United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-92/208
September 1992

EPA

Superfund
Record of Decision:

Tar Lake, MI

NOTICE

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

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-92/208	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Tar Lake, MI
First Remedial Action - Final

5. Report Date
09/29/92

6.

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401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes
PB93-964119

16. Abstract (Limit: 200 words)
The 200-acre Tar Lake site is a former manufacturing site in Antrim County, Michigan, located 1 mile south of Mancelona, Michigan, near the village of Antrim. Land use in the area is industrial/residential, with several lakes and ponds in the vicinity of the site. From 1882 to 1945, the site was the location of iron production by the charcoal method. In 1910, Antrim Iron Works Company began producing charcoal in sealed retorts from which pyroligneous liquor was recovered. This liquor was further processed into calcium acetate, methanol, acetone, creosote oil, and wood tar. Wastes from these processes were discharged into Tar Lake, a large natural surface depression. Investigations performed by EPA and responsible parties revealed soil and ground water contamination with concentrations above federal and state regulatory levels. Groundwater contamination extends 3.5 miles downgradient from the site, and Tar Lake has a strong chemical odor. This ROD addresses a final remedy for the soil and tar sludge, as well as an interim remedy to limit further contamination of ground water, as OU1. A future ROD will address OU2 as the final remedy for the ground water contamination. The primary contaminants of concern affecting the soil, tar sludge, and

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Tar Lake, MI
Remedial Action - Final
Contaminated Media: soil/sludge, gw
Key Contaminants: VOCs (benzene, toluene, xylenes), other organics (PAHs, phenols)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 56
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

Abstract (Continued)

ground water are VOCs, including benzene, toluene, and xylenes; PAHs; and other organics, including phenols.

The selected remedial action for this site includes excavation of approximately 30,000 cubic yards of tar sludge and approximately 40,000 cubic yards of contaminated soil in and around Tar Lake, dewatering via extraction wells to facilitate excavation; consolidation of excavated materials into two adjoining RCRA containment cells to be constructed within the contamination area; and addition of solidification agents, such as bentonite and cement, which will be added to the tar sludge to give it the physical stability to support a RCRA cap. Both containment cells will meet RCRA minimum technology requirements, including double liners, leachate collection systems, and a ground water monitoring system, and will be capped with RCRA Subtitle C landfill covers. A ground water pump and treat system will be installed to contain the contaminated ground water, and a treatability study will be performed during the pre-design stage to determine the effectiveness of carbon adsorption to meet ground water discharge limits. Treated water will be reinjected upgradient of the extraction wells to perform a closed loop system, and institutional controls to restrict ground water usage will be implemented. The estimated present worth cost for this remedy is $20,100,000, including an annual O&M cost of $791,800.

PERFORMANCE STANDARDS OR GOALS: All soil and sludge with an excess cancer risk level greater than $1x10^{-6}$ will be excavated from the site. Chemical-specific soil and sludge clean-up levels were based on the Michigan Environmental Response Act and health-based criteria and include benzene 0.4 ug/kg; xylenes 6,000 ug/kg; toluene 16,000 ug/kg; benzo(a) anthracene, benzo(b) fluoranthene, and benzo(k) fluoranthene all at 100 ug/kg; phenols 6,000 ug/kg; and 2-methylphenol 8,000 ug/kg. Because the ground water containment is an interim measure, ground water clean-up standards are waived. Chemical-specific clean-up levels will be provided in the final action for ground water onsite.

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Tar Lake
Antrim County, Michigan

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Tar Lake site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. 9601, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and is consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to the extent practicable.

This decision is based upon the contents of the administrative record for the Tar Lake Site.

The State of Michigan has verbally concurred with U.S. EPA's Record of Decision. A concurrence letter has not yet been received.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision, may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This operable unit remedial action is the first of two operable units and was selected to address environmental contamination and public health risks resulting from releases or potential releases from Tar Lake.

The NCP is explicit in its stated support of the "bias for action" approach on Superfund Sites. The "operable unit" is an outgrowth of this concept and is defined in the NCP Section 300.5 as "...discrete action that comprises an incremental step toward comprehensively addressing site problems...". U.S. EPA decided that for proper management of the Tar Lake Site in an effort to expeditiously implement Site remedy for protection of public health and the environment, an operable unit was a prudent and appropriate measure to take. The source is a continuing source of contamination to the groundwater. This operable unit addresses source control and interim groundwater containment. The second operable unit, at the conclusion of the Remedial Investigation/ Feasibility Study, will address the final groundwater remedy for the site.

The major components of the selected remedy are as follows:

Source Control:

- Excavation/consolidation of the tar and all of the contaminated soils (soils with an excess cancer risk level greater than 1×10^{-6}) in and around Tar Lake extending to the adjacent landfill. The vertical and horizontal extent of excavation shall be further defined during the remedial design. Initial estimates of volume are 30,000 yd^3 of tar and 40,000 yd^3 of contaminated soils. Dewatering shall be done to facilitate the excavation. The exact number and placement of the dewatering extraction wells will depend on the areal extent and depth of contamination.

- Consolidation of the tar and contaminated soils in two adjoining RCRA containment cells constructed in the area of contamination. The cells shall meet RCRA minimum technology requirements, which includes at a minimum, double liners, leachate collection systems, and groundwater monitoring. The first containment cell shall be sized to hold the tar, estimated to be 30,000 yd^3, and solidification agents (bentonite and cement), which shall be added to the tar to give it the physical stability to support the weight of a RCRA Subtitle C hazardous waste landfill cover. The second containment cell shall be sized to hold the contaminated soils. Both containment cells shall be capped with RCRA Subtitle C hazardous waste landfill covers.

Interim Groundwater Containment:

- Installation of a groundwater pump and treat system for the containment of contaminated groundwater and the treatment of water ponded on Tar Lake. Because this is an interim measure, groundwater cleanup standards are waived. The treated groundwater shall be reinjected upgradient of the extraction wells to form a closed loop system and shall meet Act 307 Type B levels and shall comply with the substantive requirements of Act 245.

- Implementation of institutional controls which shall restrict groundwater usage within the areas of the existing or potential contaminant plume.

A site evaluation will be performed every five years for a 30 year period. The purpose of this evaluation is to determine if site conditions are changing, and if so, what actions may be necessary to address these changes.

DECLARATION OF STATUTORY DETERMINATIONS

This action is protective of human health and the environment, complies with (or waives) Federal and State applicable or relevant and appropriate requirements for this operable unit action, and is cost-effective. This action satisfies the statutory mandate for permanence and treatment to the maximum extent practicable for this operable unit. Due to the large volumes of contaminated media that would have to be treated and the very high costs (and without additional environmental benefit), treatment of the tar and contaminated soils is considered impracticable and not cost effective. Although the interim groundwater containment utilizes treatment of contaminated groundwater; overall, treatment is not employed to an extent whereby it would be considered a principal element of the remedy.

Thus, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element is not satisfied by this operable unit. Subsequent actions are planned to address fully the threats posed by the groundwater at this site.

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

September 29, 1992
Date

Valdas V. Adamkus
Regional Administrator
U.S. EPA, Region V

EPA

RECORD OF DECISION

DECISION SUMMARY

TAR LAKE SITE

ANTRIM COUNTY, MICHIGAN

Prepared by:

U.S. Environmental Protection Agency

Region V

Chicago, Illinois

September 1992

DECISION SUMMARY
Tar Lake Site

I. SITE NAME, LOCATION, AND DESCRIPTION

The Tar Lake site is located in Antrim County, Michigan. The site occupies over 200 acres just east of Highway 131, approximately one mile south of Mancelona, Michigan. It is situated in a rural area near the village of Antrim. The source area, which covers over 4 acres, contains tar and water up to a depth of 27 feet. Some of the soil surrounding Tar Lake is also contaminated.

Figure 1 shows many of the relevant physical site features and surrounding land. The site itself is characterized by severe topographic relief. No permanent or intermittent streams are present and there appears to be no surface run-off from the site. Other site features include Tar Lake, slag piles, limestone piles, one sludge pile on the west side of Tar Lake, and the remains of tank supports and cooling water ditches. Tar Lake is a large natural surface depression that was partially filled in with the disposal of tar-like residuals from a wood charcoal production operation and as a result became known as "Tar Lake". There is no evidence of containerized wastes present. The site is characterized by a chemical odor. Tar Lake appears to have shrunk by more than 50% since the 1930's according to an evaluation of aerial photographs. It has been reported that Tar Lake caught fire in the 1960's and burned for an unspecified period before being extinguished by natural action. The fire may be responsible for some shrinkage considered to have occurred at Tar Lake.

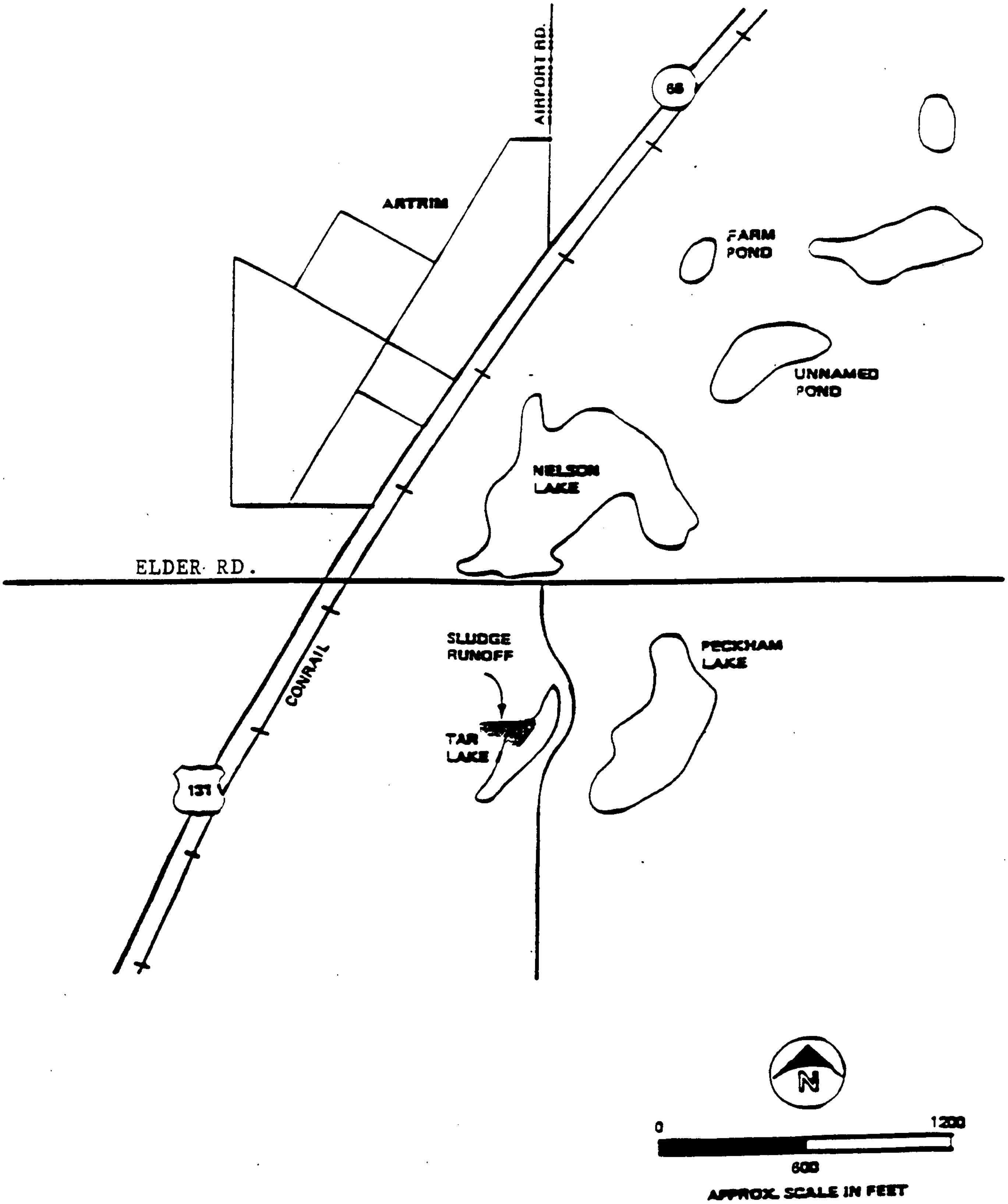
II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

From 1882 to 1945, the site was the location of iron production by the charcoal method. In 1910, the Antrim Iron Works Company began producing charcoal in sealed retorts from which pyroligenous liquor was recovered. This liquor was further processed into calcium acetate, methanol, acetone, creosote oil, and wood tar. This secondary chemical manufacturing process produced a waste equivalent to still bottoms which was discharged into a depression on-site, i.e. Tar Lake. The chemical plant operated until 1944.

In 1949, the municipal water supply was extended to the Village of Antrim and much of the surrounding area.

Tar Lake was proposed for inclusion on the National Priorities List (NPL) in December 1982. In September 1983, Tar Lake was listed on the NPL.

FIGURE 1 Physical Site Features



From Figure 2-3, Remedial Action Master Plan, Tar Lake Site, CH2M Hill/E&E, April 30, 1984

In 1984, Gulf and Western Manufacturing Company erected a six foot woven-wire fence topped with barbed wire to secure Tar Lake from unauthorized access.

In 1985, Environmental and Safety Designs, Inc. (Ensafe) prepared a Remedial Investigation/Feasibility Study (RI/FS) work plan for Fifty-Sixth Century Antrim Iron Works Company (Fifty-Sixth Century), a Potentially Responsible Party (PRP) at Tar Lake. The final work plan was completed on January 15, 1986. This final RI/FS work plan was incorporated into a Consent Order between U.S. EPA and Fifty-Sixth Century, which was effective on April 21, 1986. Under the Consent Order, Fifty-Sixth Century was to conduct an RI/FS at Tar Lake. The work plan had the RI being conducted in two phases. The first phase was the development of a preliminary endangerment assessment (PEA), which would include limited groundwater sampling. The second phase, yet to be conducted, was to be a more detailed investigation based on the findings and results of the PEA.

During the Phase I RI work, deep and shallow monitoring wells were installed and a specialized analytical protocol for low level phenolics was developed. In January 1988, sampling and analysis of Tar Lake groundwater was performed using the special analytical protocol and Contract Laboratory Program (CLP) Routine Analytical Service (RAS) organic and inorganic parameters. The results, which became available in May 1988, confirmed the presence of classes of phenolic compounds, but did not identify specific constituents. Four of the groundwater samples that were collected and analyzed from on-site wells could not be properly quantified because of unexpectedly high concentrations. CLP RAS samples indicated concentrations near or below Contract Required Detection Limits for benzene, naphthalene, toluene, and ethylbenzene in three of eight wells. The PEA was submitted on October 4, 1988. The PEA concluded that based on available data, the phenols in the groundwater posed no endangerment at the concentrations found. U.S. EPA found the PEA to be deficient because U.S. EPA believed it inadequately and incompletely used data collected and the Agency believed the conclusions drawn were not adequately supported. Consequently, U.S. EPA did not approve the PEA.

Additional work at the site was performed to evaluate the nature and extent of contamination in the soil and groundwater underneath Tar Lake. The final soil boring and monitoring well installation work plan was submitted to U.S. EPA by Fifty-Sixth Century's consultant, Ensafe, on September 13, 1989. These most recent investigations provide evidence that Tar Lake is a continuing source of contamination to the groundwater at the Site. The depth sounding survey has revealed that part of Tar Lake is actually 10 feet below the groundwater table and is over 27 feet in the western part of Tar Lake. The sampling and analyses have established a relationship between the tar and the groundwater underneath Tar Lake. Over 50 identified or tentatively identified compounds from Tar Lake have been found in the groundwater. Two substances of note are benzene and styrene. Benzene was found in the tar at 1.2 parts per million (ppm) and in the groundwater at 0.43 ppm and 0.04 ppm. These groundwater concentrations of benzene are above the Safe Drinking Water Maximum Contaminant Level (MCL) of 0.005 ppm. It should be noted that benzene was found previously in a monitoring well sampled for the Preliminary Endangerment Assessment but it was attributed to possible gasoline contamination and was not addressed further in the PEA. U.S. EPA's position was that estimated positive values for benzene (as well as for naphthalene, toluene, ethylbenzene, and xylenes) were found in other wells also; thus, it was incorrect to dismiss the significance of the presence of this constituent. Styrene was also found in the groundwater at levels above its MCL of 0.005 ppm. The concentration of styrene found was 0.006 ppm and an estimated 0.063 ppm.

The contamination due to the site extends approximately 3.5 miles downgradient from the site as evidenced by taste and odor observations in groundwater monitoring and residential wells made by Michigan Department of Natural Resources (MDNR) staff and the affected residents. Because the tar is a continuing source of contamination to the groundwater, which is a threat to the environment as well as a threat to human health, U.S. EPA determined that the remediation of Tar Lake through a source control and groundwater containment operable unit was appropriate.

The 1986 Consent Order was amended in August 1990 to have Fifty-Sixth Century conduct a Phased Feasibility Study (PFS) to address the operable unit. Fifty-Sixth Century turned in an unacceptable PFS report to the U.S. EPA, which among other errors, utilized a risk assessment based on methodology used in the unapproved Preliminary Endangerment Assessment. Fifty-Sixth Century's revision was also unacceptable, even after receiving additional time from the Agency to incorporate U.S. EPA's comments. Therefore, U.S. EPA took over the preparation of the final PFS Report. U.S. EPA completed the PFS Report in March 1992, including a risk assessment. The PFS evaluated seven remedial alternatives to address the source control and interim groundwater containment at the site.

III. COMMUNITY RELATIONS

As part of the community relations program, an information repository has been established near the site at the Mancelona Public Library. The Phased Feasibility Study Report, Proposed Plan, and other site-related materials have been placed in the repository.

U.S. EPA notified the local community, by way of the Proposed Plan, of the preferred remedial alternative for the Tar Lake site. To encourage public participation in the selection of a remedial alternative for this operable unit, U.S. EPA scheduled a public comment period from July 17, 1992 to August 17, 1992. In addition, U.S. EPA held a public meeting on August 6, 1992 to discuss the Proposed Plan. U.S. EPA's responses to comments received during the public meeting and to written comments received during the public comment period are included in the Responsiveness Summary.

The public participation requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Sections 113(k)(2)(B)(i-v) and 117 have been satisfied.

IV. SCOPE OF RESPONSE ACTION

This operable unit addresses environmental contamination and public health risks resulting from releases or potential releases from Tar Lake.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is explicit in its stated support of the "bias for action" approach on Superfund Sites. The "operable unit" is an outgrowth of this concept and is defined in the NCP Section 300.5 as "...discrete action that comprises an incremental step toward comprehensively addressing site problems...". U.S. EPA decided that for proper management of the Tar Lake site in an effort to expeditiously implement Site remedy for protection of public health and the environment, an operable unit was a prudent and appropriate measure to take. The operable unit addresses two components at the Tar Lake site. The first component is source control, i.e., the tar and contaminated soils. The second component concerns an interim groundwater remedy to prevent further migration of the contaminant plume.

Source control is addressed by excavating/consolidating the tar and contaminated soils in and around Tar Lake (soils with an excess cancer risk level of greater than 1×10^{-6}) and disposing them on-site in two adjoining Resource Conservation and Recovery Act (RCRA) containment cells. The cells shall be constructed in the area of contamination and shall meet minimum technology requirements, i.e. double liners, leachate collection systems, and groundwater monitoring. The tar shall be solidified with bentonite and cement to enable it to support the weight of a cap. The containment cells shall be covered by a RCRA Subtitle C hazardous waste cap.

Interim groundwater containment is addressed by pumping and treating the contaminated groundwater to prevent further migration of the plume. The treated groundwater shall meet reinjection standards prior to being reinjected into the ground. The reinjection location shall be upgradient of the extraction wells and shall form a closed loop system. This shall continue until the second operable unit at the Site addresses the final groundwater cleanup. Because the groundwater containment is an interim measure, groundwater cleanup standards are waived. Institutional controls to restrict groundwater usage within the areas of the existing or potential contaminant plume shall be implemented.

There will be a subsequent operable unit which will address the final groundwater cleanup. A subsequent Record of Decision will be issued selecting a groundwater cleanup remedy.

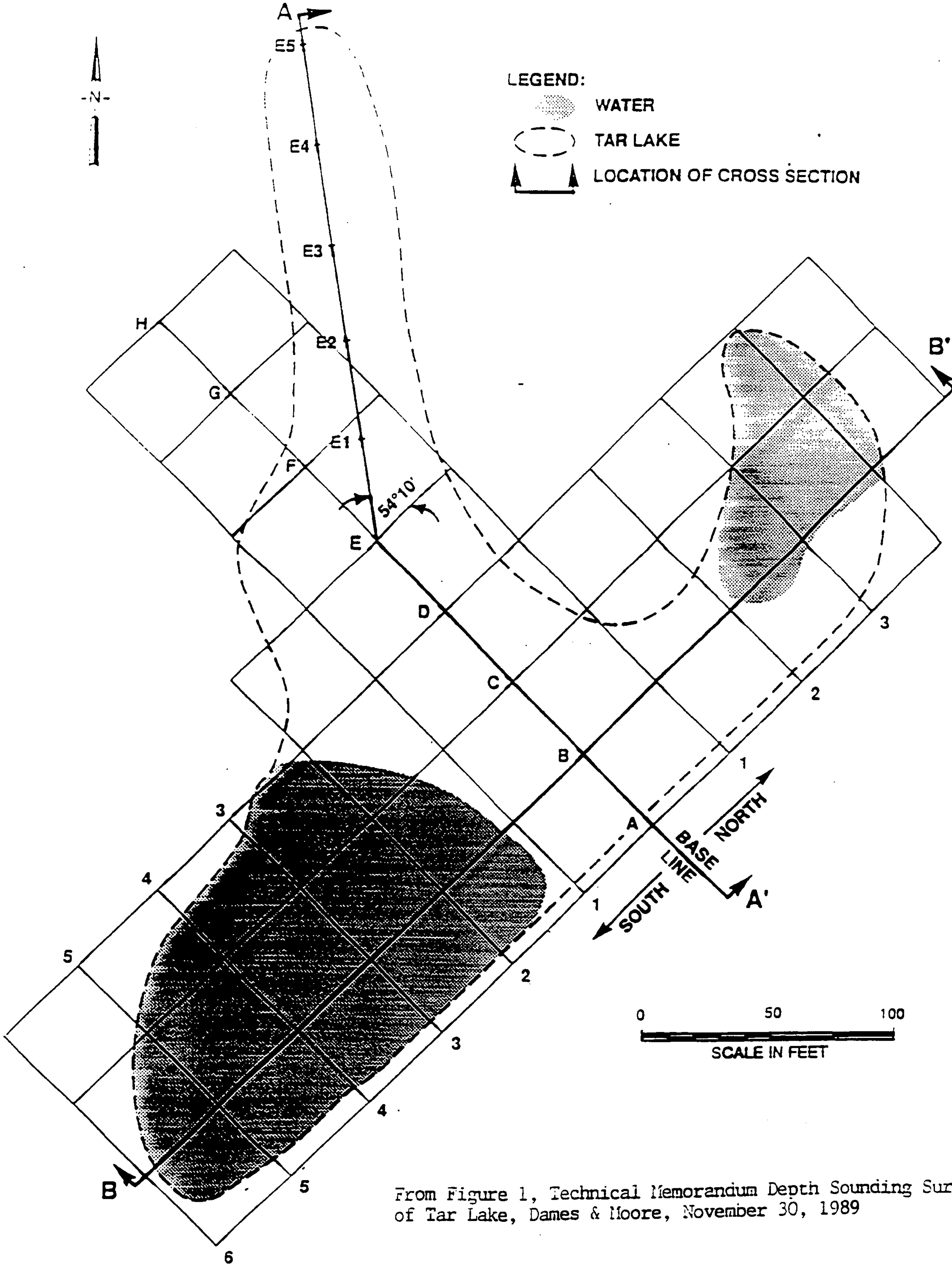
V. SITE CHARACTERISTICS

Tar Lake, itself, is approximately 4 acres in size and is located in a topographical depression. Tar was apparently deposited on the property at the top of a hill and filled in low lying areas and gullies. Because of its age, exposure to air and water, and fire, the tar exists in various physical forms, ranging from viscous liquid to semi-solid. Depth of tar varies from 2 feet to 27 feet, with part of the tar actually 10 feet below the groundwater table, as shown in Figures 2 through 4. The tar overlays a soil which is primarily sand and gravel.

The tar exhibits a strong chemical odor. Groundwater downgradient of the site also exhibits odors which have been attributed to the low odor thresholds of site contaminants.

The Tar Lake site is underlain predominantly by brown medium sand. There are some thin lenses of silt and clay. The groundwater table in the unconfined, glacial outwash aquifer is about 15 to 50 feet below the ground surface. Groundwater flow is generally in a northwesterly direction with a more northerly component on the eastern side of the site as shown in Figure 5. Groundwater contamination extends approximately 3.5 miles downgradient from the site as seen in Figure 6.

FIGURE 2 Horizontal Extent of Tar



From Figure 1, Technical Memorandum Depth Sounding Survey of Tar Lake, Dames & Moore, November 30, 1989

FIGURE 3 Depth of Tar - A-A' Cross Section

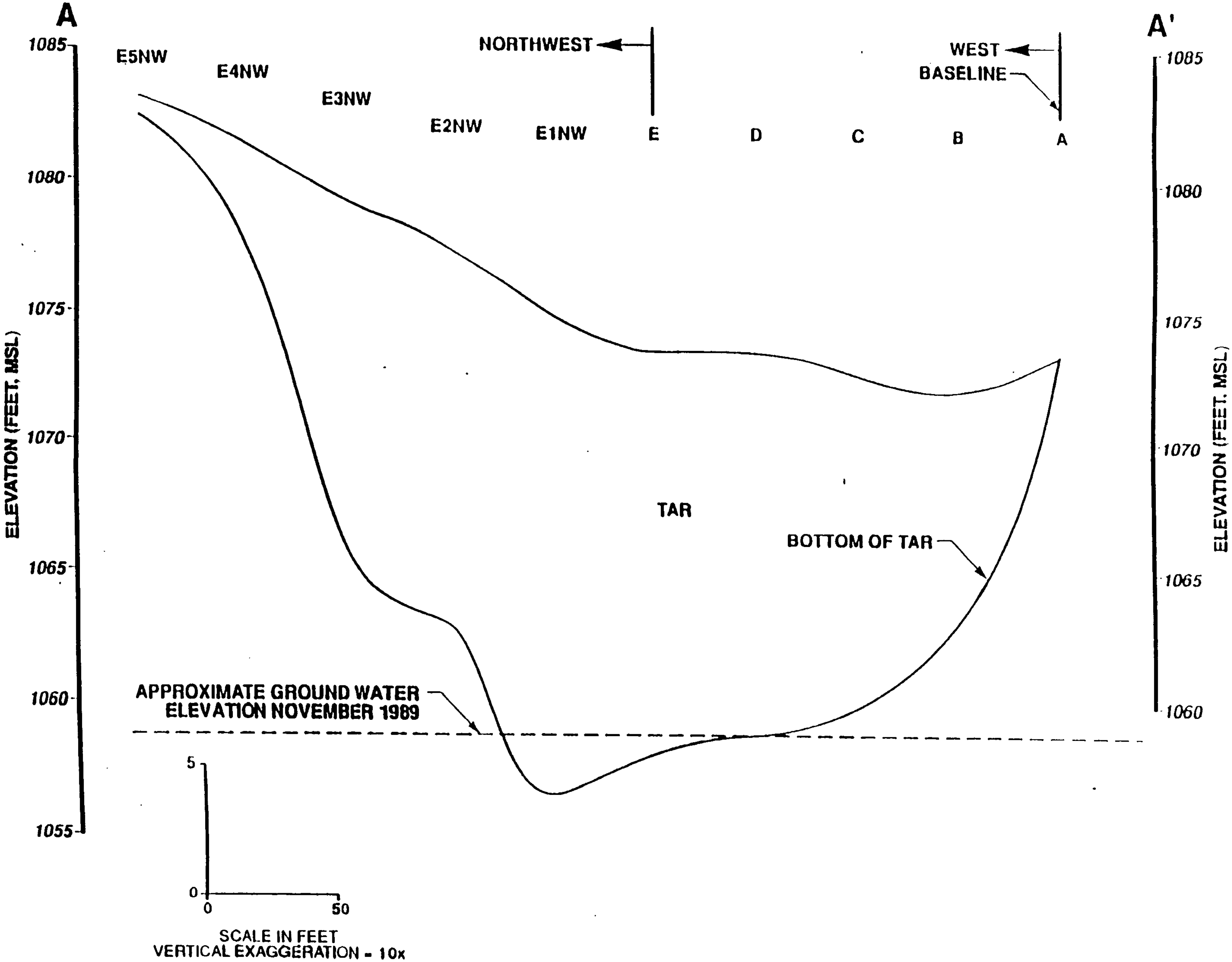
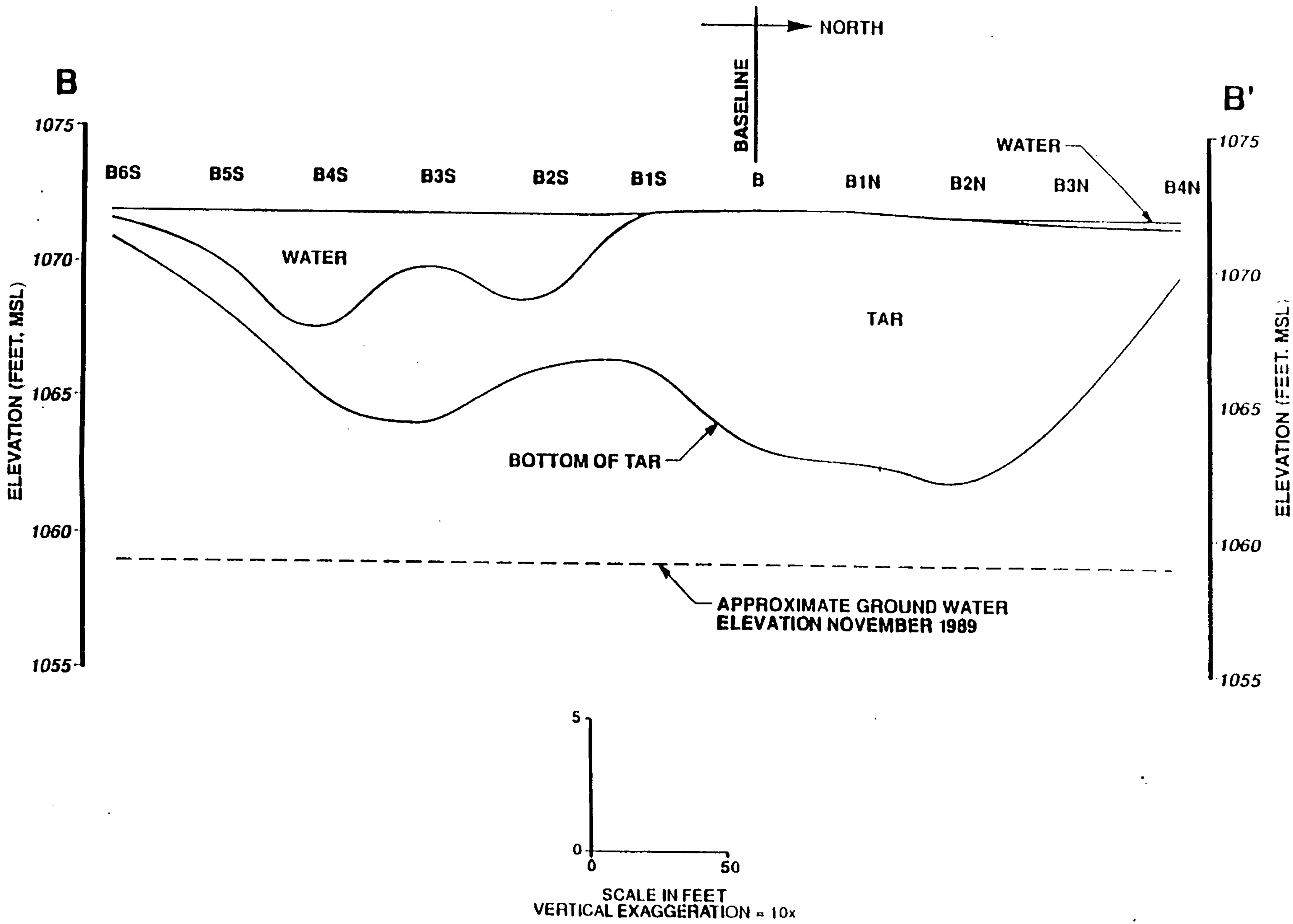
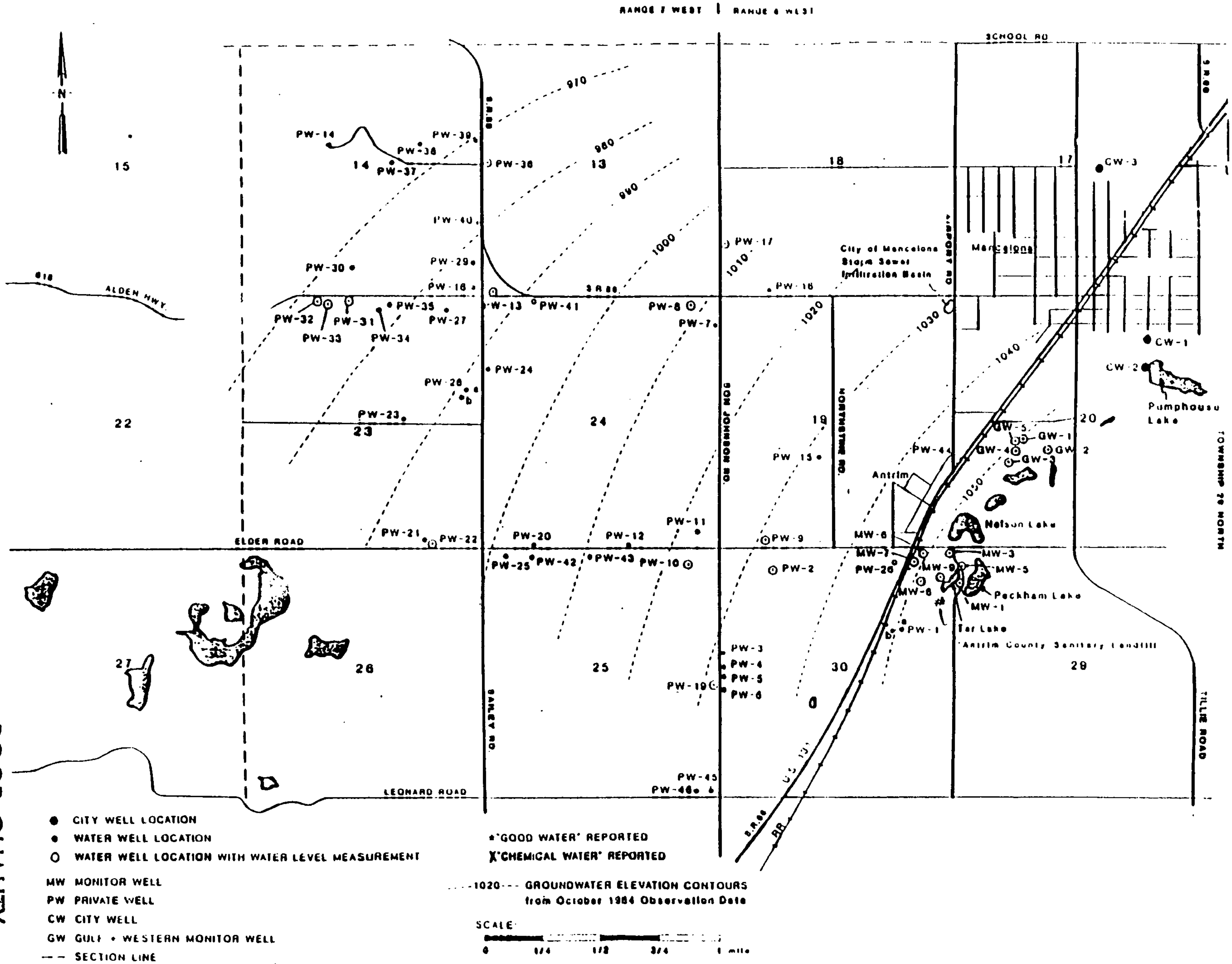


FIGURE 4 Depth of Tar - B-B' Cross Section



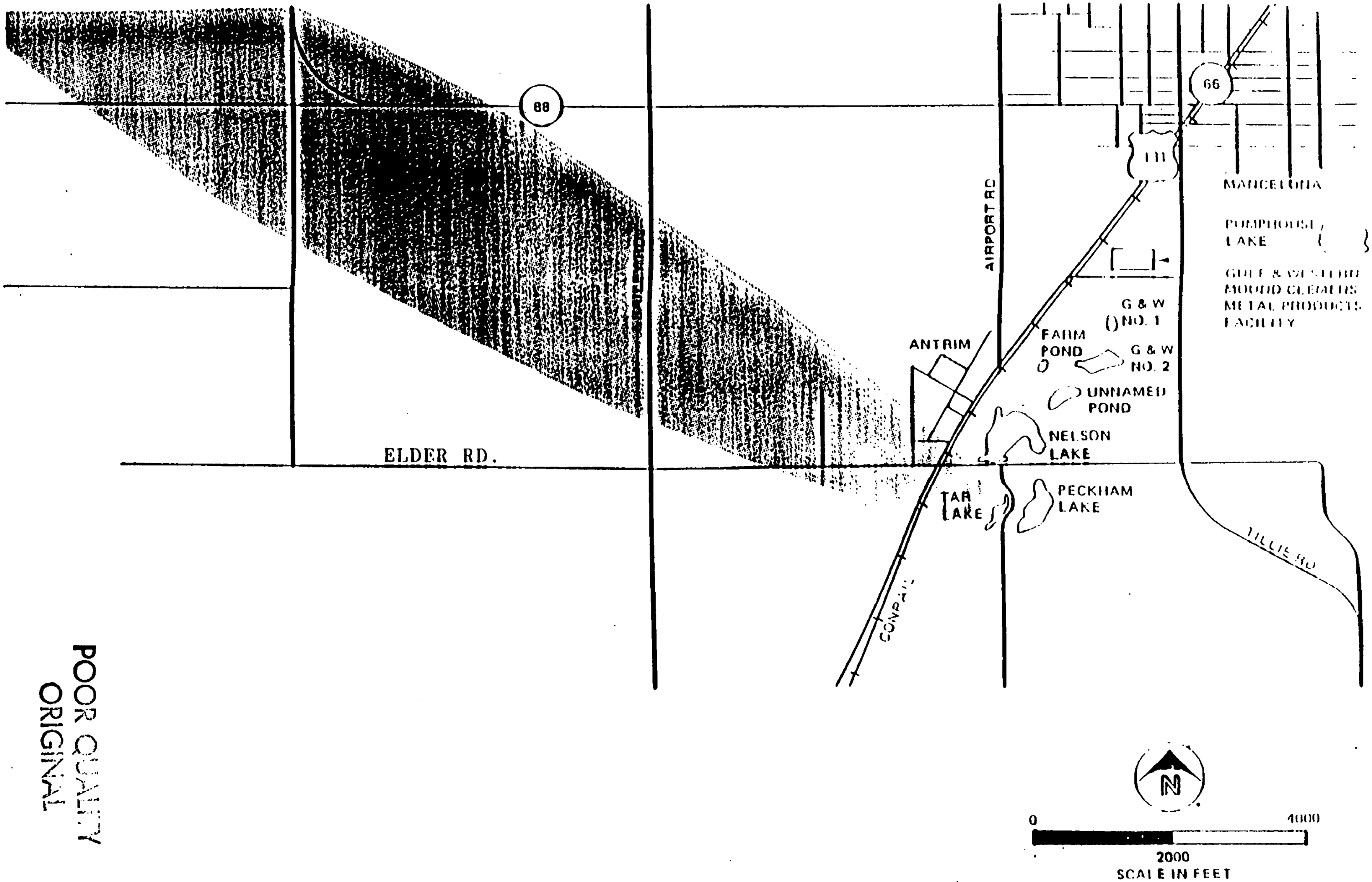
From Figure 7. Technical Memorandum Depth Sounding Survey of Tar Lake, Dames & Moore, November 30, 1989

FIGURE 5 Groundwater Flow



POOR QUALITY ORIGINAL

FIGURE 6 Groundwater Contaminant Plume



From Figure 2-5, Remedial Action Master Plan, Tar Lake Site, CH2M Hill/E&E, April 30, 1984

A) Organic Compound Analyses

The primary investigations of the identity and concentration of organic compounds associated with the site are as follows:

1983 Colorimetric Analysis for Phenolic Compounds in Groundwater
Qualitative colorimetric tests detected total phenolic compound concentrations in on-site monitoring wells at concentrations ranging from 3 to 64 ug/l.

1988 Contract Laboratory Program (CLP) Analysis for Volatile and Semi-Volatile Compounds in Groundwater
Groundwater samples collected from on-site monitoring wells (MW-6, MW-7, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16) (see Figure 7) were analyzed for volatile and semi-volatile compounds contained in the CLP Target Compound List. Results of these analyses indicated the presence in downgradient wells of three compounds at concentrations exceeding the Contract Required Quantitation Limits: 2,4-dimethylphenol (57-59 ug/l), ethylbenzene (7 ug/l), and total xylenes (7 ug/l). Other compounds tentatively identified in on-site wells included phenols, ketones, alcohols, and esters. Concentrations for the positively identified compounds are summarized in Table 1.

1988 Special Protocol Analysis for Phenols in Groundwater
Sampling and special protocol analysis of 28 area wells, predominantly off-site (see Figure 8) suggested the presence of a number of alkylphenols in downgradient groundwater. No given alkylphenol was present at concentrations exceeding the quantitation limit for the analysis, 0.8 ug/l.

The exact str··cure of indi··idual compounds detected using the special prot··ol analysis ·ould not be determined, rather alkylphenols were identified by the number of carbon atoms in substituents on the aromatic ring. For example, a compound was identified generally as a C-2 alkylphenol (an alkylphenol bearing substituent(s) containing 2 carbon atoms) which might be either 2,3-, 2,4-, 2,5-, or 3,4-dimethylphenol or 2-, 3-, or 4-ethylphenol. C-2 through C-12 alkylphenols were detected. Given the nature of the available data from the special protocol analysis, a list of compounds that could conceivable be present in the groundwater was prepared ·y Ensafe using CRC Handbook of Chemistry and Physics, 68th edition, 1987, CRC Press, Boca Raton FL, to obtain a list of those known compounds meeting the criteria of C-2 through C-12 alkylphenols. These compounds are listed in Table 2.

1989 CLP Analysis for Volatile and Semi-Volatile Compounds in Tar, Soil, and Groundwater
Samples of tar from Tar Lake, soil immediately beneath the tar, and groundwater immediately beneath the tar were

FIGURE 7 On-Site Monitoring Well Locations

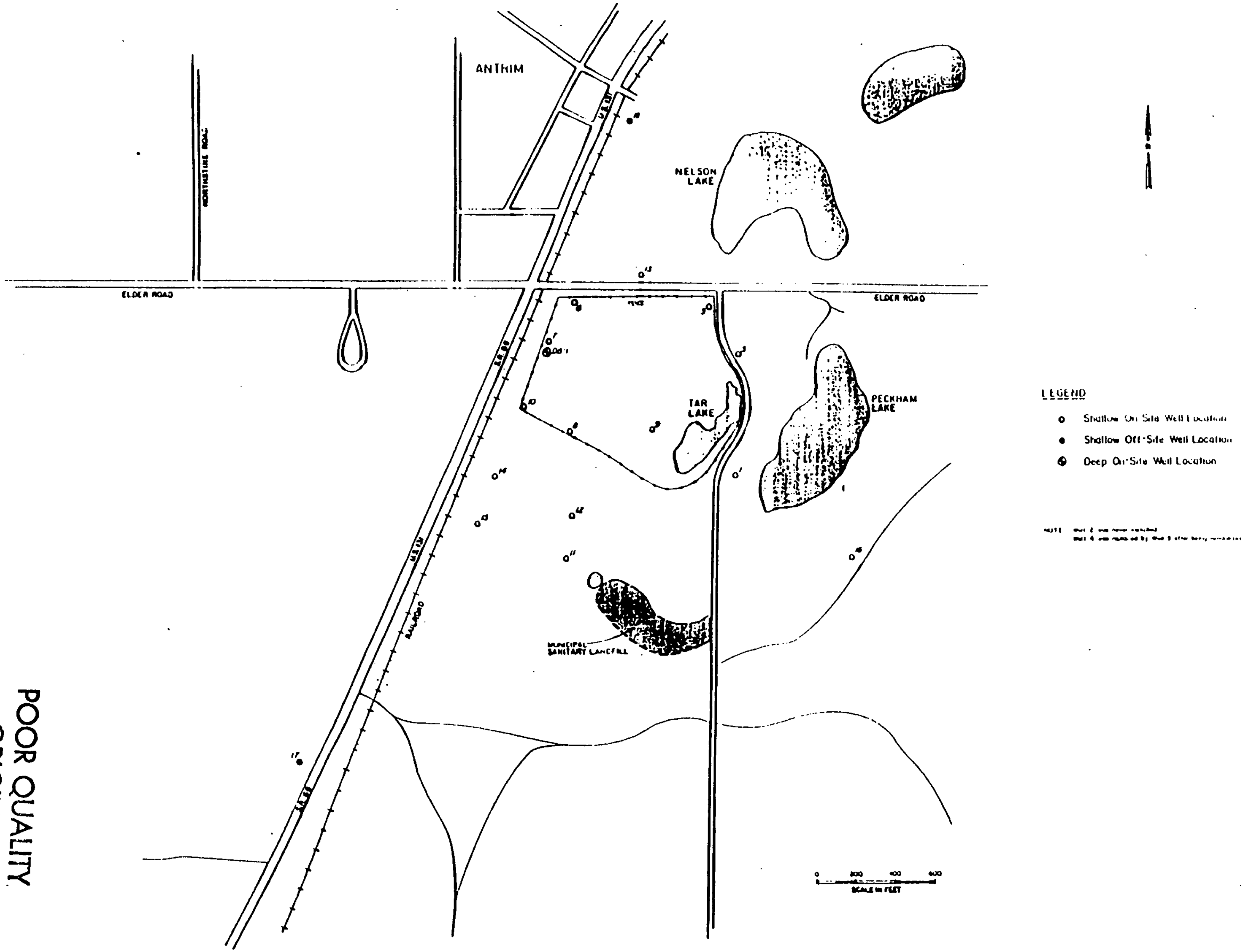


TABLE 1 - Positively Identified Compounds in Groundwater

Compound	CONCENTRATION (ug/l) MW-6	MW-7	MW-11(1)	MW-12	MW-13	MW-14(1)	MW-15	MW-16	Detect Limit
VOLATILES:									
Chloroform									5
Benzene	4 J				3 J				5
Toluene	3 J								5
Ethylbenzene					7				5
Xylenes	7								5
SEMI-VOLATILES:									
4-methyl phenol	3 J								20
Nitrobenzene	5 J								20
2,4-dimethyl-phenol	57	59							20
Naphthalene	2 J	2 J			5 J				20

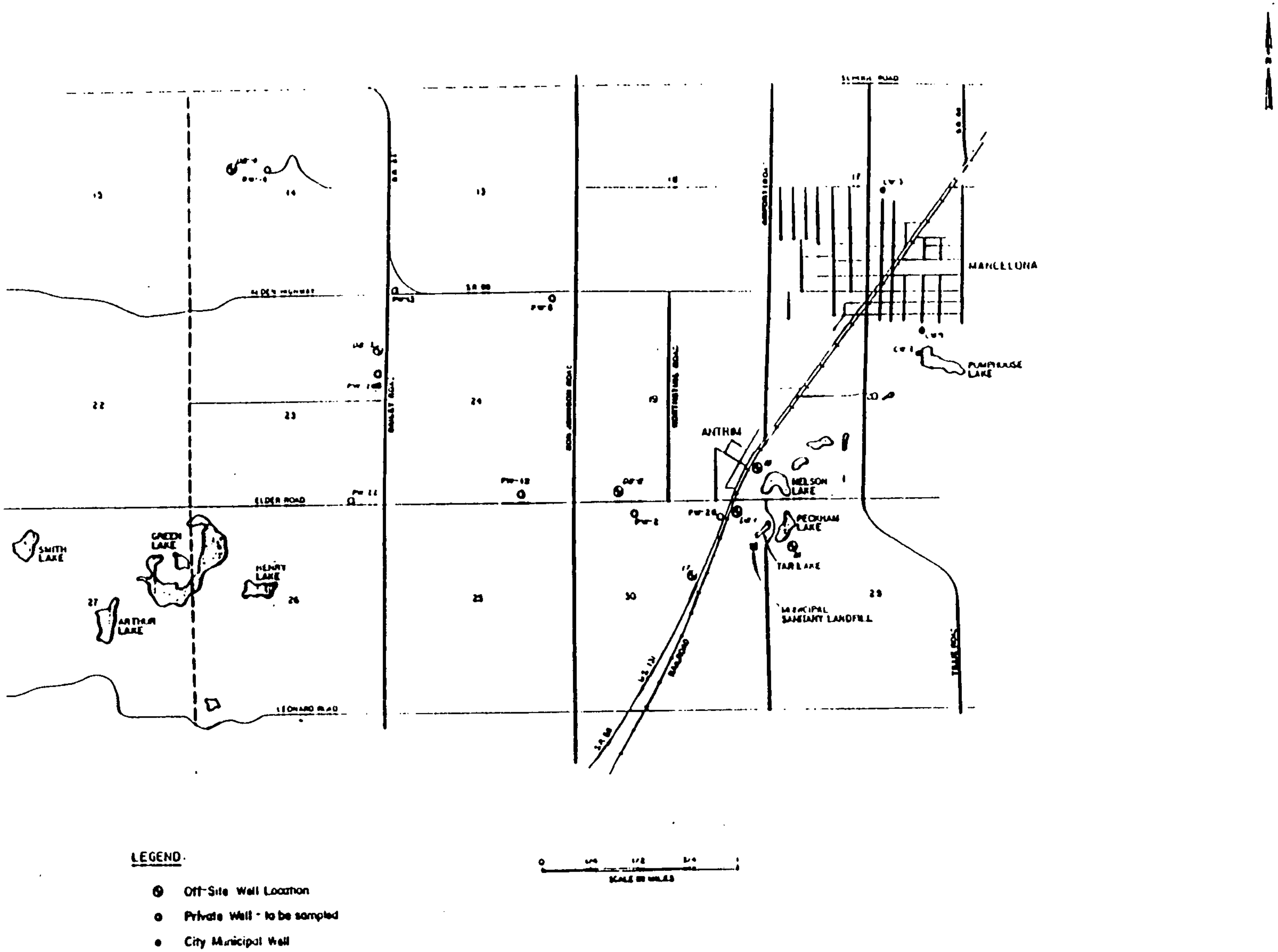
J - Compound was detected at a concentration below the quantitation limit reporte concentrations are estimated values.

A blank indicates that the compound was tested for but not detected. Only thos compounds detected in at least one sample are listed. Chloroform was detected i a field blank.

NOTES:
(1) Sample analyzed in duplicate. Values are averaged and all qualifiers ar reported.

Adapted from Table 1-1, unapproved Phased Feasibility Study, Tar Lake Superfun Site, Gradient Corporation, February 12, 1991.

FIGURE 8 Off-Site Monitoring Well Locations



POOR QUALITY ORIGINAL

From Figure 3, unapproved Preliminary Endangerment Assessment, Antrim Iron Works Site, Ensafe, Inc., October 3, 1988

TABLE 2 - C-2 Through C-12 Alkylphenols

<u>C-2 Alkylphenols</u>
2,3-dimethyl phenol
2,4-dimethyl phenol
2,5-dimethyl phenol
2,6-dimethyl phenol
3,4-dimethyl phenol
3,5-dimethyl phenol
2-ethyl phenol
3-ethyl phenol
4-ethyl phenol

<u>C-4 Alkylphenols</u>
2,3,4,5-tetramethyl phenol
2,3,4,6-tetramethyl phenol
2,3,5,6-tetramethyl phenol
2-methyl,5-isopropyl phenol
4-tert-butyl phenol
4-sec-butyl phenol
4-butyl phenol
3-tert-butyl phenol
3-butyl phenol
2-tert-butyl phenol
2-sec-butyl phenol
2-butyl phenol

<u>C-3 Alkylphenols</u>
2-propyl phenol
3-propyl phenol
4-propyl phenol
2-isopropyl phenol
3-isopropyl phenol
4-isopropyl phenol
2,4,5-trimethyl phenol
2,4,6-trimethyl phenol

<u>C-8 Alkylphenols</u>
2,4-di-tert-butyl phenol
2,6-di-tert-butyl phenol
2,6-di-sec-butyl phenol
2-octyl phenol

<u>C-9 Alkylphenols</u>
2,4-di-tert-butyl-5-methyl phenol
2,4-di-tert-butyl-6-methyl phenol
2,6-di-tert-butyl-4-methyl phenol

<u>C-10 - C-12 Alkylphenols</u>
2,6-di-tert-butyl-4-ethyl phenol
2,6-(bis)(1,1-dimethyl propyl)-4-methyl phenol
2,4,6-tri-tert-butyl phenol

Adapted from Table 1-2, unapproved Phased Feasibility Study, Tar Lake Superfund Site, Gradient Corporation, February 12, 1991 collected from the locations shown in Figure 9 and analyzed for volatile and semi-volatile compounds contained in the U.S. EPA CLP Target Compound List.

The highest concentration of organic compounds detected in tar from Tar Lake were alkylphenols (1,100 to 2,000 mg/kg). Other classes of organic compounds detected in the tar included: Benzene (1.2 mg/kg), Ethylbenzene (100 mg/kg), Toluene (100 mg/kg), Styrene (2.3 mg/kg), other polynuclear aromatic hydrocarbons (100 to 560 mg/kg), monoaromatic hydrocarbons (5 to 280 mg/kg) and ketones (1.2 to 15 mg/kg). A similar array of compounds was detected in soil samples collected immediately beneath Tar Lake at concentrations between 1 and 25% of the concentrations measured in the tar.

Groundwater samples contained the more water soluble of the organic constituents detected in the tar (i.e. alkylphenols, monoaromatic hydrocarbons, and ketones). Concentrations of these compounds were lower than the soil concentrations, roughly 0.01 to 1% of the concentration measured in the tar. Benzene (0.4-0.43 ppm) and styrene (0.006-0.063 ppm) were both present in the groundwater at concentrations which exceed the Safe Drinking Water Act Maximum Contaminant Levels (MCLs), 0.005 ppm for benzene and 0.006 ppm for styrene. Naphthalene (ranging between not detectable and 0.038 ppm) and 2-methylnaphthalene (0.017-0.38 ppm) were present in the groundwater.

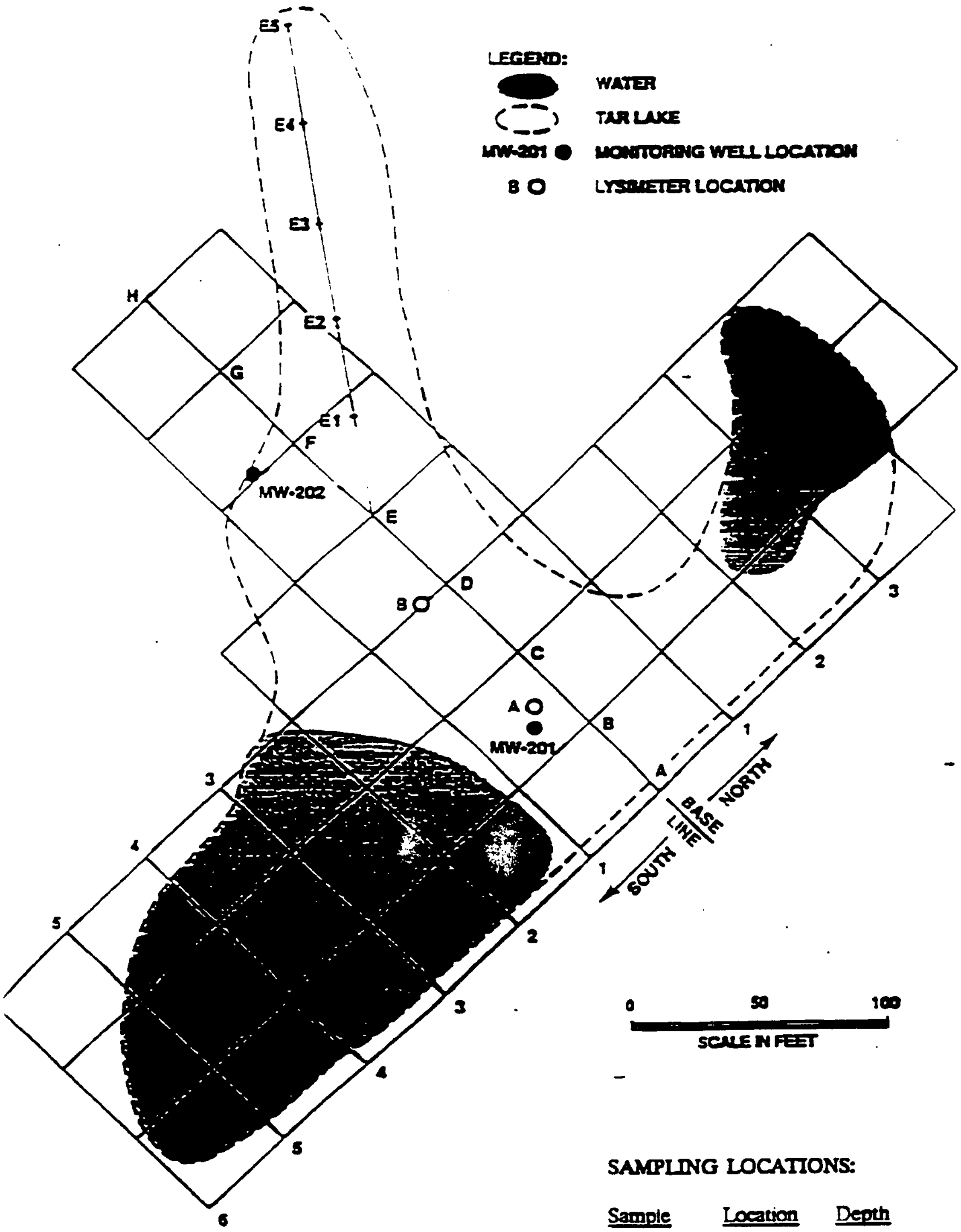
Concentration data for all of the CLP Target Compound List chemicals detected during this analysis are summarized in Table 3.

The contamination due to the site extends approximately 3.5 miles downgradient from the site as evidenced by taste and odor observations in monitored wells by the Michigan Department of Natural Resources (MDNR) staff and the affected residents. The organic compound data collected to date indicates the existence of a steep concentration gradient with distance from Tar Lake. While there is a taste and odor problem in downgradient wells, analyses of samples collected show that the contaminants are below the detection limits. This is due to the low taste and odor thresholds for the site contaminants.

B) Inorganic Compound Analyses

The primary investigations of the identity and concentration of inorganic compounds associated with the site are as follows:

FIGURE 9 Sampling Locations on Tar Lake



SAMPLING LOCATIONS:

Sample	Location	Depth
B202TAR	MW-202	10 ft below lake surface
B201A	MW-201	13 ft below lake surface; 4 ft below tar
B201B	MW-201	15 ft below lake surface; 6 ft below tar
201	MW-201	screened 16 ft below lake surface; 7 ft below tar
B202A	MW-202	15 ft below lake surface; <1 ft below tar
B202B	MW-202	17 ft below lake surface; 3 ft below tar
B202C	MW-202	19 ft below lake surface; 4 ft below tar
202	MW-202	screened 20 ft below lake surface; 5 ft below tar

From Figure 1, 1989 Antrim Iron Works (Tar Lake) Site Investigation, Vol. I, Gradient Corp., 3/

TABLE 3 Compounds Detected in Tar, Soils, and Groundwater at Tar Lake

COMPOUND	TAR SAMPLE (mg/Kg)	SOIL SAMPLES (mg/Kg)					WATER SAMPLES (mg/L)	
	B202T [1]	B201A [1]	B201B [1]	B202A	B202B	B202C [1]	201 [1]	202 [1]
VOLATILES:								
Benzene	1.2	0.63 J	2.2				0.43	0.01
Ethylbenzene	100	3.1	7.4		0.012	0.001 J	0.12	0.045
Toluene	100	4.2	16	0.001 J	0.015	0.002 J	0.62	0.16
Styrene	2.3	1.3	2.8		0.003 J		0.063 J	0.006
2-Butanone	5 E	0.12	0.26	0.026	0.01	0.003 J	1.9	0.015
2-Hexanone	11 E	0.63 J	2.4	0.013	0.023		0.91	
4-Methyl-2-pentanone	1.2	0.017	0.071				0.091 J	
Xylenes (total)	280 E	9.5	21	0.002 J	0.054	0.007	0.39	0.14
SEMI-VOLATILES:								
Acenapthene		3.7 J			0.18 J			
Acenapthylene		4.2 J	11 J		0.14 J		0.049 J	
Anthracene		4.7 J	11 J		0.18 J			
Benzo(a)anthracene		2.3 J			0.063 J			
Benzo(b)fluoranthene		0.78 JX						
Benzo(k)fluoranthene		0.78 JX						
bis-(2-Ethylhexyl)phthalate				0.063 J	0.088 J	0.077 J		0.003 J
Chrysene		1.5 J			0.074 J			
Di-n-butyl phthalate					0.082 J	0.28 J		
Fluoranthene		3.6 J			0.23 J			
Fluorene	100 J		35 J	0.074 J	0.57	0.059 J		0.005 J
Napthalene	340	51	160	0.067 J	1.2	0.13 J		0.018
Phenanthrene		19	46 J	0.039 J	0.66			0.011 J
Pyrene		3.2 J	14 J		0.27 J			
Dibenzofuran	51 J	14	43 J		0.6	0.039 J		0.011 J
2-Methylnaphthalene	560	49	120	0.08 J	1.8	0.14 J	0.38 J	0.017
2,4-Dimethylphenol	2000	170	610	1.6	7.3	1.4	29	3.1
Phenol	330	44	120		1.1		14	0.29
2-Methylphenol	1100	120	400	0.052 J	2.1		28	0.78
4-Methylphenol	1400	170	690	6	12	0.51	49	4.9

Adapted from Table 1-3, unapproved Phased Feasibility Study, Tar Lake Superfund Site, Gradient Corp., Feb. 12, 1991

1988 CLP Analysis for Metals in Groundwater

Groundwater samples collected from on-site monitoring wells (MW-5, MW-7, MW-11, MW-12, MW-13, MW-14, MW-15, and MW-16; Figure 1) were analyzed for metals contained in the CLP Target Compound List. Results of these analyses indicated that metal concentrations in groundwater downgradient of Tar Lake are comparable to background levels.

1989 CLP Analysis for Metals in Groundwater

Samples of tar from Tar Lake, soil immediately beneath the tar, and groundwater immediately beneath the tar were collected from the locations shown in Figure 3 and analyzed for metals contained in the EPA CLP Target Compound List. These results indicated that metal concentrations in groundwater are below MCLs and that metal levels in soil are comparable to background concentrations.

The inorganic data collected to date indicate a negligible impact of Tar Lake on local metal concentrations.

VI. SUMMARY OF SITE RISK

As part of the PFS, a baseline risk assessment was performed by the Region V Office of Health and Environmental Assessment. The risk assessment focused on a few of the most critical potential exposure pathways for the Tar Lake operable unit. Exposure scenarios were chosen and evaluated in accordance with current U.S. EPA guidance, Risk Assessment Guidance for Superfund, Volume 1. Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002.

By definition, a baseline risk assessment is limited to conditions assuming no corrective action will take place and no site-use restrictions or institutional controls will be imposed. The risk assessment determines actual or potential risks or toxic effects posed by the chemical contaminants at the site under current and future use assumptions.

A) Identification of Chemicals of Potential Concern

On-site groundwater sampling was conducted in 1988 and 1989. Contaminant concentration values from the associated analyses, mean and 95% upper confidence limit, were utilized in assessing risk from groundwater. A number of chemicals of concern were detected including phenol, o-cresol, p-cresol, and benzene. The list of groundwater chemicals and concentrations are found in Table 4.

TABLE 4 - COMPOUNDS DETECTED IN ON-SITE GROUNDWATER

COMPOUND	MEAN CONCENTRATION (ug/l)	95TH PERCENTILE OF MEAN CONCENTRATION (ug/l)
Benzene	49.2	115.7
Ethylbenzene	18.95	37.7
Toluene	80.05	177.1
Styrene	8.9	18.3
2-Butanone	195.5	492.0
2-Hexanone	95.5	237.2
4-Methyl-2-Pentanone	13.6	27.1
Xylenes	55.45	117.4
Acenaphthylene	13.9	20.0
Bis(2-ethylhexyl)phthalate	7.9	9.6
Fluorene	9.5	10.3
Naphthalene	10.7	15.7
Phenanthrene	9.4	10.3
Dibenzofuran	9.4	10.3
2-Methylnaphthalene	47.7	105.5
2,4-Dimethylphenol	3228.0	7736.0
Phenol	1437.0	3622.5
2-Methylphenol	2886.0	7255.6
4-Methylphenol	5397.0	13019.0
Nitrobenzene	9.5	10.3

Adapted from Table B2a, unapproved Phased Feasibility Study, Tar Lake Superfun Site, Gradient Corporation, February 12, 1991.

Despite the volume and heterogenous nature of Tar Lake, only one tar sample was collected. Certain polycyclic aromatic hydrocarbons (PAHs) detected in the underlying soil were assumed to be present in the tar at the detection limit (280 mg/kg). This is a reasonable assumption since the compounds were detected in the soil beneath the tar. A number of other compounds were detected including phenols, o-cresol, p-cresol, and 2,4-dimethylphenol. A list of chemicals detected or presumed to be present in the tar is listed in Table 5, along with their concentrations.

B) Exposure Assessment

Two hypothetical future residential exposure pathways were evaluated. In the first, it was assumed that future residents might be chronically exposed to groundwater through ingestion of drinking water. Standard U.S. EPA assumptions for Superfund were utilized (2 liters of water ingested per day for 30 years by a 70 kg individual). In the second pathway, exposure of future residents through soil was assessed. This assumed the placement of a house adjacent to Tar Lake such that soil concentrations of contaminants equal one-tenth the concentrations present in the tar itself. In accordance with current Superfund guidance, individuals were assumed to ingest 0.100 grams of soil per day in the form of some combination of soil and dust. This exposure was presumed to take place 350 days per year for 30 years. This exposure analysis did not include a separate analysis for exposure to children, due to the uncertainty in the data. If children were included in the analysis, the overall exposure and risks would be even greater.

In addressing the soil and groundwater ingestion for future residents, the risk assessment characterizes two of the most significant pathways. However, these are only two of many exposure pathways which are pertinent at this site. Other potentially significant exposure routes include soil and groundwater ingestion for future workers, soil ingestion for trespassers, dermal contact for residents, workers, and trespassers, and ingestion of contaminated game.

C) Risk Characterization

The risk assessment characterizes the most serious risks by assessing ingestion of groundwater and soil using a hypothetical future risk scenario. (See Table 6)

Significant non-cancer risks exist at the site via the groundwater pathway, both when considering mean groundwater concentrations on-site and, more appropriately, when

TABLE 5 - COMPOUNDS KNOWN OR PRESUMED TO BE IN TAR

COMPOUND	CONCENTRATION (mg/kg)
Benzene	1.2
Ethylbenzene	100
Toluene	100
Styrene	2.3
2-Butanone	5
2-Hexanone	11
4-Methyl-2-Pentanone	1.2
Xylenes (total)	280
Acenaphthene	280
Acenaphthylene	280
Anthracene	280
Benzo(a)anthracene	280
Benzo(b)fluoranthene	280
Benzo(k)fluoranthene	280
Bis(2-ethylhexyl)phthalate	280
Chrysene	280
Di-n-butyl phthalate	280
Fluoranthene	280
Fluorene	100
Naphthalene	340
Phenanthrene	280
Pyrene	280
Dibenzofuran	51
2-Methylnaphthalene	560
2,4-Dimethylphenol	2000
Phenol	330
2-Methylphenol	1100
4-Methylphenol	1400

Adapted from Table B4a, unapproved Phased Feasibility Study for Tar Lake, Gradient Corporation, February 12, 1991.

TABLE 6 - Cancer Risk and Non-cancer Hazard for Tar Lake

Future Residential Scenario (1)

EXPOSURE PATHWAY	CANCER RISK	HAZARD INDEX	ACUTE HAZARD
Ingestion of Groundwater (95% UCL)	4.8×10^{-5}	24	Not Assessed
Ingestion of Tar-Contaminated	8.0×10^{-4}	0.03	High (2)

(1) Values listed in this table were obtained from the output of the RISK ASSISTANT program.

(2) Potential for acute health effects from exposure to tar was judged to be high, based on high concentrations of phenols and cresols, reports of chemical burns and skin irritation and potentially lethal depth and viscosity of the tar.

considering the 95% upper confidence limit on the arithmetic mean of the data (95% UCL). Hazard Indices equal approximately 11 and 24, respectively. The cancer risk from ingestion of groundwater, as part of the same residential scenario, is 2.4×10^{-5} and 4.8×10^{-5} for mean and 95% UCL respectively.

The tar poses cancer risk due to the presence of polycyclic aromatic hydrocarbons (PAHs). There are numerous sources of uncertainty due to the limited data available in the cancer analysis. The tar is described as being very heterogenous in viscosity and appearance. This risk assessment utilized the assumption that a number of PAHs were present in the tar at the limit of detection. This assumption is reasonable since the PAHs assumed to be present in the tar were detected in the soil beneath the tar. Use of surrogate values in a residential scenario results in a cancer risk driven by PAHs as high as 8×10^{-4}, assuming chronic exposure to soil containing contaminants at one tenth the detection limit in the tar.

A number of compounds present in the tar could present severe acute health risks if ingested or absorbed through the skin, especially phenol. The viscosity of the tar alone presents an extreme hazard. Adolescents or others who manage to trespass on the site could easily fall into the tar and perish.

The cancer risk at Tar Lake (8×10^{-4}) exceeds the 1×10^{-4} level which warrants remedial action under U.S. EPA policy, OSWER Directive 9355.0-30. It also exceeds the acceptable exposure levels for known or suspected carcinogens of 1×10^{-4} to 1×10^{-6} as presented in Section 300.430(e)(2)(i)(A)(2) of the NCP. The non-carcinogenic risk at Tar Lake (hazard index = 24) exceeds the level at which no adverse health effects can be expected (hazard index > 1). These facts, along with excedences of MCLs in the on-site groundwater and the continuing contamination of the groundwater by the source, warrant an action at the Tar Lake Site.

D) Environmental Risks

In addition to the human health risks at the site, there are risks to the environment. The tar is 10 feet below the water table contaminating the groundwater, with effects observed 3.5 miles downgradient from the site. Because of the viscosity and depth of the tar, it poses a serious hazard to wildlife in the area. Waterfowl can be attracted to the liquid surface and can either become stuck in the tar and perish there, or may escape covered with the oily mixture, which could also be lethal. Small animals in the area also are vulnerable to the same threat of sinking into the tar.

VII. CLEANUP STANDARDS

The remedial action cleanup standards, upon which the volume of the contaminated soil excavation/consolidation are based, comply with Michigan Environmental Response Act (Act 307) Type B cleanup criteria and are as follows in Table 7:

TABLE 7 - SOIL CLEANUP STANDARDS

Chemical	Soil Criteria (ppb) *
CARCINOGENS	
Benzene	0.4
Styrene	20
Benzo(a)anthracene	100
Benzo(b)fluoranthene	100
Benzo(k)fluoranthene	100
Chrysene	100
NON-CARCINOGENS	
Ethylbenzene	1,400
Toluene	16,000
2-Butanone	7,000
4-Methyl-2-Pentanone	7,000
Xylenes	6,000
Acenapthene	2,000
Anthracene	40,000
Di-n-butyl phthalate	14,000
Fluoranthene	6,000
Fluorene	6,000
Naphthalene	800
Pyrene	4,000
2,4-Dimethylphenol	8,000
Phenol	6,000
2-Methylphenol	8,000
4-Methylphenol	8,000

* If U.S. EPA determines that local background is greater than these health-based criteria, the average local background can be used as a final cleanup goal.

The reinjection of the treated groundwater that is discharged from the groundwater containment system shall meet reinjection standards that will be determined by U.S. EPA, in consultation with MDNR. These reinjection standards will meet Michigan Environmental Response Act (Act 307) Type B levels and is deemed to meet Part 22 of the Michigan Water Resources Act (Act 245). A closed loop system shall be formed by reinjecting the treated water upgradient of the extraction wells.

VIII. DESCRIPTION OF ALTERNATIVES

The following is a short discussion of each of the remedial action alternatives that were analyzed in detail in the PFS. More precise volumes of tar and contaminated soils, as well as the additional concentration data, will be gathered during the pre-design phase of the remedial design. The exact extent of the contaminated soils may have to be determined after the tar has been removed. The following assumptions were used for each of the alternatives:

- The volume of tar present is estimated to be 30,000 cubic yards. A minimum quantity of 20,000 cubic yards of tar was calculated in a depth sounding survey. The 30,000 cubic yards includes a 50% uncertainty factor because it is believed that there is additional tar on the western and southern sides of Tar Lake.

- The volume of highly contaminated soils (excess cancer risk greater than or equal to 1×10^{-2}) is estimated to be 20,000 cubic yards.

- The volume of low level contaminated soils (excess cancer risk less than 1×10^{-2} and greater than 1×10^{-6}) is 20,000 cubic yards.

The tar waste is very similar to RCRA K087 waste, i.e., decanter tank tar sludge from coking operations, and contains many of the same hazardous compounds. Therefore, the tar and contaminated soils shall be handled as a hazardous waste.

Seven alternatives were evaluated for the source control and groundwater containment operable unit at Tar Lake.

ALTERNATIVE 1 - NO ACTION

CERCLA requires that a "no action" alternative be considered at every site. Under this alternative, no further action would be taken at the Tar Lake site to reduce risks or to control the source and migration of contaminants. The no action alternative will not modify the site in any way. Alternative 1 has no cost.

ALTERNATIVE 2 - REMOVAL AND INCINERATION OF TAR AND HIGHLY CONTAMINATED SOILS; BIO-REMEDIATION AND CONTAINMENT OF REMAINING SOILS; INTERIM GROUNDWATER CONTAINMENT

This alternative involves the excavation and incineration on-site of the tar and the highly contaminated soils (soils with an excess cancer risk level greater than or equal to 1×10^{-2}) in and around Tar Lake extending to the adjacent landfill. To facilitate the excavation of the tar and soils, a dewatering system would be constructed. The exact number and placement of dewatering extraction wells would depend on the areal extent and depth of contamination, and would be determined as part of the Remedial Design. The excavation would require the use of conventional equipment including drag-lines, conveyor loaders, backhoes, and bulldozers.

The incineration technologies available and considered appropriate to incinerate the tar and soils include rotary kiln and infrared. The rotary kiln uses a primary combustion chamber heated by a natural gas or fuel oil burner. For material like the tar, the waste itself can sometimes be used to substitute for the natural gas or fuel oil. The infrared incinerators use infrared energy to heat the waste material in the presence of air until the auto-ignition temperature is reached. The tar and contaminated soils would be incinerated separately. Contaminated soil is not a waste, but only a media containing waste. Thus, the incinerated (treated) soil would be considered clean when the contamination is reduced below health based levels and would no longer need to be managed as a hazardous waste. It could be used as backfill at the site. Ash and any residue resulting from the incineration of the tar remains a listed waste and would be treated and disposed of in a licensed hazardous waste facility.

The remaining soil with an excess cancer risk level less than 1×10^{-2} and greater than 1×10^{-6} (approximately 20,000 yd^3) would be bio-remediated in-situ to the maximum extent practicable with the goal being Michigan Act 307 Type B levels. The treated soil would be contained on-site with the installation of hazardous waste cap that meets RCRA Subtitle C and Michigan Act 64 requirements if it is determined that bio-remediation can not reach the desired cleanup goal. The bio-remediation involves the addition of nutrients and oxygen to the media to promote bio-degradation of contaminants by microorganisms. The exact amenability to this technology would be determined in pre-design treatability studies.

An interim groundwater containment system would be installed to prevent the contaminant plume from migrating further. This containment system would be constructed prior to any excavation work performed on the tar and contaminated soils so that any possible contaminant releases to the groundwater

would be captured and the dewatering system discharge can be treated. This includes:

- Installation of a groundwater pump and treat system for the containment of contaminated groundwater, the treatment of water ponded on Tar Lake, and discharge from the dewatering system

- Implementation of institutional controls including but not limited to, deed restrictions regulating the development of the Tar Lake property and groundwater usage restrictions within the areas of the existing or potential contaminant plume.

The groundwater pump and treat component would consist of: 1) a series of extraction wells at the down-gradient edge of the Tar Lake property to prevent further migration of the contaminant plume, and 2) an appropriate treatment system on-site, possibly carbon absorption, to treat the contaminated groundwater, water ponded on Tar Lake, and discharge from the dewatering system. Discharge from the treatment system would be required to meet applicable effluent discharge limitations as determined by U.S. EPA, in consultation with MDNR. Residues from the treatment system which contain constituents of K087 must be managed as hazardous waste. Because there is no surface water body or POTW nearby, the treated groundwater would be reinjected into the ground upgradient of the extraction wells forming a closed loop system. The reinjected groundwater will meet the substantive requirements under Michigan Act 307 and Michigan Act 245 Part 22. This could be used in conjunction with the bio-remediation of the lowly contaminated soils. The discharged water could be supplemented with the necessary nutrients for the bio-remediation process. Existing groundwater monitoring wells would be used to monitor the effectiveness of the groundwater containment system. Wells would be sampled on a monthly basis to ensure that exposure to contaminants does not occur. Because the groundwater containment is an interim measure, groundwater cleanup standards are waived. Final remedy for the groundwater, including the establishment of clean-up standards, will be addressed in the second operable unit.

Water use restrictions and institutional controls to restrict groundwater usage within the areas of the existing or potential contaminant plume would be implemented.

A site evaluation would be performed every five years for a 30 year period. The purpose of this evaluation would be to determine if site conditions are changing, and if so, what actions may be necessary to address these changes.

Alternative 2 has an estimated capital cost of $47.6 million and an estimated annual operation and maintenance cost of $ $874,800. The estimated present worth cost is $51.4 million.

ALTERNATIVE 3 - REMOVAL AND INCINERATION OF TAR AND HIGHLY CONTAMINATED SOILS; DISPOSAL OF THE REMAINING SOILS AT AN APPROVED HAZARDOUS WASTE LANDFILL; INTERIM GROUNDWATER CONTAINMENT

This alternative involves the excavation and on-site incineration of the tar and the highly contaminated soils (soils with an excess cancer risk level greater than or equal to 1 x 10^{-2}) in and around Tar Lake extending to the adjacent landfill as explained in Alternative 2.

The remaining soil with an excess cancer risk level of less than 1 x 10^{-2} and greater than 1 x 10^{-6} (approximately 20,000 yd^3) would be excavated and disposed of at a licensed hazardous waste landfill. The soils must first meet alternate treatment standards under a treatability variance from RCRA Land Disposal Restrictions (LDRs). The levels would be determined during pre-design. If the alternate treatment levels are above health based levels, the soils would be loaded onto trucks and transported to a hazardous waste landfill. If the treatment levels are below health based levels, the soil could be backfilled at the Site.

At the completion of the excavation, depressions caused by the excavations would be backfilled with clean soil to the original grade, covered with topsoil and revegetated to prevent erosion.

As in Alternative 2, an interim groundwater containment system would be installed to keep the contaminant plume from migrating further. (The addition of nutrients to aide bio-remediation as described in Alternative 2 is not applicable to this alternative.) Because the groundwater containment is an interim measure, groundwater cleanup standards are waived. Final remedy for the groundwater, including clean-up standards, will be addressed in the second operable unit.

Alternative 3 has an estimated capital cost of $55.1 million and an estimated annual operation and maintenance cost of $791,800. The estimated present worth cost is $58.5 million.

ALTERNATIVE 4 - REMOVAL AND INCINERATION OF TAR AND HIGHLY CONTAMINATED SOILS; THERMALLY TREAT REMAINING SOILS; INTERIM GROUNDWATER CONTAINMENT

This alternative involves the excavation and on-site incineration of the tar and the highly contaminated soils (soils with an excess cancer risk level greater than or equal to 1 x 10^{-2}) in and around Tar Lake extending to the adjacent landfill, as described in detail in Alternative 2.

The remaining soil with an excess cancer risk level of less than 1 x 10^{-2} (approximately 20,000 yd^3) will be treated through the use of thermal desorption, with the cleanup goal being Michigan Act 307 Type B levels. Treatability studies would be performed during the pre-design to determine the effectiveness of this treatment technology to the site media and contaminants. This process physically separates volatile and some semi-volatile contaminants from soil by heating the contaminated media between 200 - 1000 degrees F. Offgases may be burned in an afterburner, condensed to reduce the volume to be disposed, or captured by carbon adsorption beds. Gaseous discharges would meet the applicable air discharge limitations as determined by U.S. EPA, in consultation with MDNR. Any ash and residue resulting from the process would be treated and disposed of appropriately in a permitted facility. If the soils can be treated below health based levels through thermal desorption, the soils no longer contains a hazardous waste and no longer needs to be managed as such. If health based levels are not attained by low temperature thermal desorption, then RCRA treatment standards must be met and the treatment residue must be disposed in a RCRA Subtitle C unit.

At the completion of the excavation and treatment, depressions caused by the excavations would be backfilled with clean soil to the original grade, covered with topsoil and revegetated to prevent erosion.

As in Alternative 2, an interim groundwater containment system would be installed to keep the contaminant plume from migrating further. (The addition of nutrients to aide bio-remediation as described in Alternative 2 is not applicable to this alternative.) Because the groundwater containment is an interim measure, groundwater cleanup standards are waived. Final remedy for the groundwater, including the establishment of clean-up standards, will be addressed in the second operable unit.

Alternative 4 has an estimated capital cost of $60.8 million and an estimated annual operation and maintenance cost of $791,800. The estimated present worth cost is $64.2 million.

ALTERNATIVE 5 - REMOVAL AND DISPOSAL OF TAR AND CONTAMINATED SOILS IN A HAZARDOUS WASTE LANDFILL; INTERIM GROUNDWATER CONTAINMENT

This Alternative involves the excavation and disposal of the tar and all of the contaminated soils in and around Tar Lake extending to the adjacent landfill at a licensed hazardous waste landfill. To facilitate the excavation of the tar and soils, a dewatering system would be constructed. The exact number and placement of dewatering extraction wells would depend on the areal extent and depth of contamination, and would be determined as part of the Remedial Design. The excavation would require the use of conventional equipment including drag-lines, conveyor loaders, backhoes, and bulldozers.

Once excavated, the tar and contaminated soils would be treated in order to meet the treatment standards for K087 due to the similarity of the tar waste to K087 waste, i.e., decanter tank tar sludge from coking operations, and contains many of the same hazardous constituents. Since the treatment standards for K087 are based on incineration, incineration is the likely treatment required to meet these standards. The treatment method ultimately used would be determined during the pre-design phase. The tars and the contaminated soils would be sampled and treated separately to the maximum extent possible to avoid diluting the tar in the process. For the soil, alternate treatment levels under a treatability variance would be based on data from actual treatment of the soil; this would be established during the pre-design with the most appropriate treatment technology.

Once treated, the tar residue would be loaded onto trucks for transportation to a secure, CERCLA off-site policy compliant, RCRA Subtitle C facility for disposal. If the treated soil is below health based levels, it would be considered clean. Contaminated soil is not a waste, but only a media containing waste. When the contaminants have been removed below health based levels, the soil no longer contains the waste and no longer needs to be treated as a hazardous waste. Thus, this clean soil could be used as backfill at the site.

At the completion of the excavation, depressions caused by the excavations would be backfilled with clean soil to the original grade, covered with topsoil and revegetated to prevent erosion.

As in Alternative 2, an interim groundwater containment system would be installed to keep the contaminant plume from migrating further. (The addition of nutrients to aide bio-remediation as described in Alternative 2 is not applicable to this alternative.) Because the groundwater containment is an interim measure, groundwater cleanup standards are waived.

Final remedy for the groundwater, including the establishment of clean-up standards, will be addressed in the second operable unit.

Alternative 5 has an estimated capital cost of $48.9 million and an estimated annual operation and maintenance cost of $791,800. The estimated present worth cost is $52.3 million.

ALTERNATIVE 6 - REMOVAL AND CONSOLIDATION OF TAR AND CONTAMINATED SOILS IN ON-SITE RCRA CELLS; INTERIM GROUNDWATER CONTAINMENT

This Alternative involves excavating/consolidating the tar and all of the contaminated soils in and around Tar Lake extending to the adjacent landfill. Additional sampling would be conducted during the pre-design to define the limits of contamination. To facilitate the excavation/consolidation of the tar and soils, a dewatering system would be constructed. The exact number and placement of extraction wells would depend on the areal extent and depth of contamination, and would be determined as part of the Remedial Design. The excavation/consolidation would require the use of conventional equipment including drag-lines and bulldozers.

The tar and contaminated soils would be contained (untreated) on-site in two adjoining RCRA containment cells that would be constructed within the area of contamination. With the construction of the containment cells within the AOC and transferring the tar and contaminated soil into the cells without moving it outside of the AOC or placing it into a separate unit, placement as defined by RCRA would not occur and RCRA Land Disposal Restriction (LDR) treatment standards would not be triggered. This avoids the necessity of having to incinerate the tar and soils in order to meet the K087 treatment standards. The RCRA cells must meet minimum technology requirements, i.e. double liners, two leachate collection systems, and groundwater monitoring. U.S. EPA's Superfund Technical Assistance Response Team (START) has conducted tests on the physical capability of the tar to support the weight of a landfill cover. The results of the tests indicate that by adding solidification agents (17.5 percent bentonite and 35 percent cement) to the tar, it would be able to physically support a landfill cover. Final percentages of solidification agents to be added to the tar would be determined in the remedial design. The first RCRA cell will be sized to hold the 30,000 yd^3 of tar and solidification agents. The second RCRA cell would be sized to hold the contaminated soils. Initial design of the cells would be based on the estimate of 40,000 yd^3 of contaminated soils. The two cells will be constructed sequentially. First, the RCRA cell for the tar would be constructed so that the tar could be excavated and additional sampling can be performed on the soils underneath to better determine the extent of contaminated soils. Once the volume of contaminated soils is known, final sizing and construction of the second RCRA cell would be completed. Both cells will be closed with RCRA Subtitle C hazardous waste landfill covers.

As described in Alternative 2, an interim groundwater containment system would be installed to keep the contaminant plume from migrating further. (The addition of nutrients to aide bio-remediation as described in Alternative 2 is not applicable to this alternative.) Because the groundwater containment is an interim measure, groundwater cleanup standards are waived. Final remedy for the groundwater, including the establishment of clean-up standards, will be addressed in the second operable unit.

Alternative 6 has an estimated capital cost of $16.7 million and an estimated annual operation and maintenance cost of $791,800. The estimated present worth cost is $20.1 million.

ALTERNATIVE 7 - REMOVAL AND DISPOSAL OF TAR AND HIGHLY CONTAMINATED SOILS IN AN OFF-SITE HAZARDOUS WASTE LANDFILL; BIO-REMEDIATION OF LOW LEVEL SOILS AND CONTAINMENT; INTERIM GROUNDWATER CONTAINMENT

This Alternative involves excavating the tar and the highly contaminated soils in and around Tar Lake extending to the adjacent landfill. Additional sampling would be conducted during the pre-design phase to define the limits of contamination. To facilitate the excavation of the tar and soils, a dewatering system would be constructed. The exact number and placement of extraction wells would depend on the areal extent and depth of contamination, and would be determined as a part of the Remedial Design. The excavation would require the use of conventional equipment including drag-lines, conveyor loaders, backhoes, and bulldozers.

Once excavated the tar and highly contaminated soils would be treated in order to meet the treatment standards for K087 because the tar waste is very similar to K087 waste, i.e., decanter tank tar sludge from coking operations, and contains many of the same hazardous constituents. Since the treatment standards for K087 are based on incineration, incineration would likely be required to meet these standards. The treatment method ultimately used would be determined during the pre-design phase. The tars and the highly contaminated soils would be sampled and treated separately to the maximum extent possible to avoid diluting the tar in the process. For the soil, alternate treatment levels under a treatability variance can be based on data from actual treatment of the soil. This would be established during the pre-design with the most appropriate treatment technology.

Once treated the tar residue would be loaded onto trucks for transportation to a secure, CERCLA off-site policy compliant, RCRA hazardous waste landfill for disposal. If the treated soil is below health based levels, it would be considered clean. Contaminated soil is not a waste, but only a media containing waste. When the contaminants have been removed below health based levels, the soil no longer contains the waste and no longer needs to be treated as a hazardous waste. Thus, clean soil could be used as backfill at the site.

The remaining soil with an excess cancer risk level less than 1×10^{-2} and greater than 1×10^{-6} would be bio-remediated in-situ to the maximum extent practicable with the goal being Michigan Act 307 Type B levels. If it is determined during the remediation that bio-remediation can not achieve the desired cleanup goal, the treated soils would be contained on-site with the installation of a hazardous waste cap. The bio-remediation involves the addition of nutrients and oxygen to the media to promote bio-degradation of contaminants by microorganisms. The exact amenability and effectiveness to this technology would be determined in pre-design treatability studies.

As in Alternative 2, an interim groundwater containment system would be installed to keep the contaminant plume from migrating further. (The addition of nutrients to aide bio-remediation as described in Alternative 2 is not applicable to this alternative.) Because the groundwater containment is an interim measure, groundwater cleanup standards are waived. Final remedy for the groundwater, including the establishment of clean-up standards, will be addressed in the second operable unit.

Alternative 7 has an estimated capital cost of $47.6 million and an estimated annual operation and maintenance cost of $874,800. The estimated present worth cost is $51.4 million.

IX. COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with the NCP, the relative performance of each alternative is evaluated using the nine criteria, 40 CFR Section 300.430(e)(9)(iii), as a basis for comparison. An alternative providing the "best balance" of tradeoffs with respect to the nine criteria is determined from this evaluation.

A detailed analysis was performed on the seven alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These nine criteria are: 1) overall protection of human health and the environment; 2) compliance with applicable or relevant and appropriate requirements (ARARs); 3) long-term effectiveness and permanence; 4) reduction of toxicity, mobility, or volume through treatment; 5) short-term effectiveness; 6) implementability; 7) Cost; 8) State acceptance; 9) Community acceptance.

Overall Protection of Human Health and the Environment

This criterion addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternative 1, No Action, is not protective of human health and the environment because nothing is done to the contaminated media. The risks associated with the site are not changed.

Alternatives 2 through 7 are all protective of human health and the environment as the risks due to the tar and the contaminated soils are minimized by removal, treatment, or containment of the media.

Alternatives 2 through 4 are similar in that each reduces the direct contact threat and the continuing contamination of the groundwater by removing and incinerating the tar and the highly contaminated soils. In addition, each of these alternatives addresses the low level contaminated soils. Alternative 2 bio-remediates the low level contaminated soils. Alternative 3 excavates, treats, and disposes these soils off-site. Alternative 4 thermally desorbs the soils. The actions taken in Alternatives 2 through 4 will result in an acceptable risk level at the site by minimizing or eliminating potential exposure. Also, they provide high levels of effectiveness and permanence as residual risks are eliminated since no untreated wastes are left on the site.

Alternatives 5 through 7 each address the risks at the site in a different manner. Alternative 5 minimizes risk by removal and treatment of the tar and all of the contaminated soils and then disposal in an off-site licensed hazardous waste landfill. Alternative 6 minimizes the risk at the site by eliminating the exposure pathways. Direct contact threats and continuing contamination of the groundwater are mitigated through the removal of the tar and all of the contaminated soils and disposal on-site in two adjoining RCRA containment cells. Alternative 7 reduces risk by removing, treating, and then disposing the tar and highly contaminated soils in an off-site hazardous waste landfill. Alternative 7 also bio-remediates the low level contaminated soils. Thus, Alternatives 5 through 7 also provide high levels of effectiveness and permanence. By containing the hazardous waste, these alternatives reduce risk at the site through elimination of the exposure pathway.

Each of the seven alternatives provides additional protection through the interim groundwater containment system, which prevents further migration of the contaminant groundwater plume. This measure protects the public from the potential migration of site contaminants, some of which have been found to exceed MCLs on the Tar Lake property.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

This criterion evaluates whether a remedy meets applicable or relevant and appropriate requirements set forth in Federal and State environmental laws pertaining to the site or proposed actions or if a wavier is justified. ARARs are discussed in more detail in Statutory Determinations.

All of the alternatives, except for the no action alternative, will comply with Federal and State ARARs. The major ARARs that will be complied with include: **RCRA** and **Michigan Hazardous Waste Management Act (Act 64)**, which address the handling of hazardous materials (including requirements for incineration, transportation, land disposal restrictions, and minimum technology requirements for landfills, and hazardous waste landfill covers); the **Clean Air Act** and **Michigan's Air Pollution Control Act (Act 348)**, which address air emissions from the excavation and incineration processes; **Michigan Water Resources Act (Act 245)**, which addresses groundwater quality; and **Michigan Environmental Response Act (Act 307)**, which addresses cleanup type.

"To Be Considered" requirements that will be met are: **U.S. EPA's Off-Site Policy**, which ensures that CERCLA wastes are sent to a CERCLA off-site compliant, RCRA-permitted landfill; **Requirements for Hazardous Waste Landfill Design, Construction, and Closure EPA/625/4-89/002, August 1989** and **Final Covers on Hazardous Waste Landfills and Surface Impoundments EPA/530-SW-89-047, July 1989**, which address the design and construction of the containment cells.

The interim groundwater containment in not a final cleanup of groundwater at Tar Lake. Its purpose is to prevent the contaminants from spreading. The second operable unit at the site will addresses the final groundwater cleanup levels. Therefore, a waiver of groundwater cleanup standards shall be invoked for this operable unit.

Long-Term Effectiveness and Permanence

This criterion refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Alternative 1, No Action, does not satisfy this criterion because is does not mitigate any of the risks presently at the site.

Alternatives 2 through 4 permanently minimize the risks associated with the tar and the highly contaminated soils through excavation and incineration. Each alternative also address the low level contaminated soils but through different methods. Alternative 2 bio-remediates the soils. Alternative 3 excavates, treats, and disposes the soils off-site. Alternative 4 thermally desorbs the soils. Thus, Alternatives 2 through 4 provide high levels of effectiveness and permanence because there are no untreated waste left on the site once the alternatives are implemented.

Alternatives 5 through 7 are also effective in the long term. Alternative 5 eliminates risks by excavating and treating the tar and all of the contaminated soils and then disposing the hazardous treatment residue off-site in a permitted hazardous waste landfill. No untreated wastes are left on the site. Alternative 6 mitigates the risks at the site by excavating/consolidating the tar and all of the contaminated soils and containing them on-site in two adjoining RCRA containment cells. The protective measures of the containment cells will provide reliability to ensure that any exposures will be minimized. Proper long-term operation and maintenance will assure the integrity of the cells. Alternative 7 mitigates the risk from the tar and highly contaminated soils by treating them and disposing the hazardous residuals off-site in a permitted hazardous waste landfill. The low level contaminated soils are treated through bio-remediation. Thus, there are no untreated wastes left on site with Alternative 7.

Alternatives 2, 3, 4, 5, and 7 involve the removal of contaminated materials, with subsequent treatment, and offer the highest level of long-term protectiveness and permanence. Alternative 6 contains the contaminated material in engineered containment cells and provides an adequate level of long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation addresses the statutory preference for selecting remedial actions that employ treatment technologies which permanently and significantly reduce toxicity, mobility, or volume of the hazardous substance as their principal element.

Alternative 1, No Action, provides no treatment and thus does nothing to affect toxicity, mobility, or volume of the waste material.

Alternatives 2 though 4 reduce the toxicity, mobility, and volume of the principal threat, which is the tar and the highly contaminated soils, through incineration. This satisfies the statutory preference for the use of treatment as a principal element. In addition, each of the alternatives addresses the low level contamination. Alternative 2 reduces the toxicity, mobility, and volume through treatment of the low level contaminated soils through bio-remediation. Alternative 3 does not treat the low level contaminated soils but rather removes and disposes of it off-site. Alternative 4 reduces toxicity, mobility, and volume of the low level contaminated soils through thermal desorption.

Alternative 5 reduces the toxicity, mobility, and volume of the contaminants through the treatment that is required by LDRs prior to the off-site disposal in a permitted hazardous waste landfill. This satisfies the statutory preference for the use of treatment as a principal element. Alternative 6 reduces the ability of the contaminants to migrate through excavation and consolidation on-site in two adjoining RCRA containment cells, but this is not through treatment and does not satisfy this requirement. Alternative 7 reduces toxicity, mobility, and volume by treating the tar and highly contaminated soils prior to disposal in an off-site hazardous waste landfill and by bio-remediation of the low level contaminated soils. Consequently, Alternative 7 satisfies this criterion.

Short-Term Effectiveness

This criterion addresses the risks the remedy may pose to site workers, the community, and the environment during the construction and implementation phase until cleanup goals are achieved and the time it takes to achieve these cleanup goals.

With respect to protection of the community, Alternative 1 does not pose any additional risks to the community as no action is taken. Alternatives 2 through 7 could introduce risks to residents through the possible release of volatile chemicals through the excavation of the tar and contaminated soils. These risks, however, will be minimal and can be controlled through air monitoring. If it is determined that volatiles are being emitted into the air and pose a threat to the residents, immediate action will be taken to mitigate the threat.

There are no risks to workers with Alternative 1 as no work is being performed. Alternatives 2 through 7 could introduce risks to workers through the possible release of volatile chemicals through the excavation. These risks can be controlled by following safe working practices and implementation of the health and safety plan that will be developed for the Remedial Design/Remedial Action. This health and safety plan will indicate the different levels of protection, including but not limited to respiratory protection, and when these protective devices are to be used to ensure worker safety.

With respect to environmental impacts, Alternative 1 will have continued migration of contamination from the tar to the groundwater as the source remains partially immersed in the groundwater. Alternatives 2 through 7 could result in the release of some contaminants from the tar into the groundwater during the excavation process. However, the interim groundwater containment remedy will capture the contaminated groundwater and prevent its migration.

Evaluation of the time to implement the alternatives reveals the following estimates: Alternative 1 will not take any time to implement. Alternatives 2 through 7 will take 3 years at a minimum to implement.

<u>Implementability</u>

This criterion addresses the technical and administrative feasibility of implementing a remedy, including the availability of materials and services needed.

Alternative 1 has nothing to implement. Alternatives 2 through 7 are technically and administratively feasible. Alternatives 2, 3, 4, 5, and 7 use excavation and incineration, which are established technologies. With respect to the low level contaminated soils, Alternative 2, 4, and 7 use either bio-remediation or thermal desorption, which are innovative technologies. However, these innovative technologies are being employed at other sites and have had successful pilot tests performed for contaminants similar to those at Tar Lake. Alternatives 3, 5, and 7 utilize disposal at an off-site licensed facility. It should be noted that even though there are licensed hazardous waste landfills that can accept the waste, they may be reluctant to accept waste from a Superfund site. Alternative 6 involves construction and disposal of waste in on-site RCRA containment cells. This is an established technology. Tests conducted by U.S. EPA indicate that with the addition of solidification agents, 17.5 percent bentonite and 35 percent cement, the tar should be able to physically support the weight of a landfill cover.

The pump and treat system in each alternative for interim groundwater containment is also an established technology and is not expected to present implementability problems.

The property needed to conduct the remedial activities are owned by PRPs. Thus, access is not expected to present any problems.

Cost

This criterion compares the capital, annual operation and maintenance, and present worth cost of implementing the alternatives at the site.

The following ar the cost estimates for each of the alternatives.

Alternative	Capital Cost	Annual O&M Cost	Present Worth
1	$0	$0	$0
2	$47,600,000	$874,800	$51,400,000
3	$55,100,000	$791,800	$58,500,000
4	$60,800,000	$791,800	$64,200,000
5	$48,900,000	$791,800	$52,300,000
6	$16,700,000	$791,800	$20,100,000
7	$47,600,000	$874,800	$51,400,000

Present worth was calculated for five year at 5 percent.

All of the Alternatives, except for Alternatives 1 and 6, include incineration of the tar and at least part of the contaminated soils. Alternatives 2 - 4 include incineration as the primary treatment element. Alternatives 5 and 7 examine off-site landfilling but because RCRA Land Disposal Restrictions are triggered, treatment standards must be met prior to disposal. Incineration is also used in these two alternatives as a means to meet the treatment standards because the tar is similar to K087 waste and K087 treatment standards are based on incineration. With the large volume of materials and the high unit cost of the treatment, the $28 million incineration cost represents approximately 50% of the capital costs for each of these alternatives. When the other parts of the alternatives are included, these remedies are in the $50 - $60 million range, which brings into question the cost effectiveness.

Alternative 6 is not subject to the RCRA Land Disposal Restrictions. The RCRA containment cells would be constructed within the area of contamination (AOC) and the tar and contaminated soils transferred into these cells without moving it outside the AOC or placing it into a separate unit. Because placement, as defined by RCRA, does not occur, LDR treatment standards are not triggered and incineration is avoided.

State Acceptance

The State of Michigan has verbally concurred with U.S. EPA's selection of Alternative 6 as the preferred remedial alternative as presented in the next section. A concurrence letter has not been received yet.

Community Acceptance

Based on the comments received by U.S. EPA, the selected alternative appears to be acceptable to the community. Community concerns are addressed in the attached Responsiveness Summary.

X. SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, as amended by SARA, and the NCP, the detailed analysis of the alternatives, and public comment, U.S. EPA has determined that **Alternative 6 - Removal and Disposal of Tar and Contaminated Soils in On-Site RCRA Cells; Interim Groundwater Containment** is the most appropriate remedy for the first operable unit at the Tar Lake site.

The components of the selected remedy are as follows:

A) **Pre-design Study**
The pre-design phase shall include but not be limited to: (1) laying out a grid over Tar Lake and suspected locations of tar and taking tar samples in order to get a representation of the extent of the tar and its constituents; (2) based on the results of the tar characterization performed in (1) above, examine the possibility of recycling/reusing all or a portion of the tar; (3) soil sampling and analysis in and around Tar Lake, extending to the adjacent landfill, to characterize the extent and constituents of contamination, including a determination of background soil levels; and, (4) treatability studies to determine: the effectiveness of carbon adsorption to meet

groundwater discharge limits, the effectiveness of other groundwater treatment options to meet discharge limitations if carbon adsorption can not, and the amount of solidification agents to be added to the tar so it can support the weight of a landfill cover.

B) **Excavation/Consolidation**

The tar and the all of the contaminated soils (soils with an excess cancer risk level greater than 1 x 10^{-6}) in and around Tar Lake, extending to the adjacent landfill shall be excavated/consolidated. The vertical and horizontal extent of excavation/consolidation shall be further defined during the remedial design. Initial estimates of volume are 30,000 yd^3 of tar and 40,000 yd^3 of contaminated soils. Dewatering shall be done to facilitate the excavation/consolidation. The exact number and placement of the dewatering extraction wells shall depend on the areal extent and depth of contamination.

C) **RCRA Containment Cells**

The tar (including solidification agents) and contaminated soils shall be consolidated in two adjoining RCRA containment cells constructed in the area of contamination. The cells will meet RCRA minimum technology requirements, which includes at a minimum, double liners, leachate collection system, and groundwater monitoring. The first containment cell will be sized to hold the tar, estimated to be 30,000 yd^3 but to be better defined during the pre-design. Solidification agents, bentonite and cement, shall be added to the tar to give it the physical stability to support the weight of the RCRA Subtitle C hazardous waste landfill cover used to close the cell. The second containment cell shall be sized to hold the contaminated soils. The two cells shall be constructed sequentially. First, the containment cell for the tar shall be constructed so that the tar can be excavated and deposited in the cell, so that additional sampling can be performed on the soils underneath to better determine the extent of contaminated soils. Once the volume of contaminated soils is known, final sizing and construction of the second containment cell shall be done and the contaminated soils shall be disposed of. Both cells shall be closed with RCRA Subtitle C hazardous waste landfill covers.

D) Interim Groundwater Containment

An interim groundwater containment system shall be installed to keep the contaminant plume from migrating. This includes: (1) installation of a pump and treat system for the containment of contaminated groundwater (including groundwater from the excavation dewatering process) and the treatment of water ponded on Tar Lake; (2) reinjection of the treated groundwater, which meets Act 307 Type B standards, upgradient of the extraction wells so that a closed loop system is formed; (3) implementation of institutional controls which shall restrict groundwater usage within the areas of the existing or potential contaminant plume; and (4) implement a groundwater monitoring program during the Remedial Design/Remedial Action to detect changes in contaminant concentrations and plume location.

Remediation Goals

The purpose of this operable unit response action is to control risks posed by the tar and contaminated soils at Tar Lake, which are a continuing source of groundwater contamination. The most serious health risks associated with the site are from ingestion of the contaminated groundwater and soils by future residents at the Tar Lake site. The future use scenario indicate unacceptable risks to human health as the carcinogenic risk is 8×10^{-4} for future adult residents. The non-carcinogenic hazard index is 24 for future residents. These risks are outside of U.S. EPA's acceptable risk ranges. The cleanup levels presented in Section VII Cleanup Standards, shall be achieved for the soil at Tar Lake. Since the groundwater containment is an interim measure, cleanup standards will not be attained in this operable unit. Final groundwater cleanup levels will be addressed in the second operable unit.

Estimated Costs

The following is the estimated cost summary for the selected remedy.

Alternative 6
Removal and Disposal of Tar and Contaminated Soils in On-Site RCRA Cells; Interim Groundwater Containment

CAPITAL COSTS:

Excavation	$4.1 million
Disposal of Tar in RCRA Cell (includes $3.8 million for solidification agents)	$5.4 million
Disposal of Soil in RCRA Cell	$2.1 million
Groundwater Containment System	$1.0 million
Design and Contingencies	$4.1 million
TOTAL CAPITAL COSTS	$16.7 million

ANNUAL O&M COSTS:

Excavation (dewatering)	$144,000
Groundwater Containment System	$647,800
TOTAL ANNUAL O&M COSTS	$791,800

TOTAL PRESENT WORTH COSTS..............$20.1 million

XI. STATUTORY DETERMINATIONS

U.S. EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several statutory requirements and preferences. These require that the selected remedial action for the site comply with applicable or relevant and appropriate requirements established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must also be cost-effective and utilize permanent solutions and alternate treatment technologies to the maximum extent practicable. Finally, the statue includes a preference for remedies that include treatment as a principal element. The following sections discuss how the selected remedy for the Tar Lake site addresses these statutory requirements.

A) Protection of Human Health and the Environment

The selected remedy for the Tar Lake site protects human health and the environment through the elimination of exposure pathways with the containment of the tar and the contaminated soils. Excavation and consolidation in on-site RCRA containment cells will eliminate the direct contact and ingestion pathways as well as removing a continuing source of groundwater contamination. The containment cells will minimize precipitation infiltration and leaching of the contaminants from the tar and soils.

Additional protection is provided through the implementation of the interim groundwater containment system. The contaminated groundwater is prevented from further migration until the second operable unit addresses the final groundwater cleanup. This measure protects the public from the movement of site contaminants that exceed MCLs on the Tar Lake site.

No unacceptable short-term risks will be caused by the implementation of the remedy. The excavation/consolidation of the tar and contaminated soils could release VOCs, however, resident and site worker risks will be minimized through air monitoring and immediate action if there is threat posed; following safe work practices; and, implementation of the health and safety plan that shall be developed for the Remedial Design/Remedial Action.

B) Compliance with ARARs

The selected remedy shall comply with Federal and/or State, where more stringent, applicable or relevant and appropriate requirements (ARARs) listed below:

1) Chemical-Specific ARARs

Chemical-specific ARARs regulate the release to the environment of specific substances having certain chemical characteristics. Chemical-specific ARARs typically determine the extent of cleanup at a site.

Federal ARARs

Maximum Contaminant Levels (MCLs) and to a certain extent non-zero Maximum Contaminant Level Goals (MCLGs), the Federal drinking-water standards promulgated under the Safe Drinking Water Act (SDWA), are applicable to municipal water supplies servicing 25 or more people. At the Tar Lake site, MCLs and MCLGs are not applicable, but are relevant and appropriate since the aquifer in the area of contamination is suitable for use as a source of drinking water in the future. MCLGs are relevant and appropriate when the standard is set at a level greater than zero (for non-carcinogens), otherwise, MCLs are relevant and appropriate. CERCLA Section 121(d)(4)(A) provides that when the remedial action selected is only part of a total remedial action that will attain such level of standard or control when completed, otherwise applicable or relevant and appropriate requirement may be waived. Since the groundwater containment at Tar Lake is an interim measure, with final groundwater cleanup to be addressed by the second operable unit, these ARARs are waived.

State ARARs

Rules 705(2) and (3), 707 - 715, 717(2), 719(1), and 723 of the Michigan Environmental Response Act (Act 307) Administrative Rules are ARARs at the Tar Lake site. Groundwater cleanup standards can be derived under Type A, B, or C criteria. The groundwater containment at Tar Lake is an interim measure, with final groundwater cleanup to be addressed by the second operable unit. Therefore, these ARARs are waived as provided by CERCLA Section 121(d)(4)(A).

2) Location-Specific ARARs

Location-specific ARARs are those requirements that relate to the geographical position of a site.

No location specific ARARs have been identified.

3) Action-Specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances.

Federal ARARs

The Clean Air Act standard for total suspended particulates (National Ambient Air Quality Standard for PM-10, 40 CFR 50.6) addresses particulate matter with a diameter of 10 micrometers or less. This is relevant and appropriate at Tar Lake for the excavation/consolidation of the tar and contaminated soils.

RCRA Subtitle C requirements regulate the treatment, storage, and disposal of hazardous waste. Because the tar is similar to RCRA K087 waste, i.e., decanter tank tar sludge from coking operations, RCRA Subtitle C requirements are relevant and appropriate with respect to the handling and disposal of the tar and contaminated soils as well as to the residue from the groundwater containment treatment system. In particular, 40 CFR Part 264 Subpart N, Landfills addresses the requirements for hazardous waste landfills. This includes: minimum technology requirements for landfills, as set forth in 40 CFR Section 264.301(c), and landfill closure requirements specified in 40 CFR Section 264.310.

RCRA Land Disposal Restrictions (LDRs), 40 CFR Part 268, place restrictions on the land disposal of RCRA hazardous waste. Because the RCRA containment cells will be constructed in the area of contamination, LDR treatment standards will not be triggered since "placement" (as defined by RCRA) will not occur. Thus, RCRA LDRs are not ARARs at the Tar Lake site.

State ARARs

Michigan's Soil Erosion and Sedimentation Control Act (Act 347) regulates earth changes which involve more than one acre or is within 500 feet of a lake or stream. Act 347 is applicable to the tar and soil excavation/ consolidation as the area involved is more than one acre. Appropriate erosion and sedimentation control measures shall be planned.

The Michigan Environmental Response Act (Act 307) provides for the identification, risk assessment, and evaluation of contaminated sites within the State. The U.S. EPA has determined that Rules 705(2) and (3), 707 - 715, 717(2), 719(1), and 723 are relevant and appropriate to the Tar Lake site in compliance with Section 121(d)(2) of CERCLA. These rules provide for the selection of a remedy which attains a degree of cleanup which conforms to one or more of three levels of cleanup - either Type A (cleanup to background levels), Type B (cleanup to risk-based levels), or Type C (cleanup to risk-based levels under site-specific considerations). U.S. EPA has determined that the soils cleanup/excavation will meet Type B levels and the containment of tar and soils is a Type C cleanup.

Michigan Water Resources Act (Act 245) Part 22 addresses groundwater quality in useable aquifers. This applies to the reinjection of the treated groundwater from the containment system. A closed loop system shall be formed by reinjecting the groundwater, which shall be treated to meet Act 307 Type B levels, upgradient of the extraction wells. This closed loop reinjection system complies with the substantive requirements set forth in Act 245.

Michigan's Hazardous Waste Management Act (Act 64) regulates the generation, transport, treatment, storage, and disposal of hazardous waste. With respect to the containment cells, Act 64 is relevant and appropriate. The applicable sections of Act 64 have incorporated RCRA by reference. Therefore, by meeting the RCRA specifications and requirements for the containment cells, the substantive requirements of Act 64 will also be met.

4) To Be Considered

In addition to legally binding laws and regulations, many Federal and State environmental and public health programs also develop criteria, advisories, guidance, and proposed standards that are not legally binding, but that provide useful information or recommended procedures.

Requirements for Hazardous Waste Landfill Design, Construction, and Closure EPA/625/4-89/002, August 1989, addresses the design and construction of landfills. This guidance document applies to the design and construction of the RCRA containment cells at Tar Lake.

Final Covers on Hazardous Waste Landfills and Surface Impoundments EPA/530-SW-89-047, July 1989, addresses the design and construction of landfill covers. This guidance document applies to the design and construction of the hazardous waste landfill covers that shall be used to close the RCRA containment cells at Tar Lake.

C) Cost Effective

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportional to its cost. Alternative 6 provides adequate protection of human

health and the environment for less cost than any of the other alternatives evaluated (excluding the no action alternative).

All of the other alternatives, except for Alternative 1, no action, include incineration of the tar and some portion of the contaminated soils. In Alternatives 2, 3, and 4, incineration was the primary treatment element. Alternatives 5 and 7 examined off-site landfilling of the tar and contaminated soils. However, RCRA LDRs were triggered and treatment standards had to be met before the waste could be disposed because the tar is similar to K087 waste, decanter tank tar sludges from coking operations. These treatment standards for K087 were based on the use of incineration. Therefore, it is likely that incineration will have to be used in order to meet these standards at Tar Lake. With the large volume of wastes and the high unit cost of incineration, the $28 million cost for incineration represents approximately 50 percent of the capital cost for each of the alternatives, other than Alternatives 1 and 6. When the other component costs are included, the alternatives which include incineration are in the $50 million to $60 million range. This brings in the issue of cost effectiveness.

Alternative 6 is not subject to the RCRA LDRs because the RCRA containment cells shall be constructed within the area of contamination (AOC). The tar and contaminated soil would be transferred into these cells without moving it outside the AOC

or placing it into a separate unit. Therefore, LDR treatment standards are do not have to be met because placement, as defined by RCRA, does not occur.

Alternatives 2, 3, 4, 5, and 7, each of which include incineration as part of the treatment at the site, provide a high level of protectiveness by treating the tar and contaminated soils. Alternative 6 also provides a high degree of protectiveness by eliminating the exposure pathway through the containment of the tar and contaminated soils, but at about one-third the cost. With a present worth cost of $20.1 million, Alternative 6 is the most cost effective remedy for this operable unit at Tar Lake.

D) Utilization of Permanent Solution and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and alternate treatment technologies can be utilized in a cost effective manner for the Tar Lake site. Of those alternatives that are protective of human health and the environment and comply with ARARs, Alternative 6 provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, and considering State and community acceptance.

The selected remedy provides a high degree of long-term effectiveness and permanence by excavating/consolidating the tar and contaminated soils and containing them in on-site RCRA containment cells. The protective measures of the RCRA containment cells (i.e., double liners, leachate collection system, groundwater monitoring) will provide reliability to ensure minimal exposure potential. Proper long-term operation and maintenance will assure the integrity of the containment cells. The containment reduces the ability of the contaminants to move, even though it is not through treatment. The other alternatives which do utilize treatment to reduce toxicity, mobility, or volume are not cost effective. Short-term effectiveness and implementability are similarly satisfied for all of the alternatives evaluated. Alternative 6 is the most cost effective remedy for the Tar Lake site.

E) Preference for Treatment as a Principal Element

The containment of the tar and contaminated soils, which as a continuing source of groundwater contamination is the principal threat at the Tar Lake site, does not employ treatment as a principal element. The alternatives which included treatment (i.e., incineration) as a principal element, were not cost effective. These alternative costed up to three times as much as the selected remedy without providing additional protection of human health and the environment. Alternative 6 provides the best balance with respect to the evaluation criteria even though treatment is not a principal element.