Wildlife Coordination Act	This act requires agency consultation prior to modifying any body of water.	AA-1 through AA-4. This applies to the excavation of sediment.
Occupational Safety and Health Act (OSHA)	29 CFR 1910	Regulates working conditions to assure safety and health of workers.	AA-1 through AA-4. This applies to all workers on the site property during excavations, construction and operation of facilities
STATE AND LOCAL			
State Hazardous Waste Site Permit	Ohio Solid and Hazardous Waste Disposal Law, and Ohio Hazardous Waste Management Regulations. Ohio Administrative Code: 3734-01 through 99 and 3745-50 through 69.	If a new hazardous waste facility must be created to handle the wastes for longer than 90 days, state approval and/or generator I.D. may be required as a precondition.	AA-2 through AA-4. Pertains to the construction of the onsite interim storage, onsite landfill, thermal treatment, and water treatment facilities.
Local Operating Permit or License for Remedy	Zoning, building or fire code, or local licensing laws	Obtain local permit or license approving operation of site facilities.	AA-1 through AA-4. Local permits may need to be obtained for the operation of the interim storage, landfill, thermal treatment, and water treatment facilities.
State Hazardous Waste Manifest and State Permit or License for Transport of Hazardous Waste	Ohio hazardous waste management, hazardous materials transport, or commercial driver licensing regulations. Ohio Administrative Code 3475-52, 53	In general, the manifest systems require the generator to obtain a permit to transport wastes on public rights-of-way within the state, to use only licensed transporters, and to designate only a permitted TSD facility to take delivery of wastes.	AA-1. A manifest must be prepared for the transport of contaminated sediment to the offsite disposal facility.
Ohio NPDES Permit	Ohio Water Pollution Control. Ohio Administrative Code 3745-33, 40 CFR 123	Regulates all point source discharges to surface waters of the state.	AA-2 through AA-4. Regulates discharge from the onsite water treatment facility to Fields Brook.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
Local Approval of Sewer Use Permit	Local sewer connection and pretreatment ordinances, as well as some zoning, as subdivision, and/or building codes.	Permit, approval, and/or fee for connection to public sewer system. Requirements as to quantity and quality of effluents discharged to sewer system.	AA-2 through AA-4. Regulates the discharge from the onsite water treatment facility to the Ashtabula POTW.
Ohio Water Quality Standards	Ohio Administrative Code 3745-1	Establishes minimum water quality criteria requirements for all surface waters of the state.	AA-2 through AA-4. The designated use of Fields Brook has been defined as a limited warmwater aquatic life habitat. Discharges from the onsite water treatment facility must meet the necessary criteria.
Ohio Pretreatment Rules	Ohio Administrative Code 3745-3	Establishes state requirements and standards regulating the introduction of pollutants into POTW's.	AA-2 through AA-4. Regulates the discharge from the onsite water treatment facility to the Ashtabula POTW.
State Permit Requirements for Emissions in Prevention of Significant Deterioration (PSD) Areas	Clean Air Act, Part C; State Implementation Plans, Ohio Administrative Code 3704 and 3745-17,18,21,71	A major source of air pollutants such as NO_2, SO_2, CO, hydrocarbons, lead, and particulates in PSD area must be permitted by the state and is subject to requirements applicable to PSD areas.	AA-2 through AA-4. This regulation may apply to the emissions from all onsite facilities, particularly the thermal treatment facility.
State Permit Requirements for Emissions in Nonattainment Area	Clean Air Act, Part D; State Implementation Plans, and Ohio Administrative Code 3745-31,35	If a major source is in a nonattainment area for those pollutants for which it is a major source, it must comply with requirements applicable to nonattainment areas.	AA-3, AA-4. The Fields Brook site is in a nonattainment area for ozone. The thermal treatment facility emissions should meet the permit requirements.
Local Approval of Grading (Erosion Control) Permit (Ohio has requirements for erosion control.)	Local grading ordinances or erosion control ordinances.	Requirements affecting land slope and cover, surface water management, alteration of natural contours, or cover by excavation or fill.	AA-1 through AA-4. Erosion control will be incorporated into channel restoration following excavation and the proper maintenance of onsite facilities.

Law, Regulation, Policy, or Standard	Source of Regulation	Applicability or Relevance and Appropriateness	Alternative Affected
Local Approval of Use Permit	Local Building Code	Demonstration through presentation of evidence or onsite inspection that remedial action complies with the requirements of local health and safety laws and ordinances.	AA-1 through AA-4. Building and construction permits would be necessary for the onsite interim storage, landfill, water treatment, and thermal treatment facilities.
Local Building Permits (includes electrical, plumbing, and HVAC)	Local Building Codes	Obtain permits for construction	AA-1 through AA-4. Building permits will be obtained for the onsite interim storage, landfill, water treatment, and thermal treatment facilities.

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The recommended alternative is expected to meet all applicable standards and requirements listed in Table 9.

RECOMMENDED ALTERNATIVE

The U.S. EPA's recommended alternative is assembled alternative AA-4, excavation of sediment and partial thermal treatment. It consists of these elements:

- Mechanical excavation of contaminated sediment in Fields Brook and its tributaries to the defined 10^{-6} excess lifetime cancer risk level. For organic contaminants where the 10^{-6} excess lifetime cancer risk level is below current U.S. EPA Contract Lab Program (CLP) detection limits, the detection limits will be used to define the level of sediment removal. For inorganic contaminants, background levels (the upper 99 percent confidence limit) or health based guildlines, whichever is higher, will be used to define the level of sediment removal.

- A new onsite RCRA/TSCA-type landfill will be constructed with separate cells for: solidification of and permanent storage of sediments containing relatively immobile or lower risk organic contaminants, including sediments contaminated only with arsenic (36,000 yd^3), and a temporary storage cell for the sediment that will be thermally treated (16,000 yd^3). The latter cell may permanently contain the residual from thermal treatment if disposal in a RCRA/TSCA-type facility is required. Included in the sediment to be landfilled is additional waste due to haul roads and decon stations, demolished part of the interim storage facility and a demolished curing cell. Refer to Appendix M. of the Fields Brook FS for a complete breakdown.

- Dewatering and temporary storage in a separate cell of the onsite RCRA/TSCA-type landfill of 16,000 cubic yards of the contaminated sediment containing organic contaminants with higher mobility and the highest sediment ingestion risk, or sediment with PCB concentration greater than 50 mg/kg. This quantity of sediment will be thermally treated.

- Solidification, for containment in a separate compartment of a cell in the onsite RCRA/TSCA-type landfill, of an estimated 2,600 cubic yards of contaminated sediment where the sediment ingestion risk is strictly due to the presence of inorganic contaminants (arsenic).

- Solidification of the remaining quantity of contaminated sediment for containment in separate cells within the onsite RCRA/TSCA-type landfill. The total volume after solidification is an estimated 33,400 yd^3.

- The resulting ash from the thermal treatment of the contaminated sediment will be analyzed to determine whether or not it should continue to be managed as though it is a hazardous waste. If the ash needs to be managed as a hazardous waste, it will be placed back into the original storage cell of the onsite RCRA/TSCA-type landfill. If the ash does not need to be managed as though it is a hazardous waste, it could be disposed of as a soild waste, in the same onsite facility or possibly offsite.

- Water generated during the excavation of contaminated sediment, the dewatering process, the solidification process, thermal treatment, or within the temporary storage cell of the RCRA/TSCA-type landfill will be treated onsite using filtration and a granular activated carbon system. Discharge of treated water will be either to the Ashtabula POTW or directly to Fields Brook taking into consideration NPDES requirements. The total present worth of this alternative is estimated at $48,400,000. The annual Operation and Maintenance cost of this alternative is $55,000.

RECOMMENDED ALTERNATIVE SELECTION CRITERIA

The National Contingency Plan, 40 CFR Part 300.68 (j) states that, "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." The lead agency should "consider cost, technology, reliability, administrative and other concerns and their relevant effects on the public health and welfare and the environment." The recommended alternative meets these criteria and is cost-effective. The recommended alternative can be readily designed and constructed, and would be accepted by the public.

The alternatives which involved total landfilling (both onsite and offsite) were not considered as effective in mitigating and minimizing the threats to public health, welfare, and the environment because long-term reliability and permanence of remedy did not approach that of thermal treatment. All compounds including those most mobile (those likely to migrate from a landfill upon failure) would be disposed of in the landfill under these alternatives.

Thermal treatment offers added benefits beyond that of landfilling of long-term reliability, and destruction of the most mobile and highly toxic contaminants.

While the alternatives to thermally treat all of the sediment (AA-3) and to thermally treat a portion of the sediment (AA-4) both possessed substantially equivalent public health and environmental benefits, the cost of AA-3 exceeds that of AA-4 and therefore was not considered to be cost-effective. (AA-3) also did not take into account the relative mobilities and risks of the different contaminants present in the sediments and the possibility that more than one technology may be appropriate. Total thermal treatment would include the treatment of reaches of Fields Brook in which the risk was attributed to compounds which are not very mobile. These compounds, after solidification, would be expected to remain contained in a RCRA type landfill and not represent a potential future problem should the landfill fail. The additional cost to thermally treat this remaining quantity was not deemed cost-effective. The recommended alternative (AA-4) combines the best features of landfilling and thermal treatment to arrive at an appropriate solution to the problem. It is consistent with the current U.S. EPA Interim Policy for Planning and Implementing CERCLA Offsite Response Actions, which discusses the need to consider treatment, recycle, and reuse before land disposal is used, as well as the Hazardous and Solid Waste Amendments 1984.

Three criteria were considered to decide what portion of the sediment should be thermally treated as well as what portion could be satisfactorily landfilled with long-term effectiveness; mobility, toxicity, and concentration of PCBs. These criteria are more completely described again in Attachment B. Thus alternative AA-4 demonstrates long-term reliability, permanence of remedy, and appropriate technologies to warrant recommendation.

OPERATION AND MAINTENANCE (O&M)

Annual Operation and Maintenance (O&M) costs are costs associated with post-clos activities after completion of the remedial action, such as ongoing landfill maintenance and groundwater monitoring. The O&M costs were estimated on an annual basis over 30 years. The O&M for the recommended alternative will require ongoing maintenance and monitoring of the onsite landfill and construction, maintenance, and replacement of the cap . The costs are described in Table 6. 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.

COMMUNITY RELATIONS

There has been public interest in the Fields Brook site throughout the RI/FS. Public meetings have been held, and there have been a number of letters and phone calls regarding the site. Media coverage for the public meetings has been through the local paper and radio station.

The main concern of the community during the RI/FS was to complete the study as soon as possible. The community has stated that it is rather obvious that Fields Brook represents a health risk and that the U.S. EPA should stop studying the brook and clean it up. These sentiments have also been expressed by the Ashtabula City Council. The Citizens For Clean Water have also expressed an interest in this project and have been kept up to date on the status.

Another concern was that the industries responsible for the contamination should be held accountable. Some extreme animosity toward the industries was expressed by several people at the latest public meeting.

Residents and local officials have also expressed an interest in the U.S. Army Corps of Engineers proposed dredging of the Ashtabula River and how the Fields Brook project impacts that project.

Many of these concerns were expressed during the public comment period for the FS. The comment period was extended to 40 days from the normal 21 days to accomodate the citizens' and PRPs' request for additional time to submit comments. Comments from residents and the Citizens for Clean Water generally support the recommendation. The Ashtabula Township Trustees support a different alternative, but expressed willingness to work with EPA in siting a landfill and thermal treatment unit. The comments received and the U.S. EPA's response to them are detailed in Appendix C.

SCHEDULE

MILESTONES	DATE
Complete Enforcement Negotiations	September 1986
Approve Remedial Action (sign ROD)	September 1986
Begin Pre-Design Activities	October 1986
Award contract for Design	January 1987
Begin Design	January 1987
Complete Design	January 1989
Award contract for Construction	March 1989
Begin Construction	March 1989
Complete Construction	March 1992

FUTURE ACTIONS

Future actions for the Fields Brook project can be divided into two general categories:

1) activities related to the Sediment Operable Unit, and
2) subsequent RI/FS activities.

The necessary pre-design studies related to the sediment operable unit are a sediment quantification study, pre-burns, a facility siting study, chemcial characterization of the wastewater that will be generated by remedial activities, bench scale wastewater treatability studies, and a pilot study to determine if solidification is an acceptable method to reduce organic contaminant mobility. A sediment quantification study is necessary to re-evaluate the sediment volume estimates used in the FS. Implementation of more detailed sampling and analysis plan would better define the contaminants present, their concentration, as well as their vertical and horizontal extent. A radioactive element analysis would also be a part of this study. The results of the sediment quantification study will be used in conjunction with earlier results as the basis for distinction between sediment to be thermally treated and sediment to be landfilled after solidification, and for determination of their quantities. In the event that the quantities change significantly, the size of the necessary facilities would need to be adjusted, and would be designed to meet those needs.

Pre-burns are necessary to demonstrate whether the various types of thermal treatment processes considered are applicable for Fields Brook's waste. This would be accomplished by sending small volumes of Fields Brook sediment to a number of existing facilities.

A facility siting study is needed to identify feasible locations for the facilities needed for the recommended alternative (i.e. thermal treatment unit, landfill). Considerations would include property availability, proximity to the community and potential impacts on flood plain/wetlands. This study would be subject to a public review similar to that in Environmental Impact Statements.

Information must be generated on the chemical content of the wastewater that will be generated during the remedial activities, such as sediment dewatering, and thermal treatment (i.e., scrubber water). This information will be necessary for the actual design of a wastewater treatment system and the eventual development of direct or indirect discharge limitations. Similarly, treatability testing will be necessary to demonstrate the effectiveness of the proposed treatment technologies at removing the contaminants in the wastewater and to identify other technologies that may be effective or necessary.

Lastly, a pilot or small bench scale study would be needed to demonstrate that the mobility of organic contaminants can be successfully reduced by means of solidification. If the study reveals that mobility reduction cannot be accomplished, the sediment designated for solidification and landfilling may also be subject to thermal treatment.

In addition to the above mentioned pre-design activities, two subsequent activities are proposed. The first is an RI/FS to identify any ongoing sources of contamination to Fields Brook. This study would involve a hydrogeological study of the Fields Brook watershed area. The second would be a study to address the contamination in the Ashtabula River. Samples would be taken outside the Corps of Engineers federal project area proposed for dredging. The Office of Policy and Program Evaluation in Headquarters is evluating the appropriateness of this type of area wide investigation, whether it is evaluating the appropriateness of this type of area wide investigation, whether it is economically feasible and within the scope of the Superfund program. Both of these studies would include an exposure assessment to determine if any further remedial action is required. Both of these studies are also planned to be undertaken concurrent with the design of the Sediment Operable Unit. If remedial action is warranted, it will be conducted as separate operable units of the Fields Brook site, in time frames consistent with maintaining the environmental benefits of the Sediment Operable Unit.

ATTACHMENT B

THERMAL TREATMENT CRITERIA

The costs associated with landfilling solidified contaminated sediment are lower in comparison to the costs of thermal treatment and landfilling. Because of this, a combination alternative that thermally treats a portion of the sediment and landfills the remainder was viable.

Factors important in differentiating between solidifying before landfilling or thermal treatment of contaminated sediment are:

- Toxicity
- Mobility
- Persistence
- Bioaccumulation capacity
- Leachability

Current data for the Fields Brook site are limited to mobility, concentrations, and toxicity. Concentrations and toxicity are combined together and expressed as the risk of excess cancer due to sediment ingestion. A methodology based upon these three types of data was developed to evaluate which contaminated sediment should be thermally treated.

The mobility or transport of a contaminant through soil or sediment can be expressed by the absorption coefficients or soil-water partition coefficients (Koc).

An extensive set of Koc values has been developed by Griffin (Seymour Remedial

Investigation Report, U.S. Environmental Protection Agency, 1985). This set included Koc values for most of the contaminants found in Fields Brook sediment. Griffin has also derived a classification system based on the relative mobilities of these contaminants. This classification system is:

Koc (ml/g)	Mobility Classification
0 - 50	Very High Mobility
50 - 150	High Mobility
150 - 500	Moderate Mobility
500 - 2,000	Low Mobility
2,000 - 20,000	Slight Mobility
greater than 20,000	Immobile

Application of Griffin's classification system to those compounds found in Fields Brook sediment at levels which represent a greater than 10^{-6} excess lifetime cancer risk due to sediment ingestion (as a measure of toxicity), resulted in Figure B-1, which is a plot of sediment volume vs. Koc. In reviewing this graph it is apparent that a breakpoint occurs at Koc value of 2,400 ml/g, and a volume of 7,800 cubic yards.

Based upon the large volume increase above the Koc value of 2,400 ml/g, that value was selected as the cutoff between sediment to be thermally treated and sediment to be solidified prior to landfilling. This value indicates that compounds with greater than slight mobility according to Griffin warrant thermal treatment at this specific site.

It is uncertain whether sediment with PCB concentrations greater than 500 mg/kg do actually exist in Fields Brook. However, several analyses indicate that PCB concentrations above 50 mg/kg do exist in the sediment. In determining the volume of contaminated sediment to be thermally treated, U.S. EPA recommends that sediment containing PCB concentrations greater than 50 mg/kg be thermally treated. This is in accordance with the PCB disposal requirements in 40 CFR 761.60 (a)(4) and (5) which require contaminated soil or dredged materials to be disposed of by incineration or by a chemical waste landfill. This is referenced in the U. S. EPA Interim Policy for Planning and Implementing CERCLA Offsite Response Actions which also states that whenever disposal of PCB's are undertaken they must be incinerated unless the concentrations are less than 50 ppm. This policy also states that if the concentrations are between 50 and 500 ppm certain exceptions to incineration (primarily disposal in an EPA approved landfill) may be implemented. These guidelines for the disposal of PCB's are considered both relevant and appropriate for Fields Brook sediment. Therefore sediment containing PCB's greater than 50 mg/kg is proposed for thermal treatment.

In summary, the volume of sediment to be thermally treated was determined based upon three guidelines:

- Mobility
- Toxicity and concentration
- PCB concentrations only

About 7,800 cubic yards of contaminated sediment will be thermally treated based upon the first two guidelines. Another 7,800 cubic yards will be thermally treated because of PCB concentrations only, for an estimated total volume of 15,600 cubic yards of contaminated sediment to be thermally treated.

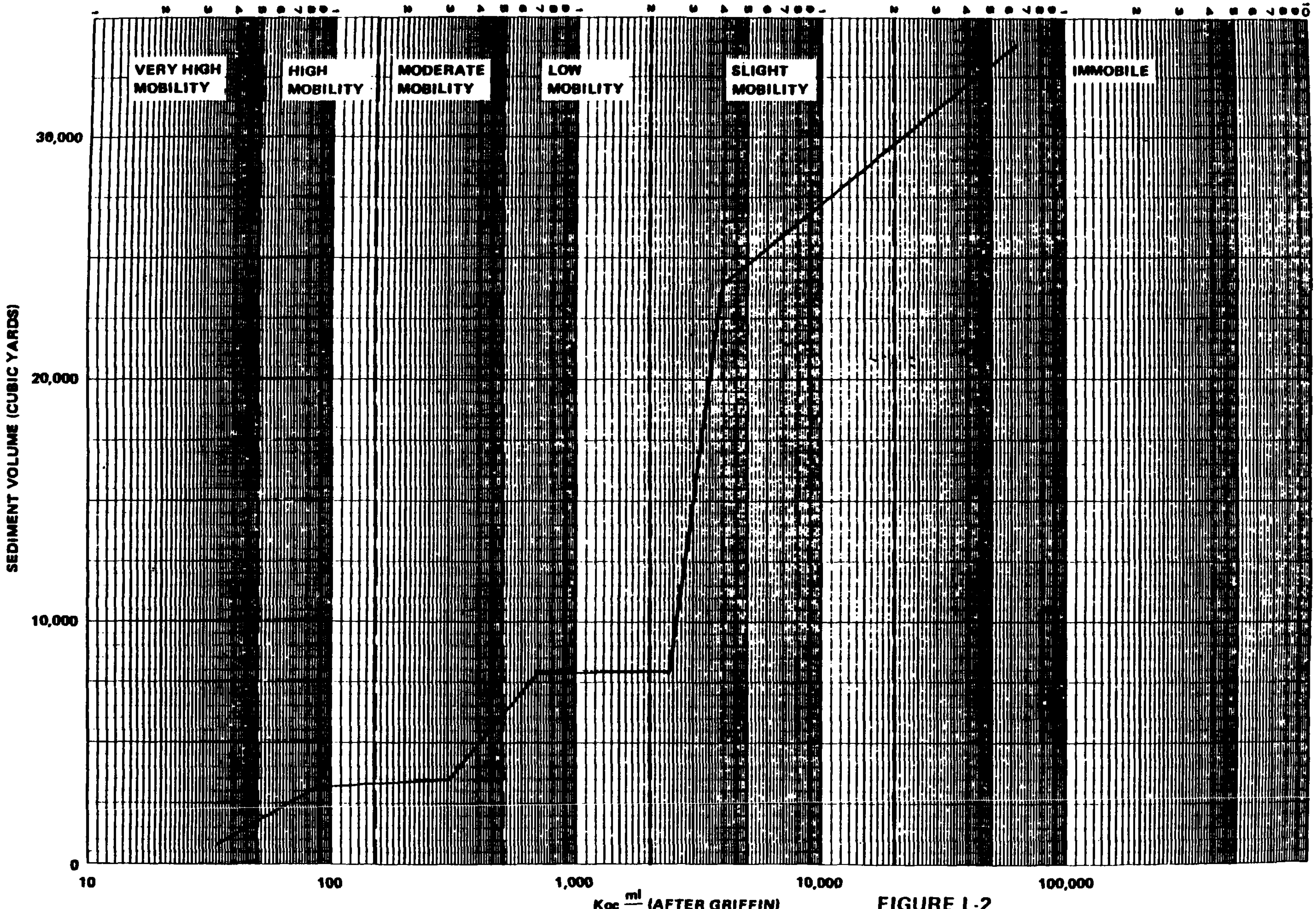


FIGURE L-2
SEDIMENT VOLUMES (10^{-6} SEDIMENT
INGESTION RISK OR GREATER) VS. M ITY
FIELDS BROOK FS

Appendix K
THERMAL TREATMENT OF SEDIMENT

Thermal treatment is a general term for the destruction of hazardous organic wastes through the application of heat. Incineration is currently the most widely used thermal treatment technology although several new technologies are emerging. Another technology capable of efficiently treating Fields Brook sediment is the high temperature fluid wall reactor developed to pyrolize organic wastes by the Thagard Research Corporation in Costa Mesa, California and marketed by the J.M. Huber Company. Pyrolysis is the application of heat in an oxygen deficient atmosphere in contrast to incineration where combustion by oxidation decomposes hazardous waste. Each technique has its own advantages and will be discussed later in the chapter.

This appendix summarizes existing and potential facilities for offsite and onsite thermal treatment of contaminated sediment from the Fields Brook site.

OFFSITE RCRA INCINERATORS

Within a 600-mile radius there are three RCRA-permitted incinerators capable of handling contaminated waste from Fields Brook: Rollins in Bridgeport, New Jersey; Trade Waste Incinerator in St. Louis, Missouri; and Chemical Waste Management in Chicago, Illinois. The three operating facilities will only accept contaminated sediment that has been containerized or drummed. Incineration costs at these facilities have been estimated to range from $700 to $1,300 per cubic yard of waste material. This does not include the material or labor cost for excavating, containerizing, transporting, and storing the sediment, nor the cost of ash disposal. Considering existing offsite incinerator capacities, material handling difficulties, potential transportation and shipping constraints, and scheduling coordination with other users of the incineration facilities, offsite incineration of the excavated sediment (10^{-6} removals) is expected to require over 10 years to complete.

OFFSITE TSCA INCINERATORS

Currently, there are five commercial waste incineration facilities in the United States that have U.S. EPA TSCA permits for incineration of PCB-contaminated wastes. Two of these facilities burn only liquid wastes and were not considered further. The other three facilities are Rollins in Deer Park, Texas; ENSCO in El Dorado, Arkansas; and Chemical Waste Management (formerly SCA) in Chicago, Illinois. Incineration costs at these facilities range between $1,000 and $1,500 per cubic yard (excavation, transportation, storing, and ash disposal not included).

ONSITE PORTABLE THERMAL TREATMENT FACILITIES

Portable thermal treatment facilities are defined as onsite facilities constructed or installed to operate for the length of time necessary to destroy the contaminants in the sediment. Once the thermal destruction is complete, the portable facility will be dismantled and salvaged or reused at other sites. Portable facilities primarily differ from mobile units in that mobile units are generally constructed and mounted on mobile trailers that limit their size and capacity. The two portable systems considered are a rotary kiln incinerator and an Advanced Electric Reactor marketed by the J.M. Huber Corporation.

ROTARY KILN INCINERATOR

The rotary kiln is capable of incinerating solid, sludge, liquid, and gaseous hazardous wastes either separately or simultaneously. A rotary kiln is a slowly rotating refractory-lined cylinder mounted at a slight incline to horizontal. The tumbling action about its horizontal axis allows for mixing of the wastes, heat, and air, improving the efficiency of combustion.

A rotary kiln incineration system (Figure K-1) for the Fields Brook site would consist mainly of the kiln and afterburner for solids destruction, possibly a waste heat boiler for energy recovery, and a venturi scrubber for emissions control. Destruction of approximately 41,500 cubic yards of waste and sediment with a 20 percent moisture content is assumed to take over 6 years in a kiln operating 290 days per year, 24 hours per day, at a feed rate of 24 cubic yards per day. Operating the kiln continuously would reduce thermal stress on the refractory, although some downtime has been allowed.

Design, installation, and startup of the incinerator is assumed to take 1.5 to 2 years. Siting, permitting, and bidding of the incineration facility may require an additional 3 to 6 years.

The rotary kiln would be approximately 20 feet in length and 10 feet in diameter, operating at about 2,200°F. Combustion temperatures for rotary kilns range from 1,500 to 2,200°F. In addition to the physical parameters of the unit, residence time of the material is also a function of the kiln speed which varies from 0.25 to 1.5 rpm, and the angle to which it is positioned, usually a 2 to 3 percent rake. Trial burns, as required by RCRA, will be conducted upon startup to determine these operating parameters along with

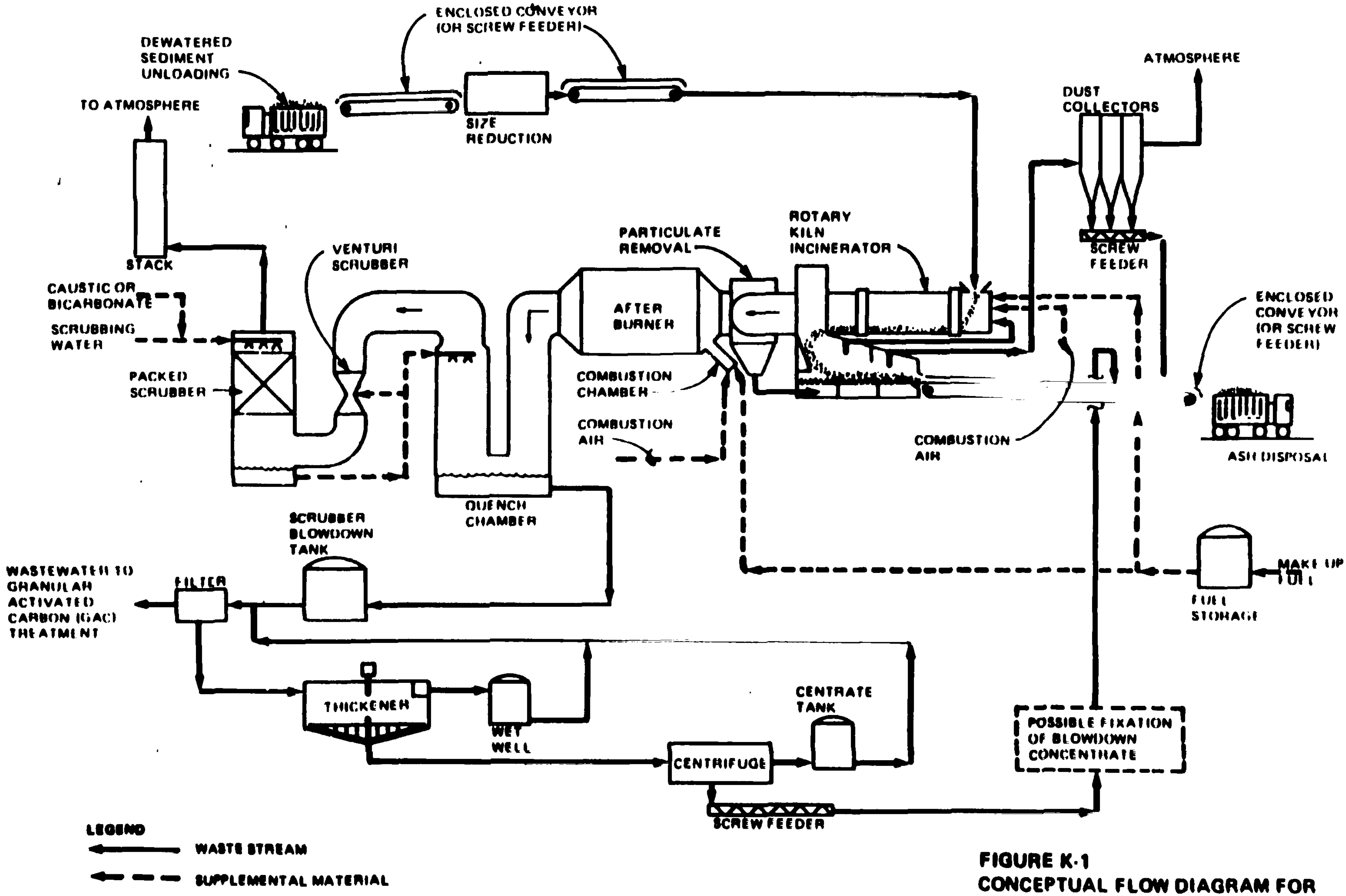


FIGURE K-1
CONCEPTUAL FLOW DIAGRAM FOR ROTARY KILN INCINERATION
FIELDS BROOK FS

the solids retention time, which can be as long as 60 minutes.

Rotary kiln systems usually have a secondary combustion chamber or afterburner following the kiln to ensure complete combustion of the waste and gases from the kiln. Liquids can also be injected into the afterburner for destruction in some cases. This chamber is usually designed to have a gas residence time of a few seconds with temperatures between 2,200 and 3,000°F.

Wastes with a heating value of 4,000 to 5,000 Btu's per pound generally do not require auxiliary fuel to sustain combustion at lower operating temperatures. Sediment from Fields Brook is assumed to have a low heating value, therefore burners would be mounted near the kiln to provide a supplementary source of heat. Approximately 260 gallons per hour of fuel oil would be needed to maintain 2,200°F.

Solids wastes will be ram fed or conveyed through the high end of the kiln. Liquid wastes such as the leachate collected at the storage facility could enter through atomizing nozzles. As the kiln rotates, the waste burns to ash and moves to the lower end of the kiln where it is discharged. The residual ash would then be placed in the storage facility and capped once incineration is complete. Laboratory testing of the ash is required to determine if its content is nonhazardous in character. If this is the case, it may be possible to delist the ash in accordance with RCRA regulations.

Incineration produces heat which can be reclaimed and utilized. The most frequent form of energy recovery is to convert the kiln's waste heat into steam. Using a waste heat boiler in the incineration system, the net steam flow available for useful work would be 16,000 pounds per hour. This is equivalent to 5.6 MW of electricity. Comparison of the costs and benefits from energy recovery through a waste heat boiler should be considered in more detail at the time of the final design.

High levels of NOx emissions are expected, especially when a rotary kiln is operated at higher temperatures. Nitrous oxides are formed from thermal fixation of nitrogen in the air used for combustion or from organic nitrogen compounds present in the waste. Emissions of SOx and particulate matter are dependent on the waste. Sulfur oxides are formed from sulfur present in the waste material and auxiliary fuel.

Emission control devices currently available may be categorized as either wet or dry process devices. Dry process devices include cyclones, dry scrubbers, dry electrostatic precipitators (ESP's) and fabric filters or baghouses. Wet control devices include wet scrubbers and wet ESP's. The wet scrubber process uses a technique of bringing a contaminated gas stream in contact with a liquid. Existing waste incinerators predominately use wet scrubbers to control emissions of particulate matter and the gaseous products of combustion. For illustrative and cost estimating purposes, a wet scrubber, the venturi scrubber, has been selected as the emission control device to be used with the rotary kiln.

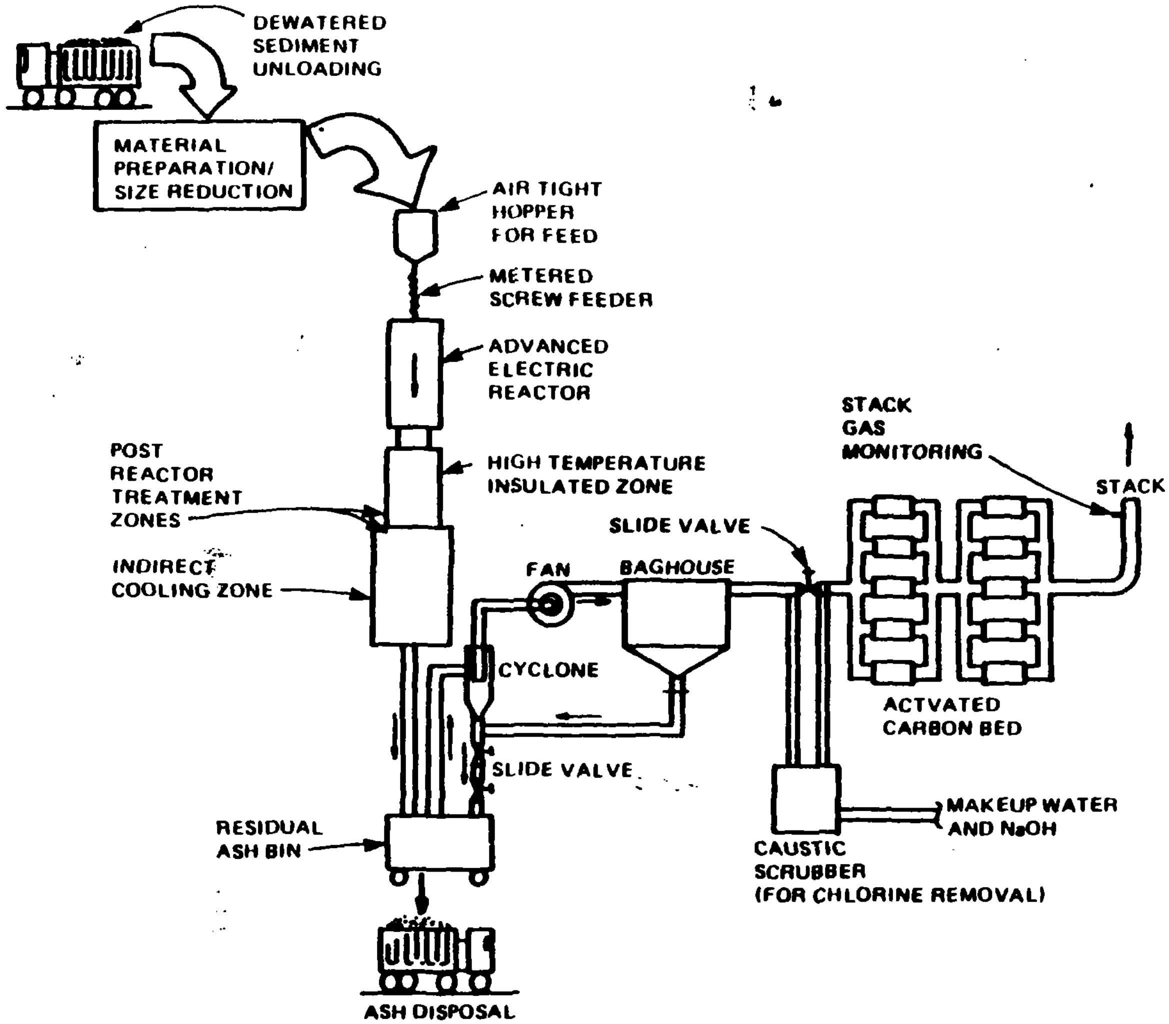
The venturi scrubber is a high efficiency, high energy gas cleaning device characterized by typical pressure drops between 30 and 50 inches of water. The water is injected in the venturi throat where gases pass through a contracted area reaching velocities of 200 to 600 feet per second. Gases then pass through an expansion section and a large chamber for separation of particles or for further scrubbing. High energy venturi scrubbers provide the highest wet scrubber efficiency with particles in the range of 0.3 to 1.0 um in diameter.

ADVANCED ELECTRIC REACTOR

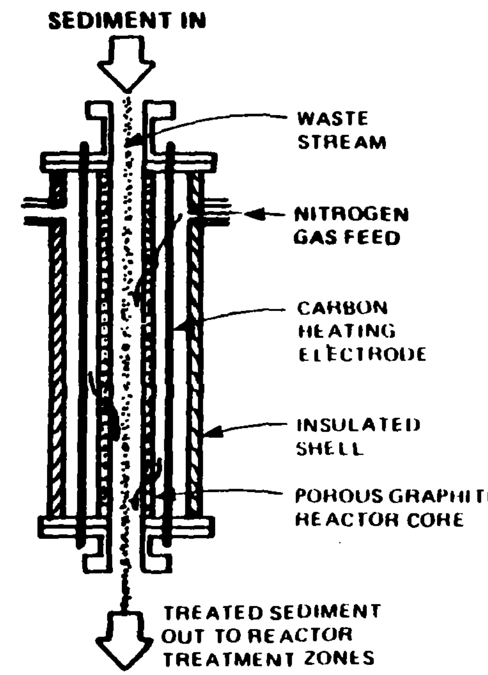
The J.M. Huber Company has purchased the patent on the high temperature fluid wall reactor from the Thagard Research Corporation. The Huber Company in Borger, Texas, now designs and markets an Advanced Electric Reactor (AER) to pyrolize organic wastes. Figure K-2 presents the conceptual flow diagram for the AER.

Pyrolysis is the chemical decomposition of organic matter through the application of heat in an oxygen deficient atmosphere. Destruction by pyrolysis rather than oxidation offers several advantages. Higher operating temperatures (4,000° to 4,500°F) can be achieved in an AER in contrast with a rotary kiln incinerator (2,200°F). This allows for high destruction efficiencies and a fused nonporous ash. Secondly, typical products produced by incineration such as carbon monoxide, carbon dioxide, and nitrogen oxides are not formed in significant concentrations in an electric reactor, which could be an important consideration in nonattainment areas (Clean Air Act). The AER also has several inherent fail-safe operating features. This lessens the need for extensive emission controls.

The electric reactor has demonstrated the ability to handle large volumes of contaminated soil with destruction and removal efficiencies (DRE's) far exceeding the RCRA requirements for hazardous wastes incinerators. Removal efficiencies for PCB-contaminated waste have been demonstrated at 99.99999 percent. The AER is also well suited for treatment of material with low heating values (Btu-content) as is the case with Fields Brook sediment.



PROCESS FLOW DIAGRAM



ADVANCED ELECTRIC REACTOR SECTION

FIGURE K-2
CONCEPTUAL FLOW DIAGRAM FOR ADVANCED ELECTRIC REACTOR
FIELDS BROOK FS

Solid waste materials are introduced into the top of the reactor by means of a materials screen feeder that connects an airtight feed hopper to the reactor. Solid feed streams must generally be free flowing and reduced to 35 U.S. mesh size. Assuming Fields Brook sediment is approximately 60 to 80 percent sands and silts, a shredder or jet impactor would be needed to reduce the particle size of the remaining waste.

Huber Corporation has designed, but not field tested, a transportable unit with a designed feed rate of 20,000 tons per year. A stationary, commercial scale, reactor permitted under RCRA and TSCA is, however, maintained at Huber's Borger, Texas research facility. Assuming one cubic yard of sediment is approximately equal to 1.4 tons, and allowing for downtime, destruction of 43,000 cubic yards of waste and sediment from Fields Brook is estimated to take approximately 4 years. Design, installation, and startup of the reactor is assumed to take approximately 1.5 years. Siting, permitting, and bidding for the facility has not been considered in this time frame and may require an additional 3 to 6 years.

The reaction chamber consists of a tubular core of porous refractory material insulated in a fluid-tight vessel. In the reactor, energy is transferred to the waste by radiation rather than by conduction or convection as with conventional incinerators. Carbon electrodes are used to heat the reactor core to temperatures between 4,000° and 4,500°F. Normal energy requirements for treatment of contaminated soils range between 800 and 1,000 kWh per ton of material processed. Nitrogen gas is injected radially through the porous walls of the chamber to prevent the hazardous materials from contacting or sticking to the reactor's walls. This protective gas blanket or fluid wall is transparent to the radiant energy generated inside the reactor.

After leaving the reactor, the product gas and waste solids pass through two postreactor treatment zones used to cool and further aid in destroying the wastes. The waste resides for about 5 seconds at 2,500°F in the first treatment zone, which is an insulated vessel. The second zone primarily cools the product gas for about 10 seconds to 1,000°F prior to emissions control. Particles in the waste gas are removed via a cyclone and a baghouse filter followed by an aqueous caustic scrubber for chlorine removal. Residual organic compounds and chlorine in the gas exiting the scrubber are removed through activated carbon beds.

Solids exiting the postreactor treatment zones would be collected in a bin and returned to the onsite storage facility for disposal. Because of the high operating temperatures and rapid reactions, the residual remaining is vitrified beads resembling glass shot. Most metal salts are soluble in the molten glass and become chemically bound within the residual. The residual may be considered a sterile sand with a greatly reduced leachability. It may be possible to delist the residual as a waste regulated under RCRA through confirmatory laboratory testing.

ONSITE MOBILE THERMAL TREATMENT FACILITIES

As an alternative to hauling sediment to offsite incinerators or using a thermal system constructed onsite, transporting a mobile incinerator or reactor to the site is possible. Mobile incinerators are available but their availability is limited. Existing mobile incinerators or reactors capable of handling Fields Brook sediment include a facility operated by Pyrotech, an ENSCO subsidiary, the U.S. EPA mobile unit, and the high temperature fluid wall reactor from Vulcan Resources Ltd.

PYROTECH'S MOBILE WASTE PROCESSOR (ENSCO)

Pyrotech's mobile incinerator occupies a 200-foot by 200-foot area. The facility consists of seven trailers on which the incineration, air pollution control, analytical laboratory, and control room equipment are mounted. Setup time is approximately 2 to 3 weeks. The solid incineration equipment includes a rotary kiln which operates between 1,800° and 2,000°F. The feed system is a belt conveyor with a charging hopper plus a ram feeder. Residual ash is collected in a discharge chute. Liquid wastes can also be injected into the afterburner which operates between 2,200° to 2,600°F. Air pollution control equipment includes a packed bed tower and a steam ejector scrubber.

The mobile system is designed to simultaneously incinerate up to 3,600 gallons per day of liquid waste and 96 tons per day of contaminated solid material. Sediment with a moisture content of 20 percent together with the desired destruction efficiency is expected to limit the feed rate to between 35 and 50 tons per day. Assuming a rate of 40 tons per day and 290 operating days per year, it would take approximately 6 years to treat the Fields Brook sediment. This does not include time for siting, permitting, design, and construction of the treatment facility. Currently, the unit is not permitted to incinerate PCB-contaminated wastes, although ENSCO has plans for a compliancy test in the near future.

U.S. EPA MOBILE INCINERATOR SYSTEM

The EPA mobile incinerator consists of major incineration and air pollution control equipment, combustion and stack gas monitoring equipment, and ancillary equipment--all mounted on four heavy-duty trailers. Each trailer requires construction of a concrete pad and some type of shelter. The overall plan area of the four trailers when assembled in operating configuration is approximately 10 feet by 150 feet. The overall capacity is 15 million Btu/hr. Additional equipment required for operation, which is not included with the four trailers, includes wastewater treatment and decontamination facilities; feed preparation equipment; and fuel, sediment, residue, and spare part storage. This additional equipment occupies another 10 to 12 trailers and the overall size of the incineration complex could be as much as 2 to 4 acres.

The EPA mobile incinerator design appears technically capable of handling Fields Brook sediment. Test burns of liquid PCB's demonstrated a destruction removal efficiency of 99.9999 percent. The solids handling capability of the system has been tested and refined. The facility is also equipped with air pollution control and stack gas monitoring systems. Incineration residue would have to be properly disposed of either onsite or in a secure landfill offsite. Initial estimates indicate the capacity of the EPA incinerator is about 30 cubic yards per 24-hour day for material containing 20 percent moisture and a PCB destruction removal efficiency of 99.9999. At this rate, it would take approximately 6 years to treat the Fields Brook sediment, assuming 290 operating days per year.

MOBILE HTFW REACTOR

A mobile high temperature fluid wall (HTFW) reactor to pyrolize organic wastes similar to the Advance Electric Reactor has been developed by the Thagard Research Corporation and is licensed by Vulcan Resources Ltd. The system consists of three trailers occupying a 100-foot by 100-foot area. The reactor is approximately 5 feet wide and 30 feet high. Once the trailers are on the site, the setup time is about 1 week. Generally the reactor is run continuously although it can be shut down on weekends without a loss in efficiency.

Contaminated sediment is brought to the top of the reactor via a bucket elevator or conveyor system and then dispersed through a power feed-through assembly. Some material preparation may be necessary before the contaminated sediment is fed into the reactor. Fine grain sand and silt which will pass through a 100-mesh screen can be treated directly. Larger waste material must be sent through a shredder or jet impactor to reduce the particle size. To avoid the need for emission control equipment, lime is frequently added to highly chlorinated wastes.

The mobile reactor is designed to treat 50 tons of contaminated soil per day. Moisture and gases present in the sediment may slightly reduce this capacity. The reactor has achieved DRE's exceeding the 99.99 percent RCRA requirement, and the unit is also permitted to treat PCB-contaminated waste. Energy requirements for the reactor are approximately 800 kWh per ton of material processed.

Assuming a feed rate of 2.6 tons per hour and operation for 290 days per year (20 hours per day), a single HTFW reactor would take about 4 years to treat the Fields Brook sediment. According to Vulcan Resources, a mobile reactor can be designed, constructed, and delivered to a site in less than 1 year. This does not include consideration of time associated with siting and permitting, which may require an additional 3 to 6 years.

ONSITE THERMAL TREATMENT PERMITTING REQUIREMENTS

Permitting of a hazardous waste incinerator may require that a trail burn be performed to establish acceptable operating parameters for the material being incinerated. The complexity of the trial burn depends on the nature of the wastes to be incinerated. A trial burn may not be required if the incinerator being used has already been permitted to burn wastes of the same form and of equal or greater incineration difficulty. A trial burn may also not be required if the incinerator is similar enough to another incinerator which is permitted to burn such wastes.

To meet the substantive requirements of obtaining a permit to operate a hazardous waste incineration facility, a trial burn may be required in accordance with 40 CFR 270. The trial burn is conducted to determine the conditions that the incinerator would be operated at to maintain compliance required the performance standards. These standards include, destruction and removal efficiencies (DRE) of 99.99 percent for principal organic hazardous constituents (POHC) or 99.9999 percent for PCB's and dioxin, controlled hydrogen chloride emissions not to exceed 1.8 kg/hr, and particulate matter emissions of less than 0.08 grams per day standard cubic foot (40 CFR 264).

The trial burn is also intended to determine the operating parameters (waste feed, waste restrictions, combustion temperature, etc.) which will be specified in the permit. Therefore, waste incinerated during the trial burn must be representative of the waste to be incinerated during the incinerator operation. An allowance for a trial burn should be included in the cost estimate to encompass preparing the trial burn plan, waste steam characterization, operation for up to 720 hours prior to the trial burn to establish the required operating conditions, a trial burn operation, monitoring procedures, and sample analyses.

In addition to the need to meet the substantive requirements of a RCRA permit, the onsite incinerator will need to meet Clean Air Act requirements for air emissions. An NPDES permit would be required if scrubber water is to be discharged to a surface water. If the scrubber water is instead sent to a sewer, the water would be required to meet federal POTW pretreatment standards.

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