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Superfund
Record of Decision:

Thermo Chem, MI

50272-101

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 9.5-acre Thermo Chem site is comprised of an inactive solvent and chemical waste reprocessing, refining, and incineration facility, and an inactive waste hauling facility in Egelston Township, Muskegon County, Michigan. The area surrounding the site consists of residential areas, light manufacturing and commercial buildings, and undeveloped woodlands. The site is adjacent to two other Superfund sites: the SCA Independent Landfill site, and the Bofors Nobel site, which are located approximately 1,800 feet south and 1.25 miles east of the site, respectively. Site features include a warehouse, an incinerator, above-ground storage tanks, a laboratory, and process buildings and associated lagoons. A trout stream, Black Creek, is located approximately 1,500 feet south of the site and forms a broad and flat wetland. From 1969 to 1980, Thermo Chem received, distilled, and regenerated solvents, paint wastes, and antifreeze into usable solvents. Unrecoverable materials and by-products including sludge and residues were incinerated onsite. The Thomas Solvent Company, which lies adjacent to, and is owned by Thermo Chem, has been included as part of the site because it is suspected to be a source of ground water contamination. The Thomas Solvent Company was operated as a hazardous waste hauling facility for Thermo

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Thermo Chem, MI
First Remedial Action
Contaminated Media: soil, sludge, gw
Key Contaminants: VOCs (benzene, toluene, xylenes), other organics (PAHs, PCBs, pesticides), metals (arsenic, chromium, lead), inorganics

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
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	None	

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

Chem and collected waste for recycling and returned the material to customers. Wastewater generated from the distillation and equipment-cleaning process at Thermo-Chem was discharged onsite into a series of three interconnected lagoons. In addition, approximately 3,500 drums containing raw and recycled materials were stored in an onsite underground storage tank farm area during the years of operation. Former onsite personnel indicated that sludge was occasionally buried onsite, and that onsite chemical spills frequently occurred. In response to investigation activities during 1988 and 1991, EPA conducted an emergency removal of drums and materials containing hazardous waste. Federal investigations in 1990 indicated that contaminant releases were one source of ground water contamination. This Record of Decision (ROD) addresses the source of contamination by remediation of soil, sludge, debris, and ground water up to the point where ground water discharges into Black Creek as Operable Unit 1 (OU1). A future ROD will address OU2, the contamination problems within Black Creek and ground water contamination south of Black Creek. The primary contaminants of concern affecting the soil, sludge, and ground water are VOCs including benzene, toluene, and xylenes; other organics including PAHs, PCBs, and pesticides; metals including arsenic, chromium, and lead; and other inorganics.

The selected remedial action for this site includes excavating, removing, and incinerating offsite approximately 2,000 cubic yards of soil and sludge; treating and disposing offsite any ash or residuals produced from offsite incineration; installing an in-situ vapor extraction (ISVE) system and treating onsite approximately 9.5 acres of remaining contaminated soil; conducting a treatability study to determine the feasibility of enhancing the natural biodegradation of organic compounds in the soil undergoing ISVE treatment; treating gases emitted from the extraction wells using a fume-rich incinerator; treating liquid from the vapor extraction process onsite; covering the site with clean soil and vegetation, if necessary; decontaminating, demolishing, and disposing offsite all onsite buildings and structures; onsite pumping and treatment of ground water using filtration, air stripping, metal precipitation, and pH adjustment, followed by treating off-gases using carbon adsorption and onsite discharge of the treated ground water to Black Creek; treating and disposing all residue, sludge, spent carbon, or spent coagulants and flocculent at an offsite landfill; conducting additional treatability and leachability tests to determine the need for further excavation and/or treatment; and implementing institutional controls including land use restrictions. The estimated present worth cost for this remedial action is $24,300,000, which includes an annual O&M cost of $1,091,000 for 30 years.

PERFORMANCE STANDARDS OR GOALS: Soil cleanup standards are based on State standards and a carcinogenic risk level of 10^{-6}. Ground water cleanup standards are based on State standards. Chemical-specific goals for soil include benzene 10 mg/kg, toluene 2 mg/kg, xylenes 1 mg/kg, PAHs 0.2 mg/kg to 0.6 mg/kg, PCBs 1 mg/kg, pesticides 0.0000006 to 0.00005 mg/kg, arsenic 0.0004 mg/kg, chromium 0.04 mg/kg, lead 9 mg/kg, and inorganics other than metals 0.08 mg/kg. Chemical-specific goals for ground water include benzene 1 ug/l, toluene 100 ug/l, xylenes 59 ug/l, PAHs 10 ug/l to 29 ug/l, arsenic 0.02 ug/l, and inorganics other than metals 4 ug/l.

THERMO CHEM SITE, MI
OPERABLE UNIT I

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Thermo Chem Site, Operable Unit I
Muskegon County, Michigan

Statement of Basis and Purpose

This decision document represents the selected remedial action for the Thermo Chem site, in Muskegon County, Michigan, Operable Unit I, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for this site.

The State of Michigan concurs with the selected remedy. The information supporting this remedial action decision is contained in the administrative record for this site.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of Remedy

This operable unit is the first of two operable units for the site. The selected remedial action for Operable Unit I addresses the source of contamination by remediation of soil, sludge and groundwater up to the Black Creek.

The major components of the selected remedy include:

* Decontamination, demolition, and off-site disposal of all on-site structures;

* Excavation and off-site incineration of Group 1 and 2 soils;

* In-Situ Vapor Extraction for all site soils;

* Off-gas treatment through a fume-rich incinerator;

* Extraction and treatment of the groundwater with subsequent discharge to Black Creek;
* Installation and maintenance of a fence around the site during remedial activities; and
* Implementation of zoning and land use restrictions during the implementation of the remedy.

The following component of the selected remedy will be evaluated during the implementation of in-Situ Vapor Extraction:

* Determination of the optimum amount of essential nutrients (e.g., moisture, nitrogen, oxygen, and phosphate) to be added to the unsaturated site soils in order to promote natural microbial activities, without decreasing the mass removal of the organic compounds through in-Situ Vapor Extraction. If determined to be feasible, this treatment will be implemented as part of the remedy.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State environmental requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will not result in hazardous substances on-site above health-based levels, the five-year review will not apply to this action.

For Valdas V. Adamkus
Regional Administrator

9/30/91
Date

RECORD OF DECISION

DECISION SUMMARY

THERMO CHEM SITE

OPERABLE UNIT I

MUSKEGON COUNTY, MICHIGAN

Prepared By:

U.S. Environmental Protection Agency

Region V

Chicago, Illinois

September, 1991

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ROD SUMMARY
THERMO CHEM SUPERFUND SITE, OPERABLE UNIT I
MUSKEGON COUNTY, MICHIGAN

I. SITE NAME, LOCATION, AND DESCRIPTION

The Thermo Chem Superfund site (the "Site") is located in Egelston Township, Muskegon County, Michigan, approximately five miles east of the City of Muskegon. The Site consists of approximately 9.5 acres of land on the south side of the road at 4331 and 4321 Evanston Road (see Figure 1). The area surrounding the Site is semi-rural and is comprised of residential areas, light manufacturing and commercial buildings, and undeveloped woodland. Black Creek is located approximately 1,500 feet south of the Site. Black Creek flows to Mona Lake, which eventually flows into Lake Michigan.

The nearest population centers to the Site are two mobile home parks located about 1/2 mile west on Evanston Road that have a total of 594 lots. The nearest single-family residence is located immediately adjacent to the west of the Site. This residence is believed to be upgradient from the Site based on local hydrogeology information obtained during investigations at the Site (See Section V below).

Two other Superfund sites are located near the Site. The SCA Independent Landfill Superfund site is located approximately 1,800 feet south of the Site (approximately 300 feet south of Black Creek), and the Bofors Nobel Superfund site is located approximately 1.25 miles east of the Site.

The Site consists of two properties which are owned by the Thomas Solvent Co.: the Thomas Solvent Co. property and the Thermo Chem, Inc. property. The Thomas Solvent Co. portion covers approximately 1.5 acres, and is situated in the northwest corner of the Site. The Thermo Chem, Inc. portion of the site covers approximately 8 acres (see Figure 2).

The Site is located in the Glacial Lake Plain physiographic unit. The Site is nearly level from north to south with an average elevation of approximately 655 feet above sea level. The changes in physical features across the Site are the result of clearing and construction activities. There is no natural surface drainage on the Site because of the nearly level land surface and the ability of the sandy soils to allow water to seep through them. Surface soil consists primarily of medium- to fine-grained sand. The only substantial surface water body in the area is Black Creek. The Black Creek forms a broad and flat wetland with standing timber. There is no designated Michigan State Significant Habitat, or historic landmark site directly or potentially affected. There are no endangered species in close proximity to the Site. Some of the areas around Black Creek lie within the 100-year floodplain area. There is a wetland located south of the Site around the Black Creek area. Black Creek is designated as a trout stream by the State of Michigan.

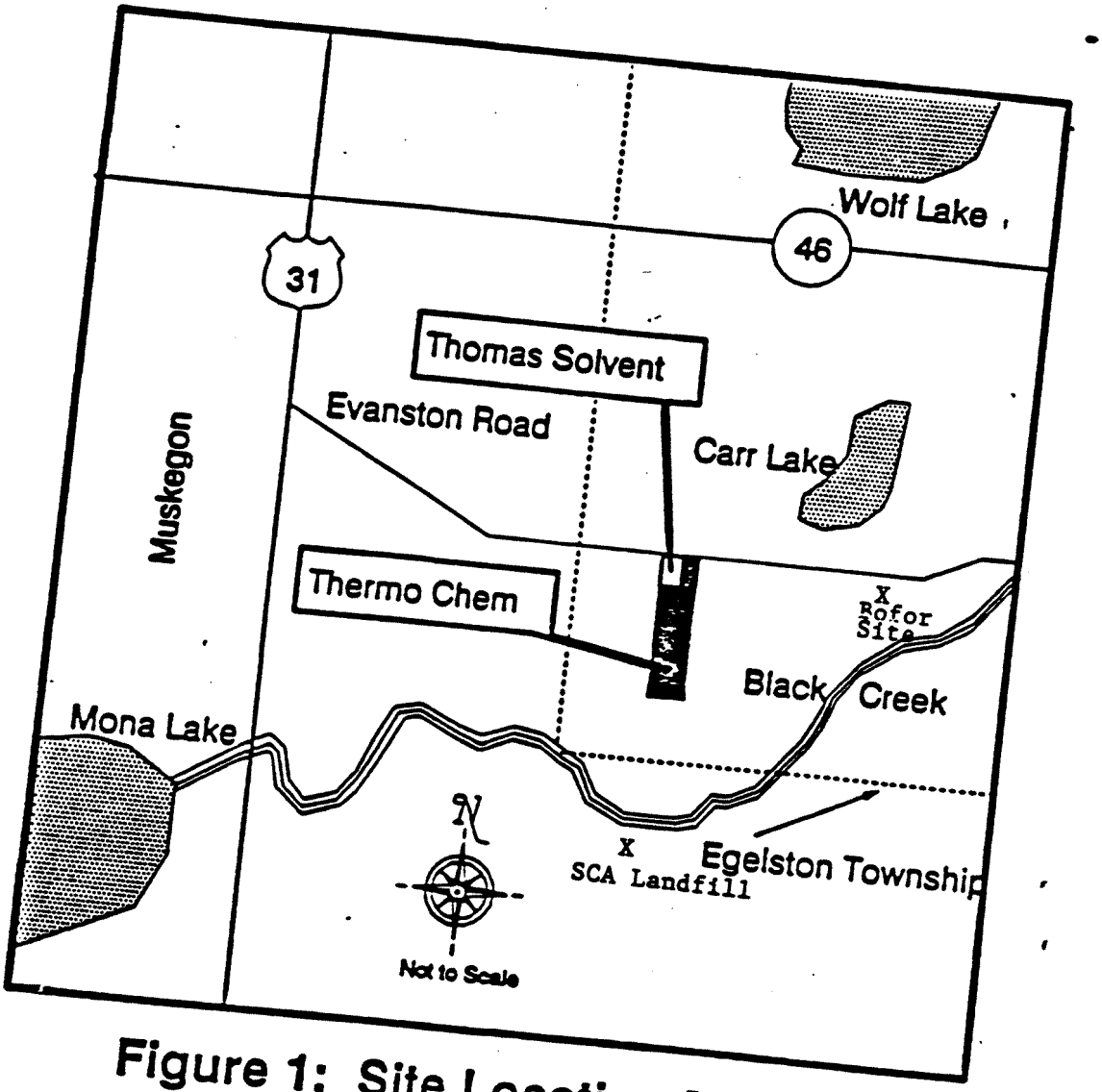
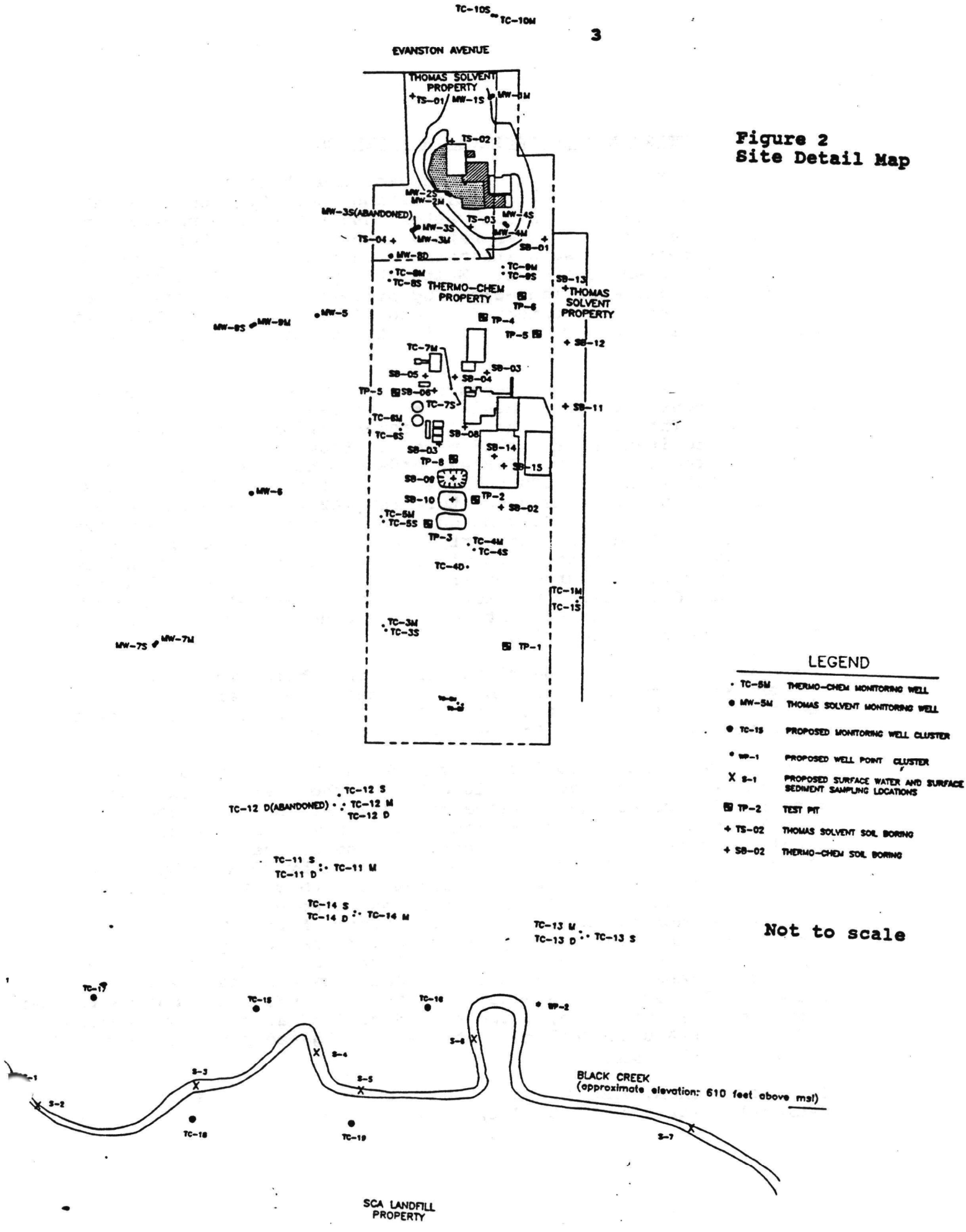


Figure 1: Site Location Map

Figure 2
Site Detail Map



II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Thermo Chem, Inc. operated as a solvent and chemical waste reprocessing, refining, and incineration facility from 1969 until August 1980. Solvents, paint wastes, and antifreeze received at the Site were distilled to regenerate usable solvents. Unrecoverable materials reportedly were incinerated on site, as were by-products such as sludge and residues. Wastewater generated from the distillation and equipment-cleaning process was discharged into a series of three interconnected lagoons (see Figure 2). The northern-most lagoon is lined with clay while the other two lagoons are unlined.

The Thomas Solvent Co. operated from 1961 to October 1986 as a licensed industrial waste hauler, and hauled hazardous waste to its subsidiary, Thermo Chem, Inc., for regeneration. The Thomas Solvent Co. also acquired the recycled material from Thermo Chem, Inc. to return to the customers. Sixteen underground storage tanks with a capacity totalling 104,000 gallons were located on the Thomas Solvent Co. property and were used to store raw materials and these recycled materials. The Thomas Solvent Co. hauled over 200 different chemicals to the Thermo Chem, Inc. property, which is also owned by Thomas Solvent Co. Some of these chemicals are designated as hazardous waste according to the Resource Conservation and Recovery Act (RCRA) (40 C 261 Subpart C and D). At least 3,500 drums were stored on the Therm Chem, Inc. and Thomas Solvent Co. properties during the time the two companies were in operation.

There were no physical barriers separating these two adjacent properties whose ownership and operations were intertwined, and materials processed at the Thermo Chem, Inc. property were sometimes deposited at the Thomas Solvent Co. property.

A soil investigation conducted by Michigan Department of Natural Resources (MDNR) on December 10, 1984 at the Thermo Chem, Inc. property indicated the presence of: 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, 4,4' DDT, 1,2-dichloroethene, 1,2-dichloroethane, toluene, ethylbenzene, and xylenes. An investigation at the Thomas Solvent Co. portion conducted by MDNR on April 30, 1985 indicated that the soil was contaminated with most of these contaminants as well. Similar compounds also were detected in the groundwater during the 1985 investigation. Former Thomas Solvent Co. and Thermo Chem, Inc. employees indicated that sludge occasionally was buried on the properties and chemical spills frequently occurred at the Site. Based on the historical documents and statements from former employees, it was determined that F001-F005 solvent wastes were disposed of at the Site, which are identified as hazardous wastes under U.S. EPA's federal regulations promulgated pursuant to the RCRA, 42 U.S.C. 6901, et seq.

The Thermo Chem, Inc. property was proposed for inclusion on the National Priorities List (NPL) in October of 1984. The Site was

placed on the NPL in June 1986. A Consent Order was signed by U.S. EPA and parties identified by U.S. EPA as being potentially responsible for the contamination problems at the Site, called Potentially Responsible Parties, (PRPs). In the Consent Order (U.S. EPA Docket No. VW 87-C-022, dated September 21, 1987), the PRPs agreed to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the Thermo Chem, Inc. property to determine the nature and extent of contamination problems at the property, and identify methods to correct these problems. The PRPs began investigative activities at the Site in April 1989.

The Consent Order provided that the Respondents would not be required to conduct a RI/FS at the adjacent Thomas Solvent Co. property. However, during the RI/FS at the Thermo Chem, Inc. portion of the Site, it was discovered that contamination was coming from the Thomas Solvent Co. property. Therefore, U.S. EPA conducted a study, called a Technical Assistance Study, to determine the nature and extent of contamination on the Thomas Solvent Co. property. U.S. EPA's investigation of contamination at the Thomas Solvent Co. property was completed in August 1990, and the final report of U.S. EPA's conclusions was completed in March 1991. The results of the investigation at the Thomas Solvent Co. property and the Thermo Chem, Inc. property indicated that the contamination releases at Thomas Solvent Co. appear to be one source of the groundwater contamination identified in the Thermo Chem site NPL listing. Accordingly, the Thermo Chem Site includes both the Thomas Solvent Co. property and the Thermo Chem, Inc. property.

The Remedial Investigation indicates that groundwater flows south-southwest toward Black Creek. During the RI at the Thermo Chem, Inc. property, high levels of contaminants were found in a well near the Thomas Solvent Co. property upgradient of the Thermo Chem, Inc. property process areas. This well contained contaminants found at the Thomas Solvent Co. property. These contaminants were not found in wells upgradient of Thomas Solvent Co. The soil and groundwater data collected from both Thomas Solvent Co. and the Thermo Chem, Inc. properties show that most of the constituents found at the Thermo Chem, Inc. property were also found at the Thomas Solvent Co. property. For example, bis(2-ethylhexyl)phthalate was found in the clay-lined lagoon of the Thermo Chem, Inc. property at a level of 140 parts per million (ppm) and in the soil of the Thomas Solvent Co. property at a level of 160 ppm. Based on the groundwater flow system and groundwater data collected, U.S. EPA believes the contaminants from the Thomas Solvent Co. property are moving toward the Thermo Chem, Inc. property, contaminating the shallow and deep aquifer of the northern portion of the Thermo Chem, Inc. property. This contamination plume then mingles with the contamination plume from the central processing area at the Thermo Chem, Inc. property. Contaminated soil at the Thomas Solvent Co. property also contributes to the groundwater contamination. The Thomas Solvent property, then, is an additional source of the releases which were identified as part of the original NPL listing. The scope of the contamination listed as

the Thermo Chem, Inc. site on the NPL includes both the Thomas Solvent Co. property and the Thermo Chem, Inc. property.

Concurrent with investigation activities at the Thermo Chem, Inc. and Thomas Solvent Co. properties, an emergency removal of drums and materials containing hazardous waste was conducted by U.S. EPA at the Thermo Chem, Inc. property from September 1988 until December 1988. The removal action was taken to reduce the threats posed to public health by the presence of the uncontained chemicals and drums at the Site. The chemicals were stored in the laboratory building, and the drums were found in buildings throughout the site. Buildings at the site were unsecured. U.S. EPA transported the chemicals off site for incineration. Four drums containing hazardous waste solids and one drum containing hazardous waste liquid were transported off site for treatment and disposal. U.S. EPA also sampled the insulation materials from buildings and tanks for the presence of asbestos material. Results indicated that the insulation material did not contain asbestos.

U.S. EPA has separated the study of contamination at the Thermo Chem Superfund site into two separate areas, called operable units. Operable Unit I, which is the subject of this Record of Decision, focuses on contaminated soil, sludge and groundwater at the site, up to the point where groundwater discharges into Black Creek. Operable Unit II will address contamination problems in Black Creek, i.e., surface water, sediment, plants and living organisms, and groundwater south of Black Creek. The Operable Unit approach was agreed upon after discussions between U.S. EPA and MDNR during the RI. This ROD is being developed for Operable Unit I.

The final RI Report for Operable Unit I was completed in May 1991, and U.S. EPA anticipates finalizing the report on Operable Unit II in April 1992. Simultaneously, U.S. EPA began developing and screening alternatives for addressing contamination problems found in Operable Unit I. A document called the Alternatives Array was prepared in January 1991, which provided a preliminary description of the technical methods under consideration for cleaning up Operable Unit I. Based on the evaluation and screening of technical methods in the Alternatives Array, a draft Feasibility Study Report was prepared in May and finalized in July 1991. The Feasibility Study Report for Operable Unit I outlines the final alternatives under consideration for correcting contamination problems found at Operable Unit I, and provides a thorough evaluation of each.

U.S. EPA asked the PRPs to conduct additional field work to define groundwater contamination problems around Black Creek and the impact of the contamination on the Creek. The field work includes installing approximately 10 monitoring wells north of Black Creek, 6 monitoring wells south of Black Creek, and collecting seven sediment and surface water samples from Black Creek. The field work for these additional activities was initiated in July 1991.

U.S. EPA also conducted emergency removal activities in April 1991. During the investigation at the Thomas Solvent property, pure solvent was discovered in monitoring well #3 which is located approximately 100 feet downgradient of the underground storage tank farm area at the Thomas Solvent Property (See Figure 4). U.S. EPA inspected these underground storage tanks and found that some contained residual solvents and had venting pipes which could not be secured. U.S. EPA determined that these tanks could pose an imminent and substantial endangerment to public health or welfare or environment because of the potential for explosion and threat of release from the tanks. The 16 underground storage tanks on the Thomas Solvent Co. property and their contents were removed and taken off site for disposal by U.S. EPA.

III. COMMUNITY RELATIONS ACTIVITIES

Upon the signing of the Consent Order in September 1987, U.S. EPA held a 30-day public comment period. A press release was sent to all media and advertisements were placed.

A fact sheet was developed in June 1988 to announce and explain the RI process.

A Community Relations Plan was prepared for the Site in July 1989. This plan lists contacts and interested parties throughout the local and government community. It also establishes communication pathways to ensure timely dissemination of pertinent information.

A public meeting was held on April 18, 1991 to explain the results of the Remedial Investigation and the plan to remove the underground storage tanks at Thomas Solvent Co. property. A fact sheet was developed in conjunction with this meeting. Advertisement were placed to announce the meeting and a press release was sent to all local media.

The RI/FS Reports and Proposed Plan for Operable Unit I at the Site were released to the public in July 1991. All of these documents were made available in the information repository maintained at the Egelston Township Branch of Muskegon County Library. An administrative record file containing these documents and other site-related documents was placed at the same repository. The notice of availability of these documents was published in the Muskegon Chronicle on July 8, 1991. Press releases were also sent to all local media. A public comment period was held from July 11, 1991 to August 9, 1991. At the request of the Thermo Chem PRP group, the public comment period was extended until September 9, 1991. In addition, a public meeting was held on July 16, 1991 to present the results of the RI/FS and the preferred alternative as presented in the Proposed Plan for the Site. All comments which were expressed verbally at the public meeting are addressed in the Responsiveness Summary of this ROD.

IV. SCOPE AND ROLE OF OPERABLE UNIT

As discussed in Section III above, U.S. EPA has divided the Site into two operable units. Operable Unit I, which is the subject of this Record of Decision, will address soil, sludge and groundwater contamination up to the Black Creek; Operable Unit II will address contamination within Black Creek and groundwater contamination South of Black Creek. This operable unit approach will address contamination flowing towards Black Creek while allowing further study of the impact on Black Creek and downgradient groundwater.

U.S. EPA identified contaminated groundwater, soil, and sludge as potential risks to human health and the environment. Contaminated soil at the Site is considered to be the principal threat. To address these risks, U.S. EPA developed the following remedial objectives for Operable Unit I based on the data obtained during the Remedial Investigation:

1) Reduce or minimize direct human and environmental contact with contaminated soil through inhalation and ingestion;

2) Reduce or minimize the release of contaminants in soil and sludge to the groundwater; and

3) Restore groundwater so that contamination levels meet appropriate health standards, and stop the flow of contaminated groundwater to Black Creek.

This ROD was developed to meet these objectives and it addresses the contamination problems identified in Operable Unit I, namely the soil, sludge, and groundwater contamination at the Thermo Chem, Inc. and Thomas Solvent Co. properties, up to the discharge point at Black Creek. This response action is being implemented to protect human health and the environment from risks posed by the contamination problems.

This present response action, by addressing contaminated groundwater, soil, and sludge, is fully compatible with all future Superfund investigation and cleanup work at the Site, including the on-going investigation at Black Creek and in groundwater south of Black Creek. The contamination problems in the Black Creek, including sediment, surface water, biota, and groundwater south of Black Creek, and the risks posed thereby will be evaluated and addressed during Operable Unit II.

V. SITE CHARACTERISTICS

Two principal aquifers were identified during the Remedial Investigation and Technical Assistance Study at the Site. The upper unconsolidated, unconfined aquifer varies in thickness from 20 feet in

the northeast area of the site to 55 feet in the southwest portion of the Site. The groundwater table lies from 17 feet below the ground surface in the northeast to 32 feet below the surface in the southwest. The upper unconsolidated deposits are predominantly medium to fine grained sand. The upper and lower aquifers are separated by a discontinuous layer of clay. The deeper confined/semi-confined aquifer is located beneath the silty-clay layer. It varies in thickness from 61 feet to 116 feet. The deepest penetrated sediments are glacial tills.

Although fluctuations in groundwater levels do occur, groundwater in both the upper and lower aquifers flows in a south-southwest direction throughout the year. The rate of the groundwater flow is between 1.7 - 2.38 feet per day. Based on the hydrogeologic information collected during RI, it is believed that the groundwater from the Site is discharging to Black Creek.

The ground surface of the Site is relatively level, and the surface material consists of sandy soil. Because rainwater flows quickly through sandy soil, the rate of seepage through the soil, called the permeability rate, exceeds 10 inches per hour. Because of this high rate, there is no surface runoff or surface drainage of rainwater at the Site, and rainwater flows directly through the ground surface to the upper aquifer.

The results of a geophysical and soil-gas survey prompted further investigation to determine if any drums containing hazardous materials were buried on the site. Eight pits were dug in search of drums, and sludge was found in the vicinity of test pit #8. Some of the sludge was excavated and stored in drums at the site for later disposal. No drums were found during test pit activities.

Soil contamination at the Site is concentrated primarily in two "hot spots", located in the central processing area of the Thermo Chem, Inc. property: the clay liner in the base of the northern most disposal lagoon on the property; and sludge in the vicinity of test pit #8. However, soil contamination above levels acceptable to U.S. EPA and MDNR health standards also has been found in other locations at the Site. The contaminants causing the most concern are volatile organic compounds. Of the volatile organic compounds detected in these areas, tetrachloroethene, trichloroethene, ethylbenzene, and total xylenes were detected frequently in soil samples (See Table 2). Phthalate compounds were the semi-volatile organic compounds most frequently detected. Inorganic compounds were found in soil samples, including arsenic, chromium, lead, and cyanide. PCB and Pesticides, including heptachlor, dieldrin and 4,4'-DDT, were also found in the soil.

On the Thomas Solvent Co. property, the highest levels of contamination were detected in the area just south of the loading dock and tank farm. Volatile organic compounds detected at this location were similar to those detected at the Thermo Chem, Inc. property.

During the study of the Thomas Solvent Co. property, the U.S. EPA excavated 16 underground storage tanks which were believed to be leaking. However, soil samples collected during the tank removal indicated that the tanks were not presently leaking.

During monitoring well installation, a vertical aquifer sampling technique was performed in order to determine the presence of a contamination plume. The groundwater in the shallow and deep aquifers was sampled at ten foot intervals to the depth of the regional clay till and analyzed for compounds of concern at the Site. The results of this vertical sampling technique were utilized to determine the appropriate depth of screening for each monitoring well.

Groundwater samples collected from shallow and medium-depth monitoring wells on the Site contained elevated levels of volatile organic compounds. The most frequently detected compounds include 1,1,1-trichloroethane, toluene, xylenes, benzene, and ethylbenzene. Of the semi-volatile organic compounds detected, phthalate compounds were the most frequently detected. Inorganic compounds such as arsenic and cyanide were also found in the groundwater. Those contaminants detected the most frequently at the site also were the contaminants detected at the highest levels (see Table 3). The deep aquifer also is contaminated with low-to-medium levels of contamination.

Table 2 identifies the maximum concentrations of contaminants in soil, sludges and the lagoon clay-liner. Table 3 identifies the average and maximum concentrations of contaminants in groundwater. Many contaminants including benzene, trichloroethene, and arsenic are known or suspected human carcinogens.

Contaminants were detected in monitoring wells downgradient of the Site, 200 feet north of Black Creek. Based on this information, U.S. EPA believes that contaminated groundwater has reached the discharge point of Black Creek. U.S. EPA currently is conducting further studies to determine whether the contamination has, in fact, reached Black Creek.

U.S. EPA determined that groundwater contamination detected both beneath and downgradient from the Site is a result of contamination sources at the Thermo Chem, Inc. and Thomas Solvent Co. properties. Operations at the two properties have contaminated the groundwater in the shallow and deep aquifers. Suspected sources of contamination include the three inter-connected lagoons located in the central processing area and sludges disposed at the Thermo Chem, Inc. property, the underground storage tanks at the Thomas Solvent Co. property, and spills throughout the site.

A single-family residence located immediately adjacent to the west of the Site has been sampled annually since 1986 by MDNR. No contamination has been detected at this well.

Based on the levels and type of contaminants found during the Remedial Investigation and the Technical Assistance Study, and site operations, U.S. EPA divided the contaminated soils into four areas. During the Feasibility Study, methods for addressing soil contamination problems focused on these four areas:

Group 1 Soils: Soils and sludge in the: a) Clay-lined disposal lagoon; b) Areas around test pit #1 and #8; and c) Areas around soil borings #3, 4, 5, 9, 10, 13, and Monitoring well #7 (see Figure 2 and 3). It is estimated that the total volume of Group 1 soils is approximately 1,800 cubic yards.

Group 2 Soils: Soils in the area around soil boring #3 of the Thomas Solvent Co. property, extending from the ground surface to the water table (see Figure 2 and 4). The estimated volume of Group 2 soils is approximately 200 cubic yards.

Group 3 Soils: Soils in the area of the Thermo Chem, Inc. central processing operations. The estimated area of Group 3 soils is 60,000 square feet.

Group 4 Soils: Soils near the operations area of the Thomas Solvent Co. property. The surface area covered by Group 4 Soils is approximately 60,000 square feet.

Group 1 soils are "hot spots" located and included within the area referred to as Group 3 soils; and Group 2 soils is a "hot spot" located and included within the area referred to as group 4 soils.

More detailed information regarding the results of the Remedial Investigation are contained in a Remedial Investigation Report.

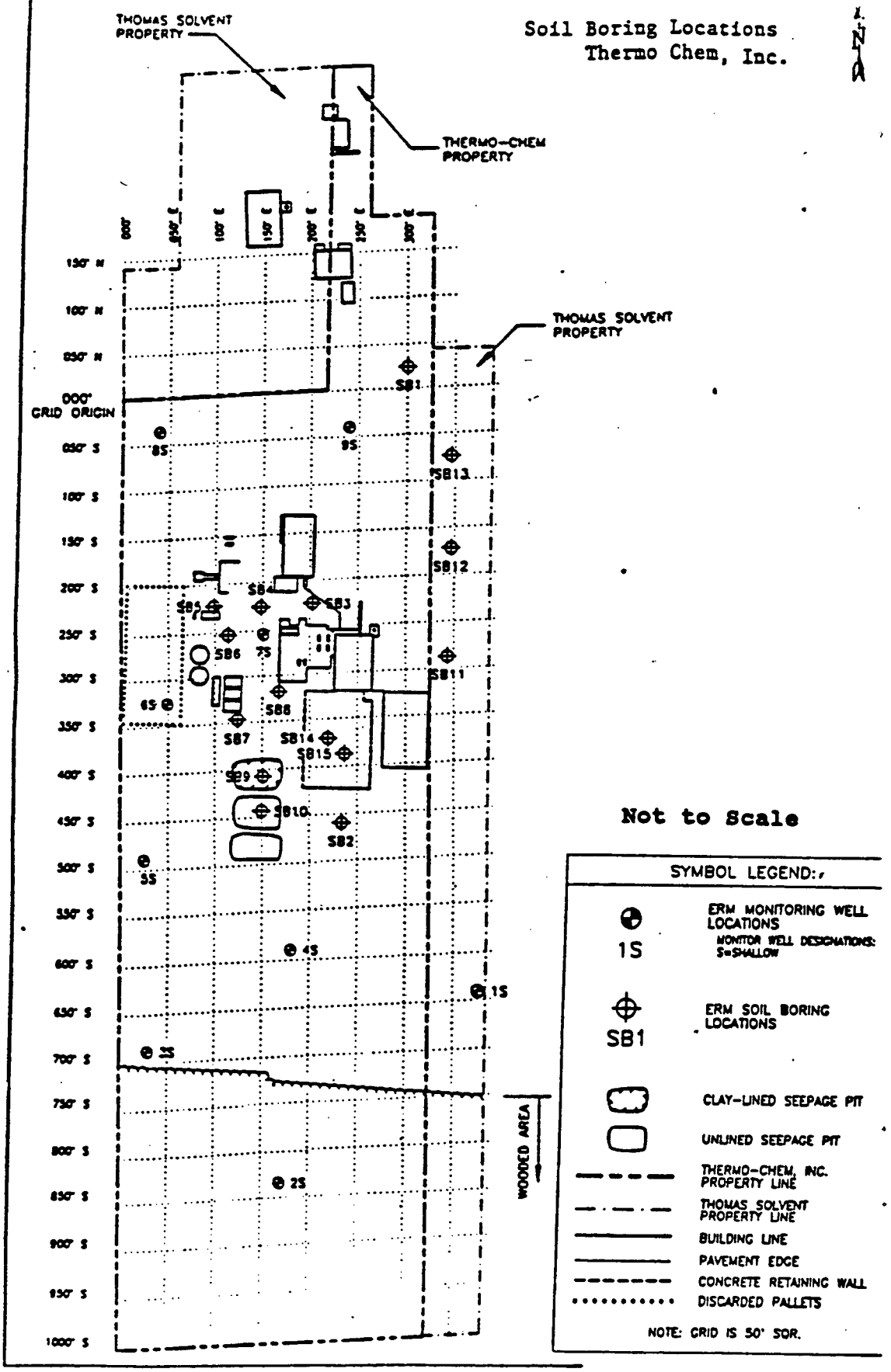
VI. SUMMARY OF SITE RISKS

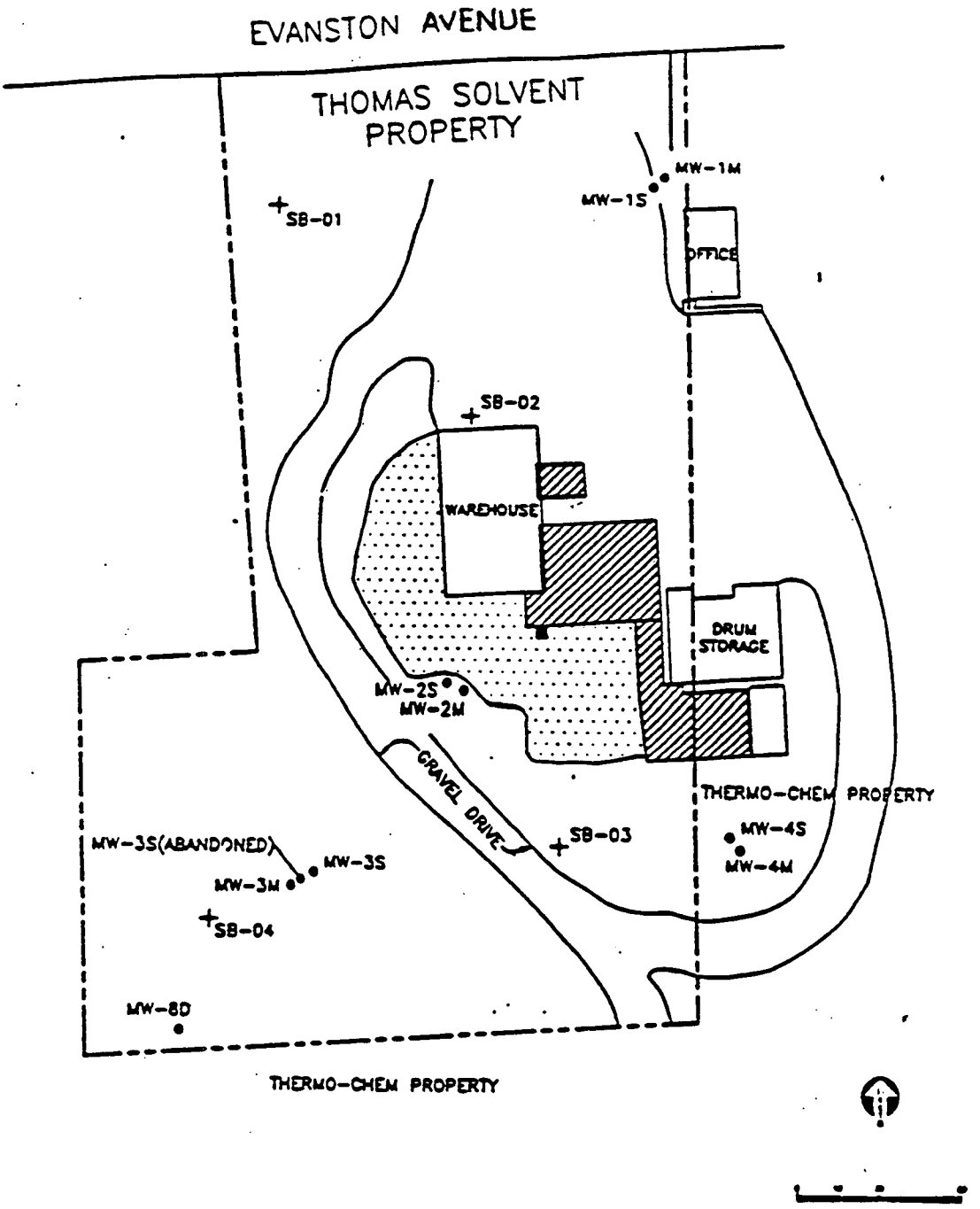
After U.S. EPA analyzed the data from the RI, a risk assessment was performed to evaluate potential effects of the contamination at Operable Unit I of the Site on human health and the environment. The existence of and risks posed by Black Creek contamination will be assessed in Operable Unit II.

The risk assessment focused on ways in which nearby residents and animals could be exposed to contaminated materials both currently and in the future. A risk assessment consists of four primary parts: identifying chemicals of concern; assessing pathways through which humans, plants, and animals could be exposed to contamination; assessing the toxicity of the contaminants; and characterizing cancerous and non-cancerous health effects on humans.

Figure 3

Soil Boring Locations
Thermo Chem, Inc.





LEGEND

●	MONITORING WELL
+	THOMAS SOLVENT SOIL BORING
	TANK FARM
	CONCRETE LOADING DOCK AND PAD

NOTE: THE LOCATION OF MW-4S AND MW-4M IS APPROXIMATE.

Figure 4

Soil Boring Locations
Thomas Solvent, Co.

a. Human Health Risks

1. Contaminant Identification

In order to evaluate potential risks posed to human health and the environment, U.S. EPA determines which chemicals were detected the most frequently; which are the most toxic;, which are the most likely to migrate off the Site; and which are the most likely to remain in the environment without breaking down into less harmful compounds. Based on these criteria, U.S. EPA identified a list of chemicals of concern for the Site (see list below and Table 2 and 3). This risk assessment focuses on health and environmental effects resulting from exposure to these chemicals.

1,1-Dichloroethene	Toluene
Total 1,2-Dichloroethene	Total xylenes
Chloroform	bis(2-Ethylhexyl)phthalate
1,2 Dichloroethane	Napthalene
1,1,1-Trichloroethane	Arsenic
Trichloroethene	Chromium
Benzene	
Tetrachloroethene	

These contaminants were detected in both groundwater and soils at the site. The maximum concentrations of contaminants in soil, sludges and the lagoon clay-liner at the site are listed in Table 2. Table 3 identifies the average and maximum concentrations of contaminants in groundwater.

2. Exposure Assessment

The exposure assessment identifies the pathways through which people or wildlife could come into contact with site-related contamination -- both currently and in the future. At the Site, U.S. EPA determined that currently, trespassers who walk on the Site to hunt or hike might come into contact with contaminants by accidentally swallowing soil, inhaling dust blowing around the Site, or inhaling chemical vapors evaporating from the soil. U.S. EPA based its evaluation on the assumption that a hiker or hunter would trespass on the Site 90 days per year and would remain on the Site for 10 hours per visit over a period of 30 years.

Currently, there are no residential wells downgradient of the Site. Therefore, U.S. EPA has concluded that local residents are not presently at risk from exposure to contaminated groundwater.

U.S. EPA evaluated potential future risks to people if a residential neighborhood were developed on the Site. U.S. EPA assumed that the site would be vegetated and paved in a future

residential development scenario. In addition, U.S. EPA based its evaluation on the assumption that future residents would install groundwater wells to be used for drinking water, cooking, and bathing. Under this scenario, U.S. EPA determined that these future residents might come into contact with site-related contaminants by accidentally swallowing contaminated soil; inhaling chemical vapors evaporating from the soil; drinking groundwater; or coming into direct contact with groundwater while bathing or inhaling vapors while showering. To evaluate potential risks to these future residents, U.S. EPA assumed that groundwater would be used for drinking and bathing 365 days per year and contact with soil would occur 240 days per year (during frost-free days) over a period of 30 years.

The risk assessment utilized a ninety-five percent upper confidence limit of the arithmetic average concentration to calculate the risk posed by each contaminant of concern in the soil. For groundwater, the risk assessment used the maximum concentrations of contaminants of concern.

3. Toxicity Assessment

U.S. EPA evaluates the harmful effects, or toxicity, of a chemical in terms of its potential cancerous and non-cancerous health effects. Research is conducted to determine the toxicity of chemicals, and U.S. EPA uses the results and conclusions of this research in its evaluation of the toxicity of site-related contamination. In the research of a chemical's toxicity, the effects of low levels of chemical exposure on people in the workplace are studied over long periods of time, and test animals are studied in laboratories, where animals are exposed to varying levels of chemicals over different lengths of time.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogen Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

The cancer potency factors for carcinogenic contaminants of concern at the site are as follows:

	Slope Factor $(mg/kg/day)^{-1}$	
	groundwater	soil
1,1-Dichloroethene	1.2	1.2
Chloroform	.081	.081
bis(2-Ethylhexyl)phthalate	.014	.014
1,2-Dichloroethane	.091	.091
Arsenic	2	50
Trichloroethene	.017	.017
Benzene	.029	.029
Tetrachloroethene	.051	.051

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The reference doses for contaminants of concern at the Site that have noncarcinogenic effects are as follows:

	Reference Dose (mg/kg/day)	
	groundwater	soil
Toluene	.2	.2
Total 1,2-Dichloroethene	.02	.02
Total xylenes	.2	.2
Napthalene	.004	.004
1,1,1-Trichloroethane	.09	.09
Chromium III	1	$6X10^{-7}$
1,1-Dichloroethene	.009	.009
Chloroform	.01	.01
bis(2-Ethylhexyl)phthalate	.02	.02
Arsenic	.001	.001
Tetrachloroethene	.01	.01

4. Risk Characterization

A risk assessment evaluates both cancerous and non-cancerous health effects. Cancer risks are evaluated in terms of the increase in the expected number of cancer cases in a community. U.S. EPA considers a cancer risk unacceptable if it might lead to

more than one additional case of cancer for every 10,000 to one million people exposed to the contamination.

Non-cancerous health effects are evaluated in terms of a Hazard Index. The Hazard Index is a formula that reflects the likelihood that exposure to a chemical will promote harmful health effects. A Hazard Index of greater than 1.0 indicates that exposure to contamination is likely to cause harmful non-cancerous effects.

Table 1 identifies carcinogenic and non-carcinogenic risk for total contaminants of concern for each media in each exposure pathways. Risks posed by each contaminant of concern are identified in the Remedial Investigation Report.

(A) Risk to Trespassers

At the Site, U.S. EPA determined that hikers and hunters who accidentally might swallow site soil, inhale blowing dust, or inhale evaporating vapors from the soil might experience an excess cancer risk of two additional cases for every 1,000 people exposed to the contamination. U.S. EPA considers this an unacceptable cancer risk. The Hazard Index associated with such exposure is 500, indicating a strong likelihood that exposure would cause harmful non-cancerous health effects as well. These effects might include nerve damage resulting from exposure to arsenic and central nervous system depression from exposure to tetrachloroethene.

(B) Risk to Possible Future Residents

Using the maximum levels of each contaminant detected in site soils for its calculations, U.S. EPA calculated the excess cancer risk for residents living on the Site if a residential area were developed there in the future. The cancer risk is nine additional cases for every 1,000 people exposed to the contamination in site soils. U.S. EPA considers this an unacceptable cancer risk. U.S. EPA also calculated the Hazard Index for possible future residents as 8.0, indicating that exposure to contaminants would likely produce harmful non-cancerous effects. The risk to possible future residents is lower than the risk to current trespassers because dust emissions would be reduced by the vegetative cover and pavement assumed for the future residential scenario.

U.S. EPA also determined that future residents living on the Site might be exposed to contaminants in groundwater by drinking it, coming into direct contact with it, or inhaling volatile organic compounds evaporating from the water during showering. U.S. EPA determined that this exposure could produce an unacceptable cancer risk of two additional cases for every 10 people exposed. U.S. EPA calculated a Hazard Index of 3,000 for exposure to

groundwater, indicating a strong likelihood that these residents might experience harmful non-cancerous health effects. These health effects would be similar to those produced by exposure to contaminated soil.

b. Risk to the Environment

Because the area south of the Thermo Chem site is heavily wooded, U.S. EPA believes animals may wander onto the property to graze and come into contact with contaminated soil at the site. In addition, contaminated groundwater from the site might discharge into Black Creek. Because some chemicals get stored in the fatty tissues of animals, animals living near the creek may experience harmful effects from the contamination. Moreover, animals or people who eat the affected animals may experience health effects, as well. Therefore, U.S. EPA will conduct an ecological study in the Black Creek area to determine the effect of contamination on living organisms during the Remedial Investigation of Operable Unit II.

The goal of this response action is to reduce risk from groundwater and soil contamination at the locations included in Operable Unit I to acceptable human health standards of 10^{-6} for cancer-causing contaminants and a hazard index of 1.0 for non-cancer causing contaminants, and applicable or relevant and appropriate standards.

Actual or threatened release of hazardous substances from this site, if not addressed by implementing the selected response action, may present an imminent and substantial endangerment to public health, welfare or the environment.

VII. DOCUMENTATION OF SIGNIFICANT CHANGES

After a careful review of the areas and volumes of soil to be addressed at the Site, U.S. EPA now estimates that only 3 acres would be addressed by Alternative 5, and has accordingly recalculated its cost estimate for Alternative 5 to $21,000,000 present net worth. As discussed below, this modification does not alter U.S. EPA's selection of Alternative 3.

VIII. DESCRIPTION OF REMEDIAL ALTERNATIVES

Based on the results of the RI and risk assessment, the PRPs conducted a Feasibility Study to identify and evaluate a variety of alternatives for protecting human health and the environment from the contamination associated with Operable Unit I at the Site. After identifying and screening of potential remedial technologies for the Site, five Alternatives were selected for further evaluation. The selection of these five Alternatives from various remedial technologies were based

on the screening process including the remediation goal, volume of media remediated, and the merit of the technology. Each of the alternatives is evaluated using a set of nine criteria that reflect the goals of the Superfund program and are used by U.S. EPA to compare the merits of each alternative. These criteria are explained in Section IX.

Descriptions of the five alternatives considered by U.S. EPA are provided below, including costs, estimated in terms of capital cost and annual operation and maintenance cost. Together these two dollar amounts are converted to net present worth. U.S. EPA's evaluation of each remedial alternative using the evaluation criteria is summarized in Section IX.

The alternatives considered for Operable Unit I are:

Alternative 1: No Action.

Alternative 2: In-situ vitrification of Group 2 and 3 soils; and Groundwater collection and treatment with discharge to Black Creek.

Alternative 3: Off-site incineration of Group 1 and 2 soils; In-situ vapor extraction of all site soils; and Groundwater collection and treatment with discharge to Black Creek.

Alternative 4: Off-site incineration of Group 1 and 2 soils; In-situ soil flushing and bioremediation of all site soils; and Groundwater collection and treatment with discharge to shallow aquifer.

Alternative 5: Slurry wall around Group 3 and 4 soil areas; Capping Group 3 and 4 soils; and Groundwater collection and treatment with discharge to Black Creek.

All of the alternatives above except Alternative 1 (No Action) contain the following components:

- Decontamination, demolition, and off-site disposal of on-site structures, including the laboratory, process buildings, a warehouse, an incinerator, and all above-ground storage tanks, all underground pipelines, and other structures located at the Site.

- Installation and maintenance of a fence around the site during the implementation of the remedy.

- Restrictions on use of property at the Site during implementation of the remedy, including groundwater

remediation, to the extent necessary to implement and protect the remedy, and to safeguard human health and the environment during implementation of the remedy.

The descriptions of Alternatives 3 and 4 also include cost comparisons of off- and on-site incineration of Group 1 and 2 soils.

A description of each of these alternatives follows:

Alternative 1: No Action

Under this alternative, the Site would be left in its present condition and no action would be taken to reduce the risk of exposure to contamination. U.S. EPA requires consideration of a no-action alternative to serve as a basis against which other remedial alternatives can be compared.

Alternative 2: In-situ vitrification of Group 2 and 3 soils; and Groundwater collection and treatment with discharge to Black Creek.

Under this alternative, Group 2 and 3 soils will be treated using in-situ vitrification. This process involves inserting four electrodes into the ground to form a square around the area of contaminated soil. An electrical current is produced which heats the contaminated soil to a temperature of 3,500 F. At this temperature, the soil melts into a liquid and the contaminants evaporate into gases. The gases are captured in a hood placed over the melting area and then treated with a process called carbon adsorption. This process involves passing the gases over a bed of treated carbon. The carbon then is regenerated or disposed of off site. The soil cools and becomes a solid that resembles glass and is left in place. Clean soil will be placed over it and vegetation will be planted. This treatment will prevent the leaching of soil contaminants into the groundwater.

Groundwater from the shallow and deep aquifers will be extracted and treated to meet Michigan Act 307 Type A or B standards throughout the plume(s) at Operable Unit I. Treatment consists of passing the water through a filter to remove grit and other coarse particles, followed by air stripping. Air stripping involves releasing contaminated groundwater from the top of a tower while air is blown up through the falling water. The blowing air forces the organic chemicals in the water to evaporate. These gases will be treated using carbon adsorption, similar to the process used for the gases produced from the in-situ vitrification of soil. Then the groundwater will pass through the metal precipitation tank to precipitate metals. The treated groundwater will be tested to ensure that its acid (pH) level is acceptable for discharge into Black Creek. If it is not, the groundwater will be treated first to correct the acid content before it is discharged.

For the discharge of off-gas emitted from the vitrification procedure and air striping, the Michigan Air Pollution Act (1965 Public Act 348) is an ARAR. All residue, sludge, spent carbon, or spent coagulant/flocculent shall be treated to meet the Land Disposal Restriction standards for F001-F005 wastes and shall be placed in a RCRA landfill in accordance with the requirement of 40 CFR 268.41. Discharges of treated groundwater to Black Creek will comply with applicable or relevant and appropriate requirements, including Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES) requirements.

Soil and Groundwater will attain Michigan Act 307 Type A or B cleanup standards. (See Tables 2 and 3)

More soil sampling and leachate tests will be required in the Group 4 soil area in order to attain Michigan Act 307 Type A or B cleanup standards. If some of these soils are exceeding the cleanup standards, then these soils will be excavated and consolidated with Group 2 soils for in-situ vitrification.

The volume of soils to be vitrified is approximately 25,000 cubic yards. The capital costs of this alternative is approximately $73,600,000, and annual Operation and Maintenance (O&M) cost is $959,000. The 30-year Present Worth (PW) cost is $82,700,000. The amount of time necessary to implement this alternative would be 17 months for soil and 30 years for groundwater

<u>Alternative 3:</u> Off-site incineration of Group 1 and 2 soils; In-situ vapor extraction of all site soils; and Groundwater collection and treatment with discharge to Black Creek.

Groundwater will be collected and treated by filtration, air stripping, metal precipitation, and pH adjustment as described in Alternative 2.

The Group 1 and 2 soils will be excavated and transported off site to a RCRA licensed incinerator which can accept such waste under the Off-Site Policy. This excavation will remove all soils and sludges in excess of Michigan Act 307 Type A or B Cleanup Standards. Transportation of the excavated soils will be conducted to meet all federal, state and local hazardous waste shipping requirements.

U.S. EPA estimates that 2,000 cubic yards of soil will be excavated in Groups 1 and 2. However, this estimate is based on the ceiling for attainment of direct contact standards for inorganic compounds and PCB/Pesticides. More soil may have to be excavated in order to attain Michigan Act 307 standards if a leaching test is not conducted or fails for remaining soils in groups 1 and 2 contaminated with arsenic, chromium, lead, zinc or cyanide. If all soils contaminated with arsenic, lead, zinc or cyanide fail a leachate test, approximately 370 additional cubic yards would have to be removed. If a leachate test

is not conducted or if the leachate test fails for soils contaminated with chromium, approximately 140 additional cubic yards of soil would have to be removed. Because of the low levels of total chromium, zinc and cyanide at the Site, U.S. EPA is confident that soils at the Site contaminated with chromium, zinc and cyanide will pass a leachate test. If U.S. EPA determines that based on information obtained during the RD/RA, the increase in soil volume constitutes a significant change and requires that the remedy be fundamentally altered with respect to scope, performance or cost, a ROD amendment will be issued. U.S. EPA does not anticipate, however, that this will occur.

After the Group 1 and 2 soils have been removed from the Site, an in-situ vapor extraction system will be installed to treat the remaining site soils to remove the volatile organic compounds to meet Michigan Act 307 Type A or B Cleanup Standards. The ISVE will include extraction wells, and may also utilize injection wells. Alternating rows of injection wells and vacuum withdrawal wells could be installed to ensure that air is distributed evenly through the soil while contaminated vapors are extracted at a rapid rate throughout the system. The gases produced during the in-situ vapor extraction will be burned in an fume-rich incinerator in order to comply with Michig Air Pollution Act (1965 P.A. 348).

During full-scale ISVE implementation, a Treatability Study will be performed to determine the feasibility of enhancing the natural biodegradation of organic compounds. The treatability study would be designed to determine the optimum amounts of nutrients (e.g., moisture, oxygen, nitrogen, and phosphate) to be added to the unsaturated soils to promote biological activity without interfering with ISVE treatment. If the results of the Treatability Study indicate that injecting nutrients is a feasible technology which will enhance the biodegradation of organic compounds, then this technology will be implemented as a component of the ISVE.

The same federal and state regulations (e.g., discharge of gases and treated groundwater) that apply to Alternative 2 also will apply to this alternative. In addition, RCRA requirements are relevant and appropriate at the Site, and applicable to certain remedial activities as discussed in Section XI.

The volume of soils to be excavated is approximately 2,000 cubic yards, and the area to be treated with in-situ vapor extraction is approximately 9.5 acres. The capital costs of this alternative is approximately $15,200,000, and annual O&M cost is $1,091,000. The 30-year PW cost is $24,300,000. The amount of time necessary to implement this alternative would be 43 months for soil and 30 years for groundwater.

If this alternative included on-site incineration (instead of off-site), the costs would be:

Capital Cost: $14 million.
Annual Operation and Maintenance: $1,091,000
Present Net Worth: $23 million.

Alternative 4: Off-site incineration of Group 1 and 2 soils;
In-situ soil flushing and bioremediation of all site soils; and
Groundwater collection and treatment with discharge to shallow aquifer.

Groundwater will be collected and treated by filtration, air stripping, metal precipitation, and pH adjustment as described in Alternative 2. However, under this alternative the treated groundwater would be injected into the shallow aquifer.

This alternative includes off-site incineration of Group 1 and 2 soils as in Alternative 3. After the soils have been removed, the remaining soil will be doused with the treated groundwater in a process called soil flushing. Prior to the soil flushing, the Site will be lined with a gravel layer to provide support for the flushing network and enhance the distribution of the flushing water. The water will be applied to the soil with a pipe distribution system. Recovery wells will be placed along the border of the flushing area to recover the flushing water. Soils will attain Michigan Act 307 Type A or B standards.

In-situ bioremediation will be evaluated as part of this alternative. A Treatability Study will be conducted to determine whether bioremediation will be effective.

The federal and state air emission, soil and groundwater requirements described in Alternative 2 will have to be met. In addition, this alternative must comply with applicable or relevant and appropriate requirements for underground injection. Requirements include Solid Waste Disposal Act requirements and RCRA Land Disposal Restrictions.

The volume of soils to be excavated is approximately 2,000 cubic yards, and the area to be treated with in-situ soil flushing is approximately 9.5 acres. The capital costs of this alternative is approximately $14,800,000, and annual O&M cost is $1,042,000. The 30-year PW cost is $24,000,000. The amount of time necessary to implement this alternative would be 12 years for soil and 30 years for groundwater

If this alternative included on-site incineration, the costs would be:

Capital Cost: $13.2 million.
Annual Operation and Maintenance: $1,091,000
Present Net Worth: $24 million.

Alternative 5: Slurry wall around Group 3 and 4 soils;
Capping Group 3 and 4 soils; and
Groundwater collection and treatment with discharge to Black Creek.

The groundwater collection and treatment activities in this alternative are identical to those included in Alternative 2.

Under this alternative, a slurry wall will be installed around the Group 3 and 4 soils area, which include the Thomas Solvent Co. operating area and the Thermo Chem, Inc. central process area. The trench will be dug to the bottom of the contained area to a depth of approximately 30 feet. The trench will be 3 feet wide. The excavated soil will be used in the backfill for the trench.

Following the installation of the slurry wall, a RCRA multi-layered cap will be installed over the Group 3 and 4 soil areas. The RCRA cap will prevent rainwater from seeping into the soil below. A drainage layer will be installed to direct water away from the capped area, and a vegetative cover will be placed on top of the cap to limit erosion by wind and rain.

This alternative reduces the risk of direct contact with soil and attains Michigan Act 307 groundwater cleanup standards in Operable Unit I. However, it does not attain Michigan Act 307 Type A or B standards for soils.

In addition to the property restrictions described on pages 19-20 above, this Alternative would require a perpetual restriction on residential development, excavation or groundwater use. Michigan Act 307 Rule 299.5719 authorizes such restrictions.

Closure of the Site with a RCRA Subtitle C cap is an ARAR, because RCRA wastes (i.e., F001-F005) were disposed of at the Site.

The area to be trenched and capped is approximately 3 acres. The capital costs of this alternative is approximately $11,200,000, and annual O&M cost is $983,000. The 30-year PW cost is $21,000,000. The amount of time necessary to implement this alternative would be 22 months for soil and 30 years for groundwater

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

A detailed analysis was performed on the five alternatives using the nine evaluating criteria in order to select a 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 as follows:

1) Overall Protection of Human Health and the Environment
An assessment of whether the alternatives can adequately protect human health and the environment, in both the short and long-term, from unacceptable risks posed by hazardous substances, pollutants or contaminants present at the site by eliminating, reducing, or controlling exposure to levels established during development of remediation goals.

2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
An assessment of whether the alternatives attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws or provides grounds for invoking a waiver.

3) Long-Term Effectiveness and Permanence
An assessment of the long-term effectiveness and permanence the alternatives afford, and the degree of certainty they will prove successful. Factors to consider include the magnitude of residual risk remaining from untreated waste or from treatment residuals at the conclusion of the remedial activities, and the adequacy and reliability of controls that are necessary to manage treatment residuals and untreated waste.

4) Reduction of Toxicity, Mobility, or Volume through Treatment
An assessment of the degree to which the alternatives employ treatment that reduces toxicity, mobility or volume, including how treatment is used to address the principal threats posed by the site. Factors considered include the treatment processes employed and materials treated; the amount of hazardous substances, pollutants or contaminants destroyed or treated; the degree of expected reduction in toxicity, mobility, or volume of waste due to treatment and the specifications of which reductions are occurring; the degree to which the treatment is irreversible; the type and quantity of residuals remaining after treatment; and the degree to which treatment reduces the inherent hazards posed by principal threats at the Site.

5) Short-Term Effectiveness
An assessment of the short-term impact of the alternatives considering the following factors: short-term risks posed to the community during implementation; potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; potential environmental impacts and the effectiveness and reliability of mitigative measures during implementation; and time until protection is achieved.

6) Implementability
An assessment of the ease or difficulty of implementing the alternatives by considering the following types of factors: technical feasibility, administrative feasibility, and availability of services and materials.

7) Cost
An assessment of the types of costs involved, including capital costs, annual operation and maintenance cost, and net present value of capital and operation and maintenance costs.

8) State Acceptance
An assessment of state concerns, including the state's position and key concerns and state comments on ARARs and proposed use of waivers.

9) Community Acceptance
An assessment of components of alternatives interested persons in the community support, have reservations about or oppose.

1. Overall Protection of Human Health and the Environment

Alternative 1, No Action, will not provide protection from risks associated with site contaminants. People will be directly exposed to the contaminated soils, and groundwater will continue to degrade due to release from the soil. Therefore, it will not be discussed any further, since it is not protective and thus, not an acceptable alternative.

Alternative 2 through 5 will reduce the migration of contamination from the contaminated soil and minimize the risks associated with direct contact with the soil. Alternatives 2 through 4 provide soil treatment, thus reducing the amount of contaminants available to move into the groundwater.

Alternatives 2 through 5 will provide protection from risks which may be associated with contaminants currently existing in groundwater by collecting and treating the contaminated groundwater.

Alternatives 2 through 4 will bring exposure levels within an acceptable risk range for carcinogens.

2. Compliance with ARARs

Alternatives 2 through 4 will comply with all applicable or relevant and appropriate federal and state environmental standards for Operable Unit I. No waiver would be necessary to implement these alternatives.

For alternative 5, a RCRA Subtitle C multi-layer cap would be installed in order to comply with RCRA cap design standards.

Clean Water Act (CWA) and NPDES requirements are ARARs for alternatives 2, 3 and 5.

The Safe Drinking Water Act, Michigan Act 307, the Michigan Air Pollution Act (1965 Public Act (PA) 348) and RCRA are ARARs for Alternatives 2 through 5.

As discussed in Section XI below, Michigan Act 307 Rules provide that remedial actions shall be protective of human health, safety, the environment and natural resources and specify three cleanup criteria: Type A, B, or C.

Human life cycle safe concentrations, secondary maximum contaminant level, 10^{-6} cancer risk numbers and background were used to determine the cleanup levels for the Act 307 Type A/B cleanup. MCLs and non-zero MCLGs are considered relevant and appropriate to the remedial action at the Site because the aquifers may be used for drinking water purposes.

U.S. EPA selected a Type A/B cleanup given the potential residential use of the Site; its amenability to a clean closure; the potential for groundwater discharge to Black Creek; the isolated nature of the areas of high contamination in soils; the expectation of restoring groundwater to beneficial uses; the increased permanence, reliability and long-term certainty of protection of human health and the environment; the increased reduction of the volume of hazardous substances remaining on site; the presence of multiple contaminants and multiple pathways of exposure; and the State's strong preference for a Type A/B cleanup. Given the presence of multiple contaminants and multiple pathways of exposure, U.S. EPA has chosen a 10^{-6} risk level for carcinogens as the point of departure for determining remediation goals consistent with the NCP.

The Land Disposal Restriction of RCRA contained at 40 CFR Part 268 are ARARs for alternatives 2 through 5. The sludges, ashes, residues, spent carbon, or spent coagulant/flocculent shall be treated in order to meet LDR standards for F001-F005 wastes and disposed of at RCRA landfill.

RCRA is relevant and appropriate at the Site and is applicable to remedial activities undertaken in alternatives 2-5.

Toxic Substances Control Act ("TSCA") is not an ARAR for this site because the maximum level of PCB detected at the Site was 1.3 ppm, which is less than 50 ppm.

The full listing of ARARs for the Site is contained in the FS. See Section XI for a more detailed discussion of ARARs.

3. <u>Long-Term Effectiveness and Permanence</u>

Alternatives 2 through 5 all provide a high degree of long-term effectiveness and permanence with regard to groundwater at the Site by collecting and treating contaminated groundwater and assuring that contaminated groundwater does not impact the Black Creek. Alternatives 2 through 4 also provide a high degree of long-term effectiveness and permanence with regard to soils at the site by excavating and treating contaminated soils.

Alternatives 2 through 5 include institutional controls which would restrict use of property on the Site during implementation of the remedy to the extent necessary to implement and protect the remedy, and to safeguard human health and the environment during implementation of the remedy. In addition, Alternative 5 require perpetual prohibitions on residential use, groundwater use and excavation.

Alternatives 2 through 4 will all result in a low magnitude residual risk once treatment is completed. Each may leave some treated residual soil contamination but at levels which would still be protective of human health and the environment.

Alternative 5 will reduce the chance of direct contact and migration of contaminants into groundwater as long as the cap and slurry wall are maintained. Because contaminants are left in place, it leaves a moderate long-term impact on human health and the environment. The soil will not be treated. A five-year review will be required for Alternative 5. Reliance on maintenace and monitoring creates uncertainties as to the long-term effectiveness of the remedy. If this cap and slurry wall deteriorate, the soils will become a source of groundwater contamination.

4. <u>Reduction of Toxicity, Mobility, or Volume through Treatment</u>

Alternatives 2 through 4 involve treatment of the principal threat, the contaminated soil, to Michigan Act 307 Type A or B health-based standards. Alternative 2 treats soil groups 3 and 4. Alternatives 3 and 4 excavate soil groups 1 and 2 for off-site incineration; and treat the rest of soil groups 3 and 4. Alternative 2 (in-situ vitrification) thermally destroys the organic compounds and encapsulates the inorganic compounds resulting in reduction of mobility, toxicity or volume. The incineration component of Alternatives 3 and 4 destroys organic and PCB/Pesticide compounds and isolates inorganic compounds for off-site disposal. Soil flushing and in-situ vapor extraction are utilized in Alternatives 4 and 3, respectively, to transfer organic contamination from soil to water or air, where the contaminants are removed using carbon or burned in a fume-rich incinerator. Assuming the carbon is thermally treated prior to land disposal or regenerated, these technologies also reduce toxicity, mobility or volume through treatment. Biological treatment breaks down the contaminants into less toxic compounds. The soil component of Alternative 5 does not involve treatment and therefore does not reduce the contaminant's mobility, toxicity, or volume.

Alternatives 2 through 5 pump and treat the groundwater at Operable Unit I to Michigan Act 307 standards throughout the plume(s) at this Operable Unit.

5. Short-Term Effectiveness

Alternatives 2 through 5 include access and zoning restrictions and would utilize equipment to control the amount of dust produced during remedial activities.

Alternative 2 also would provide protection from exposure to the waste during implementation because treatment would be in-situ and excavation is minimized; however, air emissions produced during implementation of this Alternative would pose short-term risks to on-site workers and nearby residents. Direct contact and exposure to contaminated soils may occur in Alternatives 3 and 4 during excavation of Group 1 and 2 soils.

Alternative 4 would take the longest to implement and Alternatives 2 and 5 would take the least amount of time.

6. Implementability

The technical and administrative difficulty of Alternative 2 is uncertain because in-situ vitrification has not been applied fully at any Superfund site.

Alternatives 3 through 5 would be relatively easy to implement from a technical standpoint because the components of each of these alternatives have been used at other Superfund sites. Without modification, the soil flushing and bioremediation activities included in Alternative 4 make this alternative slightly more difficult to implement because these activities can be performed during non-winter months only. Alternative 4 would take twelve years to address the risks posed by soils at Operable Unit I; Alternatives 2, 3 and 5 will take less than 4 years. In addition, because bioremediation is a relatively new technology, U.S. EPA would need to perform treatability studies before implementing this technique at the Thermo Chem site to ensure its effectiveness. From an administrative standpoint, Alternatives 3 and 4 would be more difficult to implement than the other alternatives if on-site incineration were chosen over off-site incineration. On-site incineration would require compliance with substantive Incinerator construction and operation requirements contained at 40 CFR Part 264 Subpart O which could delay the cleanup.

7. Cost

Alternative 2 ($82.7 million) has the highest present net worth cost. Alternatives 3 and 4 have comparable cost. Alternative 5 is the least expensive of the Alternatives which address the contamination at Operable Unit I. There is no major cost difference for on-site and off-site incineration.

8. State Acceptance

The State of Michigan concurs with the selected remedy. The State also concurs with the analysis of ARARs with the exception of the omission of WRC Act, MCL 323.6(a) (Act 245) and associated Part 22 Administrative Rules. U.S. EPA disagrees with the State's position that MCL 323.6(a) is an ARAR at this Site. This issue is the subject of litigation in U.S. v Akzo Coatings of America, appellate case numbers 89-2902 and 80-2137, and may be reassessed after a decision has been rendered. The State has indicated in its concurrence letter that the selected remedial action will provide for attainment of all ARARs and will comply with Part 22.

9. Community Acceptance

The specific comments received and U.S. EPA's responses are outlined in the attached Responsiveness Summary.

X. THE SELECTED REMEDY

As provided in CERCLA and the NCP, and based upon the evaluation of the RI/FS and the nine criteria, the U.S. EPA, in consultation with the MDNR, has selected Alternative 3 as the Operable Unit I remedial action at the Thermo Chem Site.

The major components of Alternative 3 include the following:

* Decontamination, demolition, and off-site disposal of all on-site buildings, including the laboratory, process buildings, a warehouse, an incinerator, and all above-ground storage tanks. When this is accomplished, soil samples from these areas will be collected and analyzed.

* Excavation and off-site incineration of Group 1 and 2 soils above Michigan Act 307 Type A or B standards. Group 1 soils include soil and sludge in the clay-lined disposal lagoon, test pit #1 and #8, and soil borings #3, 4, 5, 9, 10, 13, and monitoring well #7. Group 2 soils include soils in the area around soil boring #3 at the Thomas Solvent Co. property. The estimated volume of soils of Group 1 and 2 soils is approximately 2,000 cubic yards. Transportation of the excavated soils will be conducted to meet all federal, state and local hazardous waste shipping requirements. The ash or residue produced from off-site incineration will be treated to meet Land Disposal Restrictions and placed in a RCRA landfill.

* In-situ vapor extraction for all site soils to meet Michigan Act 307 Type A or B standards. Prior to the full-scale implementation of in-situ vapor extraction, a pilot-scale test may be conducted at the site to determine the number of extraction and injection wells necessary, the spacing between

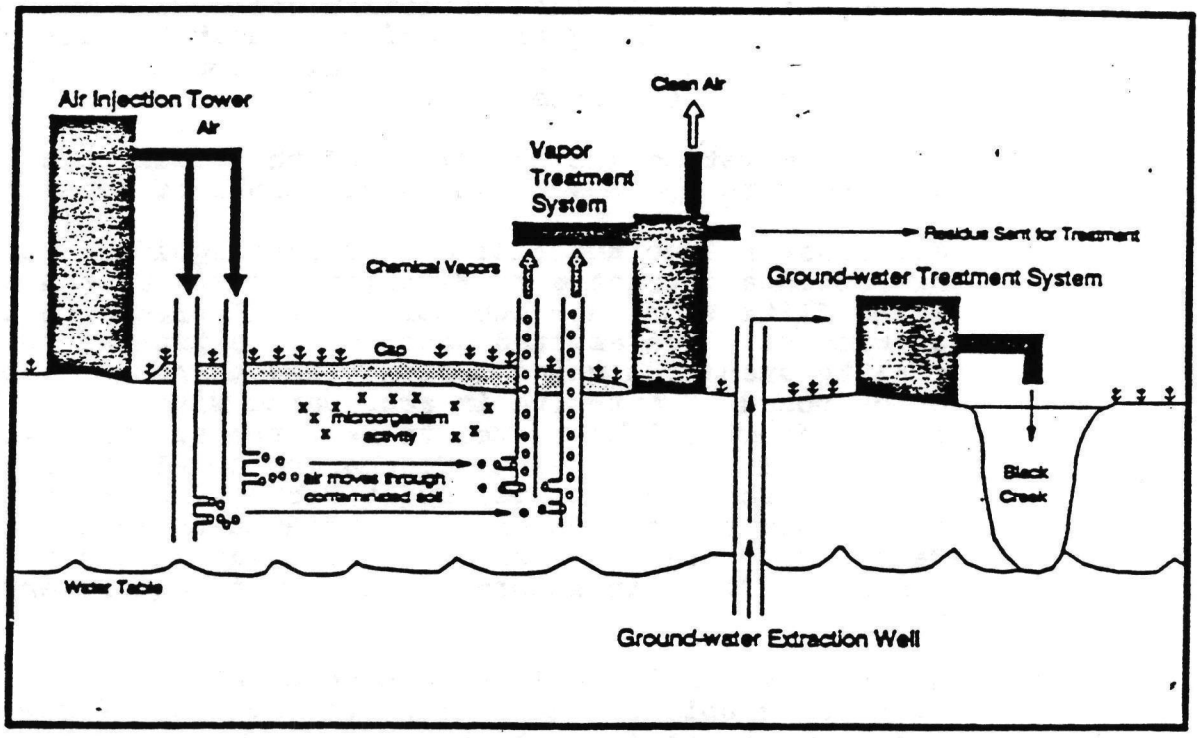


Figure 5
Selected Remedy

wells, and pumping rate necessary to achieve maximum removal of the volatile organic compounds. (See figure 5)

While the vapor extraction system is operating, a Treatability Study will be performed to determine the appropriate amount of nutrients (e.g., moisture, oxygen, nitrogen, and phosphate) that would need to be added to the site soil in order to enhance the natural breakdown of organic compounds. If U.S. EPA determines the treatment could be implemented easily and effectively, it will be included as part of the remedy.
Gases emitted from the extraction wells will be treated using a fume-rich incinerator in order to meet the air quality standards of the state. The liquid from the vapor extraction process will be treated at the Site.

After completing the treatment of the soils, the site will be covered with clean soil and vegetation, if necessary.

* Groundwater from the shallow and deep aquifers will be extracted and treated to Michigan Act 307 Type A or B standards using filtration, air stripping, metal precipitation, and pH adjustment. The emitted gases will be treated to meet State air quality standards using carbon. The carbon will be regenerated or disposed of off-site in accordance with LDRs. The treated groundwater will be tested to meet the substantive requirements under NPDES before being discharged to Black Creek. (See figure 5) All residue, sludge, spent carbons, or spent coagulants/flocculent shall be treated to meet the Land Disposal Restriction standards for F001-F005 wastes and shall be placed in a RCRA landfill in accordance with the requirement of 40 CFR 268.41.

* Additional studies will be conducted at the site to determine background soil concentration, the ability of some contaminants to leach to the groundwater, and the existence of other contaminated soil. Based on the results of these additional studies, more excavation and/or treatment may be necessary to meet Michigan Act 307 Type A or B standards.

* Institutional controls will be implemented to restrict future development of the site to the extent necessary to implement and protect the remedy, and to safeguard human health and the environment during implementation of the remedy. These include Land Use restrictions and construction of a fence around the boundary of the site.

At the completion of this remedial action, Michigan Act 307 Type A or B Standards will be attained for groundwater throughout the groundwater plume at Operable Unit I, and for soils at Operable Unit I.

Estimated Costs for Implementing the Selected Remedy are as follows:

Capital Costs:

Treatment Component		Estimated Cost
1) Excavation and Off-site Incineration of Group 1 & 2 soils	2,000 cubic yards	$ 7,200,000
2) ISVE	9.5 acres	$ 820,000
3) Groundwater Collection, Treatment and Discharge to Black Creek		$ 6,500,000
Annual Operation and Maintenance Cost		$ 1,091,000
Total Costs (Present Net Worth)		$24,000,000

XI. STATUTORY DETERMINATIONS

The selected remedy must satisfy the requirements of Section 121 (a)-(e) of CERCLA, as amended by SARA, to:

a. Protect human health and the environment;
b. Comply with ARARs (or justify a waiver);
c. Be cost effective;
d. Utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable; and,
e. Satisfy the preference for treatment as a principal element or provide an explanation as to why this preference is not satisfied.

The implementation of Alternative 3 at the Site satisfies the requirements of CERCLA, as amended by SARA, as detailed below:

a. Protection of Human Health and the Environment

This selected remedy will provide adequate protection of human health and the environment through treatment.

Risk posed by soil and groundwater contamination at Operable Unit I will be reduced and controlled by the groundwater extraction and treatment system and the ISVE system of the selected remedy.

In addition, hot spots at Operable Unit I containing Inorganic and PCB/Pesticide contamination will be excavated and treated at an off-site incinerator. The selected remedy will attain Michigan Act 307 Type A or B Standards for contaminants in the soil and groundwater.

No unacceptable short-term risks will be caused by implementation of the remedy. Standard safety programs, such as fencing, use of protective equipment, monitoring, off-gas treatment, and dust control measures, should mitigate any short-term risks. Short term risks include exposure of site workers and the community to volatile organic compounds in the soils and air, and to dust and noise nuisance during implementation of the groundwater and soil remedies. ISVE should not present short-term risks due to VOC emission if properly designed and monitored.

b. Compliance with ARARs

The selected Remedial Action for Operable Unit I at the Thermo Chem Site will comply with all Federal and more stringent State Applicable or Relevant and Appropriate Requirements for Operable Unit I. The major ARARs are presented below.

i) Chemical Specific ARARs.

The selected remedy will achieve compliance with Chemical specific ARARs related to groundwater, soil and ambient air quality at the site.

A) Groundwater

Relevant and Appropriate requirements for groundwater include primary drinking water standards established by the Safe Drinking Water Act. Several contaminants of concern identified at the Site have Maximum Contaminant Levels (MCLs), proposed MCLs and/or Maximum Contaminant Level Goals (MCLGs). MCLs are relevant and appropriate to circumstances at the Site, since the aquifers are potential sources of drinking water. MCLGs are relevant and appropriate when the standard is set at a level greater than zero (for non-carcinogens). The point of compliance for MCLs and MCLGs is throughout the plume at Operable Unit I.

As discussed in Section IX, the substantive provisions of Parts 6 and 7 of the rules promulgated under Act 307 of the State of Michigan are considered an ARAR for the remedial action. These rules provide, inter alia, that remedial actions be protective of human health, safety and welfare, and the environment and natural resources [Rule 299.5705(1)]. The rules specify that this standard is achieved by a degree of clean-up which conforms to one or more of three clean-up types (Rule 299.5705(2) et seq.). Type A criteria are based on reduction of hazardous substance levels to background or below detectable levels (Rule 299.5707).

Type B criteria are based on reduction of hazardous substance levels to an acceptable risk level (e.g., an excess lifetime cancer risk of 1×10^{-6} for carcinogens) using standardized exposure assumptions (Rule 299.5709). Type C criteria involve a site-specific assessment of risk and remedy evaluation to select remedies which do not pose an unacceptable risk (e.g., an excess lifetime cancer risk of 1×10^{-6} of carcinogens). Remedy evaluation under Type C criteria must include evaluation of alternatives which meet Type B criteria. This evaluation must be made against a variety of factors listed in Rule 299.5717.

U.S. EPA has chosen a Type A or B cleanup under Michigan Act 307. The Type B groundwater cleanup standards for such compounds are more stringent than the MCLs. The selected remedy will attain Michigan Act 307 Type B cleanup standards set forth in Table 3 throughout the plumes at Operable Unit I of the Site.

B) Soil

Relevant and Appropriate requirements for soils at the site include Michigan Act 307 standards. As discussed in Section IX, U.S. EPA has chosen a Type A or B cleanup pursuant to Act 307. Type A cleanup standards are background or detection levels; Type B cleanup standards correspond to a risk level of 10^{-6} for carcinogens and a human life cycle safe concentration for noncarcinogens.

Group 1 and 2 Soils exceeding Type A or B cleanup standards set forth in Table 2 will be excavated and incinerated and disposed of off-site consistent with Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions (LDR) treatment standards contained at 40 CFR Part 268, which are applicable. Group 3 and 4 soils will be treated by ISVE to meet the cleanup standards set forth in Table 2.

C) Residues

All sludges, ashes, residues, spent carbons, and spent coagulant/flocculent produced from soil, groundwater and air treatment will be treated to LDR standards for F001-F005 waste prior to disposal at a RCRA landfill.

D) Buildings

Investigations conducted at buildings at the Site revealed no evidence of the presence of asbestos. Prior to demolition further sampling will be conducted to detect the presence of asbestos. If asbestos is present, relevant and appropriate standards set forth at 40 CFR Part 61 will be followed.

(ii) Action Specific ARARs

The selected remedy will achieve compliance with ARARs governing the performance of activities at the site.

A) Managing RCRA Wastes

Resource Conservation and Recovery Act (RCRA) listed wastes, including F001-F005 spent solvents were found at the Site. RCRA requirements are applicable to all remedial activities involving treatment, storage or disposal of media contaminated with these wastes, including the following components of the selected remedy:

- Soils containing F001-F005 constituents can be incinerated off site only in a RCRA permitted incinerator.
- The ash from the soil and sludges containing the F001-F005 waste must meet LDR treatment standards. Incinerated sludge must meet the treatment standards in 40 CFR Part 268 Subpart D, although incinerated soil would be eligible for a treatability variance. After meeting the treatment standards, the ash may be land disposed only in a RCRA Subtitle C unit.
- The fume-rich incinerator in the ISVE must comply with the substantive requirements of 40 CFR Part 264 Subpart O.
- Tanks used in the treatment of the groundwater must comply with 40 CFR Part 264 Subpart J.
- Residues such as spent carbon from the treatment of groundwater which are regenerated must be treated in a unit in compliance with 40 CFR Part 264 Subpart X.
- Residues which contain F001-F005 constituents such as metal precipitates from groundwater treatment must meet the LDR treatment standards if land disposed.
- Corrective action must be undertaken consistent with 40 CFR 264.101.

The selected remedy complies with all of the above requirements as well as the equivalent requirements in Michigan Rule 613 and Public Act 64.

B) Closure

RCRA closure requirements are relevant and appropriate because of the presence of RCRA wastes at the Site. Compliance with Act 307 Type B standards will assure the attainment of health based standards, the prevention of leachate contamination of

groundwater and the absence of a direct contact threat. Compliance with Type B standards will achieve the requirements of 40 CFR 264.111 closure at the Site assures the attainment of health based standards. Because groundwater at the site is contaminated with RCRA waste, post closure monitoring is required.

C) UST

Underground storage tanks were removed from the Thomas Solvent property by U.S. EPA in july 1991. The requirements of 40 CFR Part 280 Subparts F and G are relevant and appropriate.

D) Air Emissions

Air Stripping, ISVE, groundwater treatment and excavation activities will comply with Michigan's Air Pollution Act (1965 Public Act (PA) 348) and Clean Air Act requirements. Best Available Control Technology (BACT) requires treatment of the air emissions from the air stripper system and ISVE. These requirements will be satisfied through use of a vapor phase activated carbon system to remove VOCs from the stripper air and the use of fume-rich incinerator to burn VOCs from the ISVE. The off-gases should be treated in order to meet PA 348 emission limit requirements.

E) Discharges

Discharges to Black Creek from the Groundwater Extraction and Treatment System and site run-off will comply with applicable NPDES requirements, and the Federal Water Pollution control Act Amendments of 1972 as amended by the Clean Water Act of 1977 (CWA), including Water Quality Criteria under CWA § 304 and State water quality standards promulgated pursuant to CWA § 303

F) Workers

Michigan Occupational Health and Safety Laws, Michigan Act 154, and the Occupational Safety and Health Administration regulations at 29 CFR 1926 govern working conditions.

(iii) Location Specific ARARs.

The selected remedy complies with location specific ARARs. The only activities conducted on wetlands or the floodplain at the Site during Operable Unit I will be the installation and use of wells for monitoring and groundwater extraction. The requirements of 40 CFR 264.18(b), CWA § 404, 40 CFR Parts 6, 230 and 320 through 330, Executive Orders 11988 and 11990, and the

Wild and Scenic Rivers Act if they become applicable or relevant and appropriate.

c. Cost-effectiveness

The Selected Remedy, Alternative 3 is a cost-effective alternative providing for protection of human health and the environment and long-term effectiveness. Alternatives 3 and 4 are slightly more expensive than Alternative 5 but provide a significantly greater degree of long-term effectiveness and permanence. Because there is no treatment of soils, there is a greater risk of contaminants entering the groundwater with Alternative 5 over the long term. Alternative 2 is three-times more expensive than Alternative 3 without providing proportional effectiveness. Although Alternative 2 provides complete destruction of the contaminants in the soil, Alternative 3 provides similar effectiveness through a combination of excavation for off-site incineration and treatment at one-third less cost. There is no major cost difference between Alternatives 3 and 4, but Alternative 3 can clean up the soil 5 times faster than Alternative 4.

d. Utilization of Permanent Solution and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

U.S. EPA, with the State of Michigan's concurrence, has determined that the selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized in a cost-effective manner for the Thermo Chem Site. Of the alternatives that are protective of human health and the environment and comply with ARARs, U.S. EPA has determined that the selected remedies for addressing soil and groundwater contamination provide the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

Alternative 3 reduces the toxicity, mobility, and volume of the contaminants in the soil and groundwater; complies with ARARs; provides long-term effectiveness; and protects human health and the environment equally as well as Alternative 2 and 4. In the long-term, Alternatives 2-4 are more effective than Alternative 5, which requires post-remedial maintenance and protection of the cap. Alternatives 2 through 4 each reduce the toxicity, mobility and volume of contaminants in the soil and groundwater; Alternative 5 contains them. In terms of short-term effectiveness, Alternative 3 would produce less short-term risks to the community and on-site workers during implementation than Alternative 2 because there are far less VOCs emitted.

Alternative 3 also can achieve protection five times faster than Alternative 4. Alternative 3 will be easier to implement technically because it requires less construction, and administratively because it will require less coordination with relevant agencies. Finally, Alternative 3 costs five times less than Alternative 2 while providing the same effectiveness. The major tradeoff that provide the basis for this selection decision are short-term effectiveness, implementability, and cost. The selected remedy is more reliable and can be implemented more quickly, with less difficulty and at less cost than the other treatment alternatives and is therefore determined to be most appropriate solution for the contaminated soil and groundwater at the Thermo Chem site.

The selected remedy satisfies the statutory preference for treatment as a Principal Element by utilizing the groundwater extraction and treatment system, the ISVE and Off-Site incineration to address the risks posed at Operable Unit I.

e. Preference for Treatment as a Principal Element

The principal threat at the Thermo Chem site is the contaminated soil, due to the current and potential use of the contaminated soil under recreational and residential land use. If left untreated, the contaminated soil would continue to leach contaminants into the groundwater.

The selected remedy directly addresses this threat by excavating hot spots in the soil which have highly concentrated contaminants for off-site incineration, and by treating the remaining organic compounds in the soil through in-situ vapor extraction and bioremediation, if necessary. In addition, the contaminated groundwater will be treated.

Table 1

Summary of Risk by Exposure Pathways

Soil

	Carcinogenic				Hazard Index			
	Current		Future		Current		Future	
	Hot Spot[1]	Soil[2]	Hot Spot	Soil	Hot Spot	Soil	Hot Spot	Soil
Ingestion	$7X10^{-5}$	$5X10^{-6}$	$2X10^{-4}$	$9X10^{-5}$	2		5	1
Dermal Contact	NA		$1x10^{-3}$	$9x10^{-3}$	NA		60	7
Inhalation/Vapor	$6X10^{-7}$	$1X10^{-7}$	$3X10^{-6}$	$3X10^{-5}$		NA	20	
Inhalation/Dust	NA[3]	$2X10^{-3}$			NA	500		
Total	$7X10^{-5}$	$2X10^{-3}$	$1X10^{-3}$	$9X10^{-3}$	2	500	90	8

Groundwater

	Carcinogenic	Hazard Index
Ingestion	$1X10^{-1}$	1000
Dermal Contact	$6X10^{-3}$	2000
Inhalation/Vapor	$1X10^{-1}$	100
Total	$2X10^{-1}$	3000

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[1]The term hot spot refers to the northernmost disposal lagoon.

[2]Soil in this table refers to all the soils except the hot spots.

A means "Not Applicable."

TABLE - 2
SOIL CONTAMINATION
MAXIMUM LEVELS DETECTED/SOIL CLEANUP STANDARDS
THERMO-CHEM SITE

COMPOUNDS	SITE CONCENTRATIONS (mg/kg) SOIL[1]	TEST PIT	CLAY LINER	FREQUENCY	STANDARDS[6] (mg/kg) GROUND WATER PROTECTION STANDARD[2]	DIRECT CONTACT STANDARD[3]	ACCEPTABLE MDL(mg/kg)[4]	BACK-GROUND (mg/kg)
VOCS								
Acetone	1.2	1,300	ND	5/69	10	8,000	0.010	0.033
Benzene	ND	19	ND	1/69	0.020	10	0.010	ND
1,2-Dichloroethene	ND	ND	1.4	1/69	1.0	800	0.010	ND
1,2-Dichloroethane	ND	4.7	ND	1/69	0.008	4	0.010	ND
2-Butanone	ND	4,400	ND	4/69	8	4,000	0.010	ND
1,1,1-Trichloroethane	2.8	ND	140	7/69	2	2,000	0.010	ND
1,1,2,2-Tetrachloroethane	0.005	ND	ND	2/69	0.004	2	0.010	ND
Trichloroethene	37	23	400	18/69	0.060	40	0.010	ND
4-Methyl-2-Pentanone	ND	660	ND	1/69	8	4,000	0.010	ND
Tetrachloroethene	1,500	16	2,900	3/69	0.01	8	0.010	ND
Toluene	180	270	270	22/69	2	16,000	0.010	ND
Chlorobenzene	0.53	ND	6.6	4/69	1	2,000	0.010	ND
Ethylbenzene	80	19	220	18/69	0.6	8,000	0.010	ND
Styrene	1.6	ND	33	3/69	0.020	10	0.010	ND
Total Xylenes	500	62	770	19/69	1	200,000	0.010	ND
Semi-VOCs								
1,4-Dichlorobenzene	0.063	0.55	0.42	3/120	0.020	20	0.330	ND
1,2-Dichlorobenzene	0.15	2.8	2.5	4/120	0.1	7,000	0.330	ND
2-Methylphenol	0.11	17	ND	3/135	0.8	10,000	0.330	ND
4-Methylphenol	3	190	ND	6/135	8	10,000	0.330	ND
Isophorone	ND	3.7	ND	1/120	0.2	90	0.330	ND
2,4-Dimethylphenol	0.8	76	ND	7/135	0.6	10,000	0.330	ND
Naphthalene	2.8	36	40	17/135	0.600	1,000	0.330	ND
2-Methylnaphthalene	2.5	7	18	17/135	0.200	400	0.330	ND
Dimethylphthalate	0.18	0.64	ND	3/120	ND	ND	0.330	ND
Hexachlorobenzene	0.064	ND	ND	1/120	0.00004	0.8	0.330	ND
Pentachlorophenol	3.7	ND	57	4/120	0.006	10	1.700	ND

TABLE 2-(Continued)
SOIL CONTAMINATION
MAXIMUM LEVELS DETECTED/SOIL CLEANUP STANDARDS
THERMO-CHEM SITE

COMPOUNDS	SITE CONCENTRATIONS (mg/kg) SOIL[1]	TEST PIT	CLAY LINER	FREQUENCY	STANDARDS[6] (mg/kg) G.W. PROTECTION STANDARD[2]	DIRECT CONTACT STANDARD[3]	ACCEPTABLE MDL (mg/kg)[4]	BACKGROUND (mg/kg)
Pesticides/PCB								
Heptachlor	0.200	ND	ND	4/54	0.00004	.30	0.0017	ND
Dieldrin	0.019	ND	ND	1/54	0.0000006	.080	0.0033	ND
4,4'-DDT	0.031	ND	ND	1/54	0.00005	4.0	0.0033	0.028
Aroclor-1254	1.3	ND	ND	6/69	1.0	1.0	0.033	ND
Inorganics								
Aluminum	7,010	2,720	5,650	131/131	1.0	NA	NA	2525
Arsenic	5	1.3	10.1	64/131	0.0004	0.8	0.050	1.0
Barium	46	49.1	255	116/131	40	90,000	1.0	9.0
Cadmium	1.4	24	22.6	8/131	0.080	100	0.005	ND
Chromium[5]	33.7	978	242	126/131	0.04	1,000	0.050	4.0
Lead	109	49.5	1,050	124/131	9	NA	0.125	2.0
Mercury	0.29	ND	0.73	7/131	0.04	NA	0.050	ND
Zinc	125	26.8	753	122/131	20	50,000	0.050	21
Cyanide	18.6	599	58.7	24/131	0.08	2,000	NA	1.0

1: Contaminants Detected in Soil other than Test Pit and Clay-Liner area.
2: 20 Times Act 307 Groundwater Type B Standards
3: 10^{-6} Carcinogenic Risk as Calculated Using Act 307 Type B Standards
4: As Determined by MDNR
5: Total Chromium (Standards are for hexa-chromium)
6: These standards include Surface Water Standards, Rule 57(2) of part 4 of Act 245.
NA: Not Available
ND: Not Detected
MDL: Method Detection Limit
* If background levels are higher than standards for inorganics, the background levels will be the standards.

TABLE - 3
GROUNDWATER CONTAMINATION *THERMO-CHEM SITE*

COMPOUNDS	SITE CONCENTRATION (ug/l) AVERAGE	MAXIMUM	FREQUENCY	STANDARDS (ug/l) 307(B)	MCL	ACCEPTABLE MDL (ug/l)	BACK-GROUNDS (ug/l)
VOCs (ug/l)							
Acetone	331	1,600	4/76	500	ND	5	ND
Benzene	3,209	26,000	20/76	1	5	1	ND
Carbon Tetrachloride	4.0	110	3/76	0.3	5	1	ND
Chloroform	619	2,600	16/76	6	NA	1	ND
1,1-Dichloroethane	1,572	7,900	23/76	700	NA	1	ND
1,2-Dichloroethene	4,061	20,000	36/76	70	NA	1	ND
1,1-Dichloroethene	58	380	15/76	7	7	1	ND
1,2-Dichloroethane	270	3,100	15/76	0.4	5	1	ND
2-Butanone	836	2,900	4/76	400	NA	5	ND
1,1,1-Trichloroethane	3,649	44,000	45/76	117	200	1	ND
1,1,2-Trichloroethane	63	200	6/76	0.6	5	1	ND
1,1,2,2-Tetrachloroethene	3	5	2/76	0.2	NA	1	ND
Trichloroethene	9,542	140,000	47/76	3	5	1	ND
Tetrachloroethene	5,960	60,000	43/76	0.7	5	1	1.0
Toluene	14,835	140,000	40/76	100	1,000	1	ND
Ethylbenzene	1,189	7,900	32/76	30	700	1	ND
Styrene	484	1,000	6/76	1	100	NA	ND
Xylenes (total)	2,878	28,000	38/76	59	10,000	1	ND
Semi-VOCs (ug/l)							
1,2-Dichlorobenzene	5	5	1/76	7	75	5	ND
2-Methylphenol	24	58	20/76	40	NA	NA	ND
Naphthalene	58	660	26/76	29	NA	5	ND
2-Methylnaphthalene	16	150	15/76	10	NA	NA	ND
Bis(2-ethylhexyl)phthalate	431	4,500	11/76	2	NA	5	6.0
Pentachlorophenol	17	27	2/76	0.3	200	2 0	ND
Inorganic Compounds (ug/l)							
Aluminum	272	3,210	20/76	50-200	NA	NA	280
Arsenic	12	132	37/76	0.02	50	50	ND
Cyanide	55	315	14/76	4	200	50	ND
Iron	2,941	21,500	45/76	300	NA	NA	170
Zinc	522	3,720	55/76	80	NA	NA	1,500

307(B): Act 307 Type B Standards for the State of Michigan
MCL: Maximum Contaminant levels for U.S. EPA's drinking water standards
ND: Not detected NA: Not Available
MDL: Method Detection Limit
* If background levels are higher than standards for inorganics, the background levels will be the standards.

RESPONSIVENESS SUMMARY
THERMO CHEM SITE
OPERABLE UNIT I
MUSKEGON COUNTY, MICHIGAN

PURPOSE

This responsiveness summary, required by the Superfund Law, provides a summary of citizen's comments and concerns identified and received during the public comment period, and U.S. EPA's responses to those comments and concerns. All comments received by U.S. EPA during the public comment period have been considered in the selection of the remedial alternative for the Site. The responsiveness summary serves two purposes: It provides U.S. EPA with information about community preferences and concerns regarding the remedial alternatives, and it shows members of the community how their comments were addressed.

This document summarizes written comments received during the public comment period of July 11 to September 9, 1991. The public meeting was held at 7:00 p.m. on July 16, 1991 at Egelston Township Hall, Muskegon, Michigan. Several comments were submitted during the public meeting.

OVERVIEW

The preferred alternative for the Thermo Chem site was announced to the public just prior to the beginning of the public comment period. The selected alternative includes:

* Demolition and off-site disposal of all on-site structures;
* Excavation and off-site incineration of Group 1 and 2 soils;
* In-Situ Vapor Extraction of all site soils;
* Off-gas treatment through fume-rich incinerator;
* Groundwater collection and treatment with discharge to Black Creek.

PUBLIC COMMENT AND AGENCY RESPONSE

Comments received during the public comment period on the FS and Proposed Plan for the preferred remedy along with U.S. EPA's responses are summarized below. Comments and responses have been divided into three sections. The three sections are as follows:

A. Summary of comments received during the public meeting, July 16, 1991;

B. Summary of comments submitted by the public during the public comment period; and

C. Summary of comments submitted by the PRP Steering Committee.

The comments below have been paraphrased in order to effectively summarize them in this document. Copies of the public meeting transcript and written comments are available for review at the public information repository.

A. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC MEETING, JULY 16, 1991

Comment: One resident inquired whether the structures located on-site could be relocated off-site and reused. He also inquired whether site itself could be reused after completion of the remedy.

Response: The on-site structures, including laboratory buildings, warehouse, incinerator, storage tanks and underground pipelines will be decontaminated and demolished for off-site disposal. This part of the remedy is necessary in order to determine the contamination problems in the soil beneath the on-site structures and to implement the selected remedy at the Site. However, some of these structures such as process buildings, equipment and storage tanks could be relocated off-site for reuse after such structures are decontaminated and pass the Wipe Test approved by U.S. EPA. The incinerator located on-site is outdated and may not comply with current incinerator standards. After Operable Unit I of the site is cleaned up to cleanup standards for both soil and groundwater, it can be reused as an industrial or even a residential area.

Comment: One resident asked if a treatability study for the selected remedy will be conducted in order to ensure the remedy will work.

Response: During the Remedial Design for the selected remedy, U.S. EPA may conduct treatability studies and/or pilot tests for several components of the ISVE and groundwater extraction system. While the ISVE is operating, U.S. EPA will perform a treatability study to determine the appropriate amount of nutrients (e.g., moisture, oxygen, nitrogen and phosphate) that would need to be added to site soils in order to enhance the natural breakdown of organic compounds. If U.S. EPA determines that this treatment is feasible, it will be included as part of the remedy. In addition, U.S. EPA may conduct a pilot-scale test of the ISVE before conducting full-scale ISVE to determine operation parameters such as the number of extraction wells and pumping rate required in order to achieve cleanup standards. With regard to the Groundwater Extraction System, a treatability test may be performed to determine the design parameters of the treatment system in order to meet the discharge limit and to evaluate the optimum pH and coagulant/flocculent dosage for the metals removal.

Comment: One commentor wanted a future assessment of natural resources damages by this site and any other sites that may be contributing to contamination at Muskegon Lake and Mona Lake.

Response: Muskegon Lake is not connected to the Site. Natural resource damage assessments are conducted by the State and/or Federal Natural Resources Trustees. U.S. EPA will determine whether Black Creek, which is located approximately 1500 feet South of the Site, is impacted by groundwater contamination from the Site in Operable Unit II. In July 1991, several sediment and surface water samples were collected from Black Creek to determine the contamination problem. If the results of these samples indicate that Black Creek is impacted by the Site, then U.S. EPA will determine the extent of this contamination. It may be that the contamination from the Site reaches Mona Lake. U.S. EPA will also determine whether the bio-community such as fish, plants and animals may be affected by contaminants from the Site.

Comment: The same commentor expressed concern with the utilization of off-site incineration and its effect on the people hosting the incinerator.

Response: At this time, U.S. EPA does not know the off-site incinerator to which the soils from the Site will be sent. However, the soils must be sent to a licensed RCRA incinerator acceptable for receipt of such waste. The facility the waste is sent to will be subject to RCRA regulations, and must be acceptable under the Off-site Policy. For a facility to be acceptable under the Off-site Policy it must, among other requirements, be in compliance with any applicable State or Federal Laws, including RCRA. The purpose of the off-site policy is to avoid having CERCLA wastes contribute to present or future environmental problems by directing these wastes to facilities determined to be environmentally sound. Ashes and residues generated from the incineration of site materials will be treated to meet Land Disposal Requirements at 40 CFR Part 268, prior to land disposal in a RCRA landfill.

Comment: An Attorney for the PRPs expressed reservations about attaining Type-B criteria in a 30-year time period at this or any site.

Response: U.S. EPA believes that most of the contaminants found in the groundwater at the Site can be cleaned up to Type B standards within 30 years using a groundwater extraction system which includes air stripping and metal precipitation. However, in the case of Arsenic, it is difficult to say at this time whether Arsenic can be cleaned up to type A or B levels using current technology.

Comment: One Commentor suggested capping or entombing the contaminants without expending cleanup funds. His suggestion was to cap the contaminants over, and keep people off.

Response: Alternative #5 contains a RCRA cap over contaminated areas, and a slurry wall. U.S. EPA evaluated this alternative against the other alternatives with regard to the nine criteria. Although Alternative #5 is slightly less expensive than the selected remedy, it is not as protective as alternatives which treat the source of contamination. It is also possible that the cap and slurry wall will deteriorate in the future and the contaminated soil will act as a source of groundwater contamination. The remedies which treat the soil achieve more long-term permanence and protectiveness.

Comment: One Commentor felt that the Site should be fenced off.

Response: The Site will be fenced off with a six-foot high chain link fence topped with three-strand barbed wire during remediation.

Comment: The same commentor also felt that wildlife should be a priority and wanted an investigation of what was happening with the foodchain and the Creek and its inhabitants.

Response: An investigation into the effects of the Site on Black Creek is underway. If sediments and surface samples collected from Black Creek in July 1991 indicate that the Site has contaminated Black Creek, then U.S. EPA will conduct a biological impact assessment including impact to fish, animals and plants around Black Creek. These concerns will be addressed in Operable Unit II.

Comment: One Commentor expressed concern about air emissions in the Muskegon area, requested monitoring and asked that we consider the chemical makeup of the air in the county in any kind of cleanup plan implemented.

Response: The Selected Remedies require that emissions from on-site treatment components and excavation be treated to Clean Air Act and Michigan Air Pollution Act (1965 Public Act 348) Standards. Gas emissions from ISVE systems will be treated using a fume-rich incinerator, and vapor emissions from air stripping will be treated through a carbon adsorption process. During implementation of the selected remedy, U.S. EPA will perform air emission monitoring throughout the site.

B. SUMMARY OF COMMENTS SUBMITTED BY THE PUBLIC DURING THE PUBLIC COMMENT PERIOD

Comment: One commentor related the history of a well located 1500 feet South of Black Creek. According to this commentor, the water

in this well was good in the 1950's, bad in 1980's and, after a new well point was installed deeper in 1990, OK again.

Response: This ROD addresses contamination problems in the soil and groundwater up to the discharge point at Black Creek. The well located 1500 feet South of Black Creek is not part of this response. However, during Operable Unit II investigations, U.S. EPA will investigate whether the contaminants from the Site reached this well.

Comment: A commentor questioned the following public meeting exchanges:

- U.S. EPA's statement that an imminent danger at the Site was the possibility that a child could trespass and eat dirt contaminated with something;

- The change in U.S. EPA's position regarding the need for removal of soil at the Thomas Solvent Property after the removal of the underground storage tanks;

- The ground layouts were out of scale and wrong;

- The ground was said to be contaminated with cyanide, lead, arsenic and other metals although such materials were allegedly not handled at the location, and the response was incoherent;

- The incorrect impression given that 200 drums left at the Site were left by Thomas/Thermo Chem, the lack of markings on such drums, and the waste of time and money involved in incinerating these drums, which contained contaminated soil and gloves from test boring instead of treating them with total Site soils;

- Much time was spent on alleged residues found along Black Creek although there is no easy access to the creek which is at least 1/4 mile from any activity;

- If a surface or groundwater problem exists, the landfill across the lake and Lakeway should also be suspect;

- To spend money cleaning up any possible minor residues here is a complete waste; EPA should clean up Mona Lake and Muskegon Lake which have higher residues; representatives could not provide a relative comparison of any potential dangers at this site to other sites in the area, state, or country;

- The criteria used to evaluate this site were flawed;

- Representatives were unaware of any new state of the art techniques for clean up;

- A clean up will never be successful until an agreeable definition of how good is good and how bad is bad is made;

- None of the proposed alternatives are viable or realistic and the cost estimates are outrageous.

Response: A review of the Administrative Record contains a more complete response to the questions raised than can be answered in brief public meetings.

- The Remedial Investigation (RI) Report, for instance, contains a detailed discussion of the scenarios U.S. EPA considers in assessing risk. The potential effects of contaminants on a child eating dirt from the site is a recognized risk in a future residential scenario.

- The Technical Assistance Report indicated high levels of groundwater contamination which suggested soil contamination as well on Thomas Solvent Co. property. In fact, pure solvent product was discovered in a well 100 feet downgradient from the tank farm area during the investigation. This indicated that the tanks had been or were leaking. Analysis of the tanks upon removal indicated that they were not currently leaking. This does not mean that they did not leak in the past. It is also possible that chemicals leaked during the loading and unloading process in the tank farm area. The sandy nature of Site soils is such that the contaminants could pass through the soil to the groundwater without leaving a major trace in the soil.

- The figures included in the proposed plan were developed in a not-to-scale format in order to provide the reader a quick glance at the positions of site structures. More accurately scaled and detailed figures can be found in the RI and FS reports.

- The RI report and the Technical Assistance Report document the presence of inorganic compounds, including cyanide, lead, and arsenic at the Site above local background levels. For example, lead was found in the on-site clay lagoon at a concentration of 1,050 mg/kg.

- The drums located on-site contain mostly cutting soils and decontaminated water. These drums were marked, dated and fenced. There were also drums containing hazardous materials which were extracted from the 16 excavated underground storage tanks. These drums, labelled as hazardous material were stored at the site during analysis of the contents of the tanks, and disposed of off-site once the results of analysis were reviewed. U.S. EPA did not incinerate drums containing contaminated soils and gloves from test borings or any other drummed materials. However, the selected remedy does call for the future excavation and incineration of Hot Spots of soils at the site.

- With regard to contamination of Black Creek, the avenue for contamination of this Creek by the Site is the groundwater. U.S. EPA is currently investigating whether groundwater contaminated by the Site has reached and impacted Black Creek.

- This investigation around Black Creek will examine the potential for other sources.

- U.S. EPA does not consider the contamination at this Site minor and has determined remedial action is required to protect human health and the environment.

- The investigations conducted were aimed at determining the nature and extent of contamination at this particular site. Information about other superfund sites in Michigan can be obtained from the Region V Office of Public Affairs.

- The commentor did not specify his objections to the evaluation of the Site, or any particular state of the art technique he felt should have been considered.

- The Site will be cleaned up to clean-up standards which are based on health-based standards and ARARs. The Site can be defined as "clean" if it is cleaned-up to these clean-up standards.

- The Alternatives evaluated have been successfully implemented at other Superfund Sites. The costs of the selected remedy is comparable to costs for such a cleanup at other Sites. One cost estimate (Alternative 5) was revised downward based on a clarification of the assumptions.

Comment: This commentor felt U.S. EPA should consider the following alternative: remove all "hot spots" and any solvent floating on the water table, treat highly contaminated water, fence off contaminated areas, buy neighboring properties if contaminated, prohibit drinking water wells and residences and identify the site as a permanent contaminated site.

Response: The selected remedy includes the removal of hot spot soils for off-site incineration. As suggested by this commentor, clean-up and performance standards are required to establish the manner and end-point of a clean-up. They are also required by Applicable or Relevant and Appropriate Requirements, including Michigan Act 307, RCRA and Safe Drinking Water Act (SDWA) MCLs. It is the expectation of the SDWA and the NCP that groundwater will be returned to beneficial uses. The CERCLA and the NCP also expresses a preference for treatment. The commentor's remedy would not comply with ARARs and would be inconsistent with the NCP. This proposal only addresses highly contaminated groundwater. It also leaves contaminants in the soil which could further contaminate the groundwater. U.S. EPA did evaluate a soil containment alternative. Alternative #5 called for capping of site soils with fencing and

institutional controls such as perpetual prohibitions on residential use and drinking water wells. U.S. EPA chose the selected alternative, however, based on an evaluation of the nine criteria set out in the NCP. It is also more productive to treat non-hot-spot soils with the ISVE, and render the site amenable to residential and industrial use and eliminate the need for long-term maintenance of a cap.

Comment: Another commentor opposed incineration of highly-contaminated hot spots in the selected remedy for the following reasons:

- There is an unknown impact of incineration on health and the environment. Emissions contain toxic, persistent, and bioaccumulative pollutants which pose a serious health threat to humans and animals. These emissions threaten more than the immediate area, could be dispersed across the hemisphere and may end up in the waters and sediments of the Great Lakes.

- The EPA should study the impact of incinerators on public health if it believes so strongly in this technology.

- There are no methods developed for direct monitoring of an incinerator. No sampling and analysis techniques exist to identify and quantify many of the potential compounds emitted, toxicity data is not available for all compounds, and there are no methods for identifying products of incomplete combustion.

- A destruction and removal efficiency of an incinerator determined by the trial burn is not a reliable indicator of an incinerator's impact on health and environment because it does not include other routes of chemical releases such as fugitive emissions, deposition in residues, unburned chemicals, heavy metals, and newly formed chemicals or PICs. The 4-nines standard does not mean that 99.99 percent of the chemical was actually destroyed.

Response: Incineration is recognized as an acceptable treatment technology in appropriate circumstances. Incinerators are extensively regulated by RCRA. U.S. EPA will send its wastes to an incinerator which complies with RCRA and other applicable Federal and State laws. For contaminated soils from the Site, it is believed that the organic compounds and pesticides will be destroyed in the incinerator. Inorganic compounds such as arsenic and lead would remain in the ash with minimal air pollution effect. The ash will be treated to meet Land Disposal Restriction requirement.

Comment: This Commentor questions U.S. EPA's motives for sending soils to an off-site incinerator when the State is bringing a portable kiln to the nearby Bofor's site.

Response: U.S. EPA evaluated Alternatives 3 and 4 with both off-site and on-site incineration for hot-spot soil. An On-site incinerator must be constructed in a manner consistent with RCRA performance standards. U.S. EPA will comply with RCRA incinerator requirements for the fume-rich incinerator utilized in the ISVE.

However, requirements for the incinerator needed to incinerate hot spot soils are much more extensive and make the remedy more difficult to implement. Therefore, off-site incineration can be implemented more easily. With the estimated soil volume of 2,000 cubic yards, there is no cost difference between on-site and off-site incineration. U.S. EPA will send the excavated soils off-site to an already established and approved facility which is in compliance with RCRA.

Comment: This commentor urged U.S. EPA to look at other options for soil destruction even at more cost.

Response: In Alternative #2, U.S. EPA considered in-situ vitrification. The costs involved are roughly three times the costs of Alternatives 3, 4 or 5. In addition, difficulties have been encountered in the implementation of in-situ vitrification technology. This is a new technology which raises many uncertainties in implementation.

C. SUMMARY OF COMMENTS SUBMITTED BY THE PRPs

U.S. EPA is only responding to comments on the remedy, not liability, and makes no representations as to the PRPs rendition of the facts or law.

Comment: The Thomas Solvent PRPs questioned the need for a treatability study to determine the amount of nutrients to be added to soil to enhance biodegradation. According to these PRPs, the chlorinated chemicals at the site are not amenable to aerobic degradation and the chemicals that are aerobically biodegradable can be easily volatilized from the soils using the vapor extraction system.

Response: The ISVE will remove volatile organic compounds from contaminated soil to cleanup standards. However, U.S. EPA is not fully assured that the ISVE will remove semi-volatile organics to cleanup standards. The purpose of conducting a treatability study during the full-scale implementation of the ISVE is to determine whether injection of nutrients such as oxygen or nitrate will promote the naturally occurring bioactivity in the soil in order to break down semi-volatile organic compounds. If the treatability study indicates that this treatment component is feasible, U.S. EPA will utilize the enhancement of biodegradation during the ISVE.

U.S. EPA does not believe this component will increase the cost of the remedy significantly.

Comment: The Thomas Solvent PRPs found no cleanup goals in the Feasibility Study or the Proposed Plan. They did not read the human health standard of 10-6 for carcinogens and a 1.0 hazard index for noncarcinogens or the Michigan Act 307 Type B standards in Tables 3 and 4 as clean-up levels.

Response: The Michigan Act 307 Type B standards correspond to a human health standard of 10^{-6} excess cancer risk for carcinogens and a human life cycle safe concentration for noncarcinogens. Set out in Tables 3 and 4 of the proposed plan, these Type B standards or background and detection limits (Type A) are considered by U.S. EPA and MDNR to be the appropriate clean-up levels for Operable Unit I at the Site.

Comment: The Thomas PRPs did not feel the Feasibility Study considered the possibility of a Type C Clean-up under Michigan Act 307, and states that if remedial alternatives had been evaluated with respect to Type C clean-up levels, a more cost-effective remedy could have been selected.

Response: Alternative #5 was a containment cleanup. This remedy would have to comply with Type C in order to comply with Act 307. However, an evaluation of other criteria such as protectiveness, long-term effectiveness and reduction of toxicity, mobility and volume through treatment recommended the selected Alternative.

Type A/B cleanup, not a Type C cleanup, is appropriate for the Site and is the best at achieving the nine evaluation criteria contained and the expectations and goals of the NCP, considering:

- the potential residential use of the Site;
- the potential use of the aquifers for drinking water;
- the increased permanence, reliability and long-term certainty of protection of human health and the environment;
- the potential for groundwater discharge to Black Creek;
- the increased reduction in the volume of hazardous substances remaining on site;
- the State's strong preference for a Type A or B cleanup;
- the CERCLA mandate to use permanent solutions to the maximum extent possible;

- the restoration of groundwater to beneficial uses; and
- the presence of multiple contaminants and multiple pathways of exposure.

U.S. EPA has determined that ISVE, offsite incineration of hot spot soils and groundwater Extraction and treatment is a cost-effective alternative which provides the best balance of the nine-criteria. Containment of the source without treatment does not satisfy the statutory preference for treatment as a principal element of the remedy.

Comment: The Thomas PRPs pointed out that oxidation processes for groundwater treatment was dropped out without any reasons in Development and Screening of Remedial Action Alternatives of the Feasibility study. According to the PRPs, the oxidation technique using ultraviolet rays can present a considerable cost savings over air stripping/carbon.

Response: The Chemical oxidation technique, which included oxidation with ultraviolet rays, was identified as one of the viable technologies for treatment of groundwater in the early phases of the Feasibility Study. However, this technique was dropped in development and screening of remedial action because organic compounds in groundwater can be treated through air stripping and inorganic compounds can be treated through the precipitation with lime. EPA welcomes any additional treatability study information the PRPs can provide demonstrating that this technology provides greater benefits than conventional treatment.

Comment: The Thomas PRPs questioned the capital cost estimate of $2.6 million for groundwater treatment.

Response: These costs are needed to clean up the inorganic compounds, including Arsenic in groundwater using a metal precipitation tank.

Comment: The PRPs did not believe the data supported the statement in the Fact Sheet that EPA was studying ways to correct the contamination problems the Site has caused in Black Creek. The PRPs felt it has not been proven that the Site had a detectable impact on Black Creek, and stated that there was no acknowledgement of alleged impact by other sites on Black Creek. According to the PRPs, the investigations being conducted this year are to determine whether site operations have impacted the Creek.

Response: During the investigation at the Site, contaminants were detected in monitoring wells downgradient of the site, located 200 feet North of Black Creek. Based on this information and hydrogeologic data obtained during the investigation, U.S. EPA believes that contaminated groundwater from the Site has reached the discharge point of Black Creek. However, U.S. EPA hereby

states that it has not yet concluded that Black Creek has been impacted by the Site. As the Proposed Plan notes at page 11, "U.S. EPA currently is conducting further studies to determine whether the contamination has, in fact, reached Black Creek." These studies will also examine the possibility of contamination from other sources. At this time, U.S. EPA does not know whether other sites have impacted Black Creek.

Comment: The PRPs object to the statements made in the fact sheet and the proposed plan that drums containing hazardous chemical wastes were removed from the Site in 1988. According to the PRPs, the materials removed consisted of laboratory reagents in their original containers stored in the laboratory building at the Site, and the jars and bottles were packed by a U.S.EPA contractor into larger drums for transport and handling. The PRPs feel that the statement is misleading with respect to the condition which the materials were stored on the site and with respect to the character of those materials.

Response: On August 9, 1988, U.S. EPA conducted a site assessment and recommended that a removal action be implemented. The investigation observed that the buildings on site were not restricted and access could be gained through doors and broken windows. U.S. EPA also observed and inventoried 330 containers of various chemicals and solvents in the laboratory and drums containing borax, sulfuric acid, and sodium hydroxide in the manufacturing buildings on site. U.S. EPA determined the laboratory chemicals left at the abandoned buildings combined with the proximity of the buildings to a residential areas presented a threat of imminent and substantial endangerment to human health and the environment. Therefore, U.S. EPA removed approximately 43 laboratory packs (acids, bases, flammable, and poisons) off-site for incineration. Four drums of hazardous waste solids (bases) and one drum of hazardous waste liquid (corrosive) were transported off-site for treatment and disposal. Abandoned and disposed hazardous chemicals are considered hazardous chemical wastes.

Comment: The PRPs object to the fact sheet statement that the field work will include studying ecological impacts of the contamination on wildlife, plants, and organisms. They say that the work currently planned for the Black Creek area does not include a study of ecological impacts, and the work to be conducted during the summer of 1991 is determine (sic) whether or not any impact could potentially exist.

Response: The PRPs are correct in noting that the current field work does not include a study of ecological impacts. The Proposed Plan at page 8 does not include such a study. If Black Creek is contaminated, an ecological impact study will be conducted.

Comment: The PRPs object to the statement made in the proposed plan that sixteen underground storage tanks were located on the

Thomas Solvent Company property and were used to store these recycled materials. The PRPs feel this statement is inaccurate and misleading and cite a 1984 Pollution Incident Prevention Plan (PIPP) prepared by Thomas Solvent Company as only identifying two tanks containing recycled material.

Response: The PIPP's only description of the contents of the tanks is a listing of compounds next to tank numbers. Contrary to the PRP's assertion, there is no reference in the PIPP as to use of the materials in the Tanks or any characterization as "commercial" or "product." Because only two of the items listed have "recovered" preceding the names, the PRPs have concluded that only two tanks stored recycled materials. The PIPP listing did not correspond to the sampling results from the tanks. However, U.S. EPA's statement may be overly broad. While U.S. EPA has evidence that recycled materials were placed in the tanks, it does not follow that such materials were placed in all of the tanks. Accordingly, U.S. EPA has corrected this statement in the ROD at page 4.

Comment: The PRPs object to the conclusion "at least 22 of those chemicals are designated as hazardous waste". This statement is said to be taken from a 1991 Metcalf and Eddy report which is said to list commercial products produced and sold by Thomas Solvent.

Response: The list referred to above although labelled a "Products List," includes materials sent to the Site for treatment or disposal as well materials which came out of the site. U.S. EPA has reviewed waste transaction documents and found hazardous wastes a defined by RCRA as well as hazardous constituents. At page 4, U.S. EPA has deleted the number of hazardous wastes.

Comment: The PRPs object to the Statement that the scope of the contamination listed as the Thermo-Chem, Inc. on the NPL encompasses the Thomas Solvent Company property. The PRPs state that data documents that there is a defined plume for Thomas Solvent which is distinguishable from the Thermo Chem plume, and argue that it is the contamination discovered on the Thomas Solvent property encompasses or impacts the Thermo Chem property and not vice versa. They feel U.S. EPA's statement implies that contamination of Thomas Solvent is a result of Thermo Chem.

Response: While it is true that contamination at Thomas Solvent may have resulted from Thermo Chem operations, the statement cited merely refers to the fact that the contamination noticed on the NPL listing encompasses both the Thermo Chem, Inc. Property and the Thomas Solvent Company property. A clarification to this effect has been made at pages 5 - 6 of the ROD.

Comment: The PRPs request that U.S. EPA clarify that it is the ground water table which is encountered, not the top of the aquifer, from 17 feet to 32 feet below ground surface.

Response: The PRPs are correct in pointing out that it is the groundwater table, not the upper aquifer, which lies from 17 feet to 32 feet below the ground surface. This has been clarified on page 9 of the ROD.

Comment: The PRPs request that U.S. EPA present the necessary assumptions and calculations to support U.S. EPA's estimation that approximately 100 gallons per minute of groundwater discharges to Black Creek.

Response: Based on the local hydrogeologic data and the thickness of shallow aquifer, U.S. EPA estimated that groundwater discharges to Black Creek at a rate of approximately 100 gallons per minute from the Site. However, U.S. EPA recognizes that such calculation is premature at this time without conducting further investigation, i.e. pump test, around Black Creek. Therefore, U.S. EPA deleted this calculation from the ROD on page 9.

Comment: The PRPs felt that insufficient investigations had been conducted to limit Group 2 Soils to the area around soil boring 3, and that Group 4 soils have not been delineated. They note that U.S. EPA did not detect any contamination beneath the removed underground storage tanks and that the Technical Assistance Study documented a significant groundwater contamination plume in the vicinity of the underground storage tanks.

Response: U.S. EPA conducted a Technical Assistance investigation at Thomas Solvent to determine the nature and extent of the contamination problem. 166 soil-gas samples were collected at Thomas Solvent and analyzed for volatile organic compounds. This soil-gas survey was conducted to determine possible source areas, the extent of contamination in the soil and groundwater, and to assist with locating soil borings at the Thomas Solvent Property. Based on soil/gas results, five soil borings were drilled and sampled at this 1.5 acre property. (For the locations of soil borings, see the Technical Assistance Report.) Each soil boring was sampled every two feet to a depth of 16 feet. Based on the results of the soil samples, soil boring #3 was considered a hot spot. This soil boring contains high levels of organic and inorganic compounds and PCBs, including 1,500,000 ug/kg PCE, and 1,300 ug/kg PCB. The absence of soil contamination beneath the underground storage tanks at the time of the removal does not mean that these soils were never contaminated. The sandy nature of the soil may have allowed contaminants to pass through to the groundwater without retaining residues. The fact that we discovered pure solvent product in a downgradient well located 100 feet south of the tank farm area indicates the possibility of leaking or injecting of contaminants during the loading and unloading process or releases from the underground storage tanks.

Comment: The PRPs object to U.S. EPA's expansion on the PRP prepared FS to address the Thomas Solvent Property, and to require

a pilot test. The PRPs also feel that the cost estimates do not incorporate U.S. EPA's expansion on the FS.

Response: While U.S. EPA agreed in the Consent Order not to have the PRPs conduct RI/FS activities at the Thomas Solvent property, and the PRP generated FS consequently limited the Therm Chem property, U.S. EPA conducted its own investigation to determine the nature and extent of the contamination at the Thomas Solvent Property. U.S. EPA utilized the Technical Assistance Report findings to categorize the soil at the Thomas Solvent Property. Since Thomas Solvent contains similar contaminants at similar levels as the Thermo Chem property, U.S. EPA determined that it is appropriate to consider the alternatives evaluated in the feasibility study for Thermo Chem property at the Thomas Solvent property.

U.S. EPA is uncertain about the effectiveness of the ISVE to treat semi-volatile organic compounds to clean-up standards. The purpose of the bioremediation pilot test is to establish whether the injection of nutrients during a full-scale ISVE will promote naturally occurring bio-activity in order to degrade semi-volatile organic compounds. If the treatability study indicates that it is feasible, this injection of nutrients can be incorporated into the remedy to treat semi-VOCs to clean-up standards without major system modifications or a significant increase in cost.

Since the FS prepared by the PRPs for the Thermo Chem Site has calculated costs for each alternative for a range of volumes of soils, and since the addition of Thomas Solvent Property soils to the soils to be addressed at the Thermo Chem property falls within the range upon which the cost estimate was based, the estimate for applying the alternatives to both properties at the Site would be consistent with the estimates provided in the FS. For example, the FS estimated costs for alternative #5 for an area of soil ranging from 0.7 acres to 18 acres. The site, including both the Thomas Solvent Property and the Thermo Chem property, contains an area of only 9.5 acres. The estimated costs for off-site incineration of hot spot soils in Alternatives 3 and 4 were based on a range of volume from 400 cubic yards to 2,000 cubic yards. The selected remedy, which addresses both properties, calls for excavation of approximately 2,000 cubic yards. The cost of groundwater treatment may increase from the estimates provided for the limited area of the Thermo Chem property addressed in the FS; but this increase will not be significant. The major part of groundwater cleanup costs, Operation and Maintenance costs, will not be affected.

Comment: The PRPs argue that because of the incorrect technical and legal conclusions, the most significant of which pertains to U.S. EPA's decision to require the Thermo Chem PRPs to undertake remediation of the Thomas Solvent property, U.S. EPA's proposed remediation of the Thermo Chem site as set forth in the Proposed Plan must be revised.

The PRPs argue that, U.S. EPA is attempting to combine two separate facilities into one facility, and that U.S. EPA does not have a valid basis for combining the two facilities. The PRP position is that U.S. EPA is expanding the site to cover a wholly different release originating from a separate parcel of property upgradient from the originally defined Site. They cite Washington State Department of Transportation v. U.S. EPA 917 F.2d 1309 (D.C. Cir. 1990) to support an inverse proposition that if a Site is named after an industrial plant as opposed to a geographical location, the NPL site does not give notice that any property other than the namesake property would be included in the NPL site. The PRPs contend that the Thomas Solvent Facility is an independent, upgradient source of contamination for which the Thermo Chem PRPs have no liability.

Response: Data obtained during the RI/FS at Thermo Chem and the Technical Assistance Study at Thomas Solvent revealed that Thomas Solvent was a source of contamination identified as the Thermo Chem Site in the NPL listing. The HRS package for the Thermo Chem Site includes all groundwater contamination at the Thermo Chem property, including the contamination emanating from the Thomas Solvent property. A full reading of 56 Federal Register 5600 - 5601 explains the inclusion of the Thomas Solvent Property:

> " Facility [Site] Boundaries. The NPL does not describe releases in precise geographical terms.... the purpose of the NPL is merely to identify releases of hazardous substances that are priorities for further evaluation. The names of sites are provided for identification purposes only; the sites are not limited to (or coextensive with) the boundaries of properties that may be referred to in the name. Of course, HRS data upon which listing is based will, to some extent, describe which release is at issue; that is, the NPL site would include (but not be limited to) all releases evaluated as part of that HRS analysis (including noncontiguous releases evaluated under the NPL aggregation policy, see 48 FR 40663 (September 8, 1983.)
>
> Identifying a release or facility on the NPL provides notice that the entire facility will be addressed; the facility includes the source or sources of contamination and any area where a hazardous substance release has "come to be located" (CERCLA section 101(9). The listing process is not intended to define or reflect the "boundaries" of such facilities or releases. In fact, CERCLA does not refer to site "boundaries," and that term has little or no legal significance.
>
> The NCP does provide that the nature and extent of the threat presented by a release will be determined by an RI/FS as more information is developed on site

> contamination [40 CFR 300.430(d)(2) (55 FR 8847, March 8, 1990)]. During the RI/FS process, the release may be found to be larger or smaller than was originally known, as more is learned about the source and the migration of the contamination. However, this inquiry focuses on an evaluation of the threat posed; the boundaries of the release need not be defined, and in any event are independent of listing. Moreover, it generally is impossible to discover the full extent of where the contamination "has come to be located" before all necessary studies and remedial work are completed at a site; indeed, the boundaries of the contamination can be expected to change over time. Thus, in most cases, it will be impossible to describe the boundaries of a release with certainty. At the same time, however, the RI/FS or the Record of Decision which defines the remedy selected may offer a useful indication to the public of the areas of contamination at which the Agency is considering taking a response action, based on information known at that time.
>
> For these reasons, the NPL need not be amended if further research into the extent of contamination expands the apparent boundaries of the release. As discussed above, the NPL is only of limited significance, as it does not assign liability to any party or to the owner of any specific property.... If a party wishes to contest liability for releases on discrete parcels of property, it may do so if and when the Agency brings an action against that party to recover costs or to compel a response action at that property.

The PRP make the incorrect assumption that an NPL site may only be expanded when the same release is found to have contaminated an area that is larger than the originally detected area. As indicated above, the facility includes the source or sources of contamination and any area where a hazardous substance release has "come to be located" (CERCLA Section 101(9). The NPL site may be expanded to include the source of a release. In Washington State Department of Transportation v. U.S. EPA, the property included was a "source" of the contamination noticed on the NPL. As indicated above, a site is not limited to the boundaries of properties that may be referred to in the name of that Site, and includes all releases evaluated as part of the HRS analysis.

Comment: The PRPs do not believe the Administrative Record supports the inclusion of the Thomas Solvent Property in the Thermo Chem Site. They cite a negotiated RI/FS Consent Order which expressly prevents U.S. EPA from modifying the RI/FS Work Plan to require them to conduct an RI/FS at the adjacent Thomas Solvent of Muskegon; and the limited definition of "Site" in this Consent

Order. The PRPs claim that U.S. EPA relies on the PRAP alone as the basis for its decision.

Response: The Proposed Plan at pages 6-7 describes the findings supporting its conclusion that the release listed on the NPL included the Thomas Solvent Property. These findings are documented in the Administrative Record. In particular, the RI report, the HRS package and the Technical Assistance report contain the findings which support the inclusion of the Thomas Solvent Property.

Comment: The PRPs state that U.S. EPA has statements from undisclosed persons justifying the decision to combine both properties at the Site, and has refused to provide those statements on request.

Response: Although U.S. EPA does have interviews with undisclosed persons which contain information which may be relevant to the issue of liability, such statements were not the basis for including the Thomas Solvent property at the Thermo Chem Site. The documents establishing a basis for the inclusion of the Thomas Solvent Property are described in the response to the previous comment. U.S. EPA has advised PRPs at meetings, including public meetings, and in phone conversations that the document described exists. This document, which is dated July 1990, and which documents interviews with numerous persons regarding operations at the Thomas Solvent and Thermo Chem properties is exempt from FOIA under 40 CFR 2.118(a)(5) and (7)(i)(A) and (D). U.S. EPA has received and responded to numerous FOIA requests at this Site. If any requestor feels this document was responsive to their request and was not identified, they should identify the RIN number so that U.S. EPA can review the request.

Comment: The PRPs argue that a cleanup in accordance with the PRAP would impose liability on the Thermo Chem PRPs for contamination for which they claim they are not legally responsible.

Response: The Site characterization does not assign liability to any party or to the owner of any specific property. If a party wishes to contest liability for releases on discrete parcels of property, it may do so if and when the Agency brings an action against that party to recover costs or to compel a response action at that property. The subject of the Proposed Plan and this ROD is the Site and the remedy; not liability. Comments with regard to liability will not be addressed in this responsiveness summary.

Comment: The PRPs argue that since U.S. EPA has not undertaken a feasibility study for the Thomas Solvent property, the proposal for a remedy for the TS property, which they call a facility, is premature and violates CERCLA.

Response: U.S. EPA arranged for an RI/FS at the Thermo Chem Site. When it was determined that this site also included the Thomas Solvent Property, investigations were conducted on this property to obtain the information that the negotiated RI/FS did not already provide with regard to this portion of the Site. Much of the information acquired during the PRP RI/FS was applicable to both properties at the Site.

Comment: The PRPs claim that the Type B standards are not ARARs and may not be used for the cleanup. They argue that Type B standards cannot be used as ARARs, since they are not specifically part of the promulgated Act 307 Rules but are the result of cleanup criteria developed by MDNR. They add that standards are constantly being revised and are not fixed Targets.

Response: The substantive provisions of parts 6 and 7 of the Act 307 Rules have been determined to be ARARs. These rules are promulgated standards, requirements, criteria or limitations, under a state environmental or facility siting law, more stringent than the Federal requirements and have been found to be relevant and appropriate at the Site. They are legally enforceable and of general applicability. U.S. EPA finds no inconsistency in the application of cleanup goals by the State of Michigan or in the application of cleanup goals identified for this Site. These rules contain criteria for complying with Type A, B, and C cleanups. They provide that remedial actions shall be protective of human health, safety, and welfare and the environment and natural resources, and specify that this standard is achieved by a degree of cleanup which conforms to one or more of the Type A, B or C cleanup criteria. The substantive requirements of Parts 6 and 7 of the Act 307 rules must be complied with in order to be consistent with CERCLA and the NCP. U.S. EPA has selected a remedy which is protective of human health and the environment as required by CERCLA and the NCP. This remedy, and the specific site standards set forth in Tables 2 and 3, have been determined to comply with the promulgated criteria and methods contained in Rules 299.5703, 299.5709, 299.5723 and 299.5725.

Comment: PRPs argue that U.S. EPA should have and did not consider a Type C cleanup, and must reevaluate the possible remedial alternatives, including an evaluation of a Type C cleanup.

Response: This comment is addressed at page 10.

NATURAL RESOURCES COMMISSION
MARLENE J. FLUHARTY
GORDON E. GUYER
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STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF NATURAL RESOURCES

STEVENS T. MASON BUILDING
P.O. BOX 30028
LANSING, MI 48909

~~BELBERT RECTOR, Director~~

ROLAND HARMES, Director

September 19, 1991

Mr. Valdas Adamkus, Regional Administrator
U.S. Environmental Protection Agency
Region 5, 5RA-14
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Adamkus:

The Michigan Department of Natural Resources (MDNR), on behalf of the State of Michigan, has reviewed the draft Record of Decision (ROD) which we received on August 14, 1991, for the Thermo-Chem Superfund site in Muskegon County, Michigan. We are pleased to inform you that we concur with the selected remedy outlined in the draft ROD for operable unit number 1.

The major components on the selected remedy include:

- decontamination, demolition and off-site disposal of all on-site buildings, with subsequent sampling of underlying soils;

- institutional controls, including zoning, land use restrictions, and construction of a fence around the perimeter of the site. The institutional controls will extend until the groundwater remedy has been completed;

- excavation and off-site incineration of soils from selected "hot spots";

- in-situ soil vapor extraction of contaminants in remaining soils and a treatability study to determine whether enhanced biodegradation should also be added. The cleanup levels for soils will be dictated by the Rules promulgated under the Michigan Environmental Response Act (MERA) (1982 P.A. 307, as amended). Since groundwater discharge to Black Creek is occurring, as required by MERA Rule 713 (2), soil cleanup numbers will be set based on 20 times the allowable level specified pursuant to Rule 57(2) of the Part 4 Rules of the Water Resources Commission Act (1929 P.A. 245, as amended) (WRC Act), where these are more stringent than those resulting from MERA Rules 711(2) or 711(5). These numbers are listed in Table 2 of the draft ROD;

- o groundwater extraction and treatment from both the shallow and deep aquifers. Groundwater treatment will include filtration, air stripping, metals precipitation, and pH adjustment. The air stripper shall be equipped with a vapor phase activated carbon treatment unit. Monitoring of the treated effluent will be done to assure compliance with the substantive requirements of a National Pollutant Discharge Elimination System (NPDES) permit prior to discharging the effluent to Black Creek. It is possible that aqueous phase carbon will be needed to treat semi-volatile contaminants. The groundwater cleanup numbers will be dictated by the Type B numbers generated pursuant to MERA Rule 709 or, as required by MERA Rule 713(2), the Rule 57(2) numbers, whichever is more stringent. These cleanup criteria are listed in Table 3 of the draft ROD;

- o additional studies will be done to determine background concentrations of inorganic soil contaminants, the ability of some contaminants to leach from site soils to groundwater, and the existence of other contaminated soil. These studies may dictate that additional excavation and/or treatment may be needed to meet federal or state standards.

The state also concurs with the analysis of legally applicable or relevant and appropriate requirements (ARARs) contained in Section XI - Statutory Determination Summary, with the following exception. The state has previously identified the WRC Act, MCL 323.6(a) and the associated Part 22 Administrative Rules, MAC R.323.2201 et seq. as ARARs for this site. It remains our position that the WRC Act and the associated Part 22 Rules are ARARs for the remedial action for this site because hazardous substances in the aquifer beneath the site are migrating to degrade previously uncontaminated groundwater.

It is the MDNR's judgement that the selected remedial action for this site will provide for attainment of all ARARs, including the Part 22 Rules of the WRC Act by preventing further discharges of injurious substances into the groundwater outside of the containment area and by remedying the existing groundwater contamination.

The MDNR believes that the ROD should include a requirement that a program to monitor the effectiveness of the remedial action be designed and implemented.

This operable unit is the first of two planned for the site. This first operable unit addresses soils, sludges, and groundwater up to its discharge point to Black Creek. The function of this operable unit is to eliminate the source of contamination and treat contaminated groundwater which has already migrated from the site. The second operable unit will address surface water and sediments in Black Creek, and groundwater south of Black Creek, if necessary. While the remedy in operable unit 1 addresses some of the principal threats at the site, the second operable unit will involve all other aspects of the Thermo-Chem site.

If you have any questions regarding this site, please contact Mr. Mitchell Adelman at 517-373-8436, or you may contact me directly.

Sincerely,

ACTING Delbert Rector
Deputy Director
517-373-7917

cc: Mr. Jonas Dikinis, EPA
Ms. Mary Tyson, EPA
Mr. Jae Lee, EPA
Mr. Robert Reichel, Department of Attorney General
Mr. Alan Howard, MDNR
Mr. William Bradford, MDNR
Mr. Peter Ollila, MDNR/Thermo-Chem File

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	12	85/03/29	Letter re: Thomas Solvent Co. Chapter 11 No. NK-84-00843, Thermo Chem, Inc.	James Gregg, Varnum, Riddering, Schmidt & Howlett	Roger Przbybsz, MDNR	Correspondence	1
	4	85/08/29	Letter re: Analytical results and location map for the soil gas survey conducted on 4/30/85, at the Thomas Solvent Co.	Roger Przybysz, MDNR	D. Adams, Thomas Solv Co.	Correspondence	2
	7	86/05/21	Letter re: USEPA's consideration of spending public funds to investigate and take corrective action for the control of the release of hazardous substances at the Thermo Chem site	Basil Constantelos, USEPA	Various	Correspondence	3
	9	86/09/08	Letter re: USEPA's consideration of spending public funds to investigate and take corrective action for the control of the release of hazardous substances at the Thermo Chem site	Basil Constaelos, USEPA	R. Byersmith	Correspondence	4
	5	86/09/09	Letter re: USEPA's documentation of the release or threatened release of hazardous substances, polluntants and contaminants at the Thermo Chem site	Basil Constantelos, USEPA	Various	Correspondence	5
	11	86/10/22	Letter re: 5/21/86 letter regarding Thermo Chem from USEPA	Diane Diks, USEPA	Various	Correspondence	6

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	1	87/11/12	Letter re: Abandoned Underground Storage tanks at 4321 E. Evanston Ave.	Larry Hruskach, Egelston Township Fire Department	Thermo Chem Inc.	Correspondence	7
	1	87/11/30	Letter re: 11/12/87 letter addressed to Thermo Chemical Co.	James Sullivan, Sullivan, Hamilton & Schulz	Egelston Twsh. Fire Dept.	Correspondence	8
	15	88/01/29	Letter re: Summary of all response costs incurred by the USEPA at the Thermo Chem site	Diane Diks, USEPA	Susan Franzetti	Correspondence	9
	1	88/03/24	Letter re: Receipt of 11/12/87 to Thermo Chem/Thomas Solvent and their response dated 11/30/87	Mitchell Adelman, MDNR	Dan Willea	Correspondence	1
	1	88/06/02	Letter re: Review of Chief Hruskach, Egelston Township Fire Department letter dated 11/12/87 to Thermo Chem and the response dated 11/30/87	Jae Lee, USEPA	James Sullivan, S,H&M	Correspondence	11
	55	88/07/25	Letter re: Thermo Chem, Inc. NPL Site	Susan Franzetti, Gardner, Carton & Douglas	Jon Faletto, USEPA	Correspondence	12
	4	88/08/11	Letter re: Emergency removal action at Thermo Chem, Inc.	Jon Faletto, USEPA	Susan Franzetti	Correspondence	13
	10	89/01/09	Letter re: Thermo Chem NPL site Administrative Order	Valdas Adamkus, USEPA	James Sullivan	Correspondence	14

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			directing compliance with the USEPA's request for access to the Thermo Chem NPL site located at 4331 Evanston Ave.				
	12	89/02/21	Letter re: Cost Reimbursement for Thermo Chem site	Jae Lee, USEPA	Susan Franzetti	Correspondence	15
	11	89/07/12	Letter re: Administrative Order directing compliance with the USEPA's request for access to that portion of the Thermo Chem, Inc. NPL site drum storage area that has been found to be on Thomas Solvent Co. property	Susan Prout, USEPA	James Sullivan	Correspondence	16
	4	89/10/23	Letter re: ERM's conduct on the Thermo Chem site during the week of 9/11-15/89	William Herceg, MDNR	Jae Lee, USEPA	Correspondence	17
	30	90/01/11	Letter re: Recovery of costs incurred by the USEPA for response activity, performed under CERCLA as amended 12/03/88 thru 09/30/89	Ivars Antens, USEPA	Susan Franzetti	Correspondence	18
	32	90/01/29	Letter re: Recovery of costs incurred by the USEPA for response activity performed under the authority of the CERCLA	Ivars Antens, USEPA	Susan Franzetti	Correspondence	19

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	4	90/02/09	Letter re: Summary of the PRP meeting notes for the Thermo Chem site Work Assignment C05028	Thomas Lentzen, Metcalf & Eddy	Jae Lee, USEPA	Correspondence	20
	6	90/04/02	Letter re: Cost Overdue under Thermo Chem, Inc. Consent Order	Maria Gonzalez, USEPA	Susan Franzetti	Correspondence	21
	41	90/04/09	Letter re: Review Comments on the Technical Memorandum No. 2 for the Remedial Investigation, Thermo Chem	Jae Lee, USEPA	K. Waskiewicz, Ford Co.	Correspondence	22
	8	90/04/27	Thermo Chem, Inc. Site Consent Order	Maria Gonzalez, USEPA	Susan Franzetti	Correspondence	2[illegible]
	2	90/05/04	Letter re: USEPA Sponsored work at Thomas Solvents	Steven Kohl, Landman, Latimer, Clink & Robb	Jae Lee, USEPA	Correspondence	24
	35	90/05/10	Letter re: Thermo Chem, account that has been outstanding for over 90-days	Ivars Antens, USEPA	Susan Franzetti	Correspondence	25
	2	90/06/22	Letter re: Thermo Chem RI/FS Schedule	John Imse, ERM-NC	Jae Lee, USEPA	Correspondence	26
	1	90/07/06	Letter re: MDNR's completion of its review of the Thermo Chem Sampling and Analysis Plan, Part 1 and 2	Bill Herceg, MDNR	Jae Lee, USEPA	Correspondence	27

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	16	90/09/18	Letter re: Request for Information Pursuant to Section 104(e) of CERCLA and Section 3007 of RCRA, for the Thomas Solvent site	Robert Bowden, USEPA	Various	Correspondence	29
	26	90/09/18	Letter re: Thomas Solvent site General Notice of Potential Liability	Robert Bowden, USEPA	Steven Kohl	Correspondence	30
	2	90/09/25	Thomas Solvent site General Notice of Potential Liability	Richard Thomas, Thomas Solvent Co.	Carol Graszer, USEPA	Correspondence	31
	5	90/09/25	Letter re: Thomas Solvent site General Notice of Potential Liability	Richard Thomas, Land, Latimer, Clink & Robb	Robert Bowden, USEPA	Correspondence	32
	2	90/10/03	Letter re: Additional Field Work Requirements at Thermo Chem	James Strayton, Metcalf & Eddy	Jae Lee, USEPA	Correspondence	33
	6	90/10/04	Letter re: Request for Information Pursuant to Section 104(e) 3007 of RCRA, for the Thomas Solvent site	Richard Thomas, Thomas Solvent Co.	Carol Graszer, USEPA	Correspondence	34
	6	90/10/11	Letter re: Request for additional field activities for the Remedial Investigation at the Thermo Chem site	Jae Lee, USEPA	K. Waskiewicz, Ford Co.	Correspondence	35

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	2	90/10/25	Letter re: Tes X Work Assignment No. C05028 Thermo Chem RI/FS Oversight Summary of ROD Meeting, 10/18/90	Barry Nelson, Metcalf & Eddy	Jae Lee, USEPA	Correspondence	37
	4	90/10/29	Letter re: Position of the USEPA following the meeting held on 10/18/90, regarding the RI/FS at the Thermo Chem site	Jae Lee, USEPA	K. Waskiewicz, Ford Co.	Correspondence	38
	4	90/10/30	Letter re: Tes X Assignment No. C05028 Thermo Chem RI/FS Oversight Slug Test Qualifications and Comments	James Strayton, Metcalf & Eddy	Jae Lee, USEPA	Correspondence	39
	4	90/11/02	Letter re: Request for additional Work	Raymond Murphy, Ross & Hardies	Jae Lee, USEPA	Correspondence	40
	13	90/11/16	Letter re: Administrative Order on Consent concerning the Thermo Chem site written on behalf of the Respondents	Timothy Vanderver, Patton, Bogs & Blow	Valdas Adamkus, USEPA	Correspondence	41
	9	90/11/26	Letter re: Thermo Chem Inc. Additional Work Dispute	Jae Lee, USEPA	T. Vanderver, P,B&B	Correspondence	42
	2	90/11/29	Letter re: 11/16/90 letter requested on behalf of the Thermo Chem	Timothy Vanderver, Patton, Boggs & Blow	Valdas Adamkus, USEPA	Correspondence	43

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			participating PRPs that a withdrawal of a directive from the RPM which purported to order additional work for the Thermo Chem site				
	3	90/12/13	Letter re: Agreements reached at meeting on 12/11/90 and subsequent telephone conversation concerning EPA's demand for additional RI/FS work at the Thermo Chem site	Timothy Vanderver, Patton, Boggs & Blow	Maria Gonzalez, USEPA	Correspondence	44
	6	90/12/26	Letter re: 10/11/90, letter from the USEPA recommending that the PRPs for the Thermo Chem Superfund site submit each chapter of the baseline risk assessment report separately for review	Jae Lee, USEPA	J. Imes, ERM-NC	Correspondence	45
	3	91/01/02	Letter re: Access to Waste Management, Inc. Property	Maria Gonzalez, USEPA	R. Leininger, WMNA	Correspondence	46
	7	91/02/14	Letter re: Comments upon Proposed Removal Action at Thomas Solvent of Muskegon, Inc.'s Bulk Storage Facility	Steven Kohl, Landman, Latimer, Clink & Robb	Jae Lee, USEPA	Correspondence	47
	28	91/03/15	Alternative Array Review Comments	Jae Lee, USEPA	John Imes, ERM	Correspondence	48
	5	91/03/22	Letter re: Thermo Chem RI/FS Alternative Array	John Imse, ERM-NC	Jae Lee, USEPA	Correspondence	49

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	4	91/04/22	Letter re: Response to 4/17/91 letter requesting applicable or relevant and appropriate State of Michigan requirements (ARARs) for the tank removal at the Thomas Solvent facility	Michael Adelman, MDNR	Stavros Emmanouil, USEPA	Correspondence	51
	2	91/07/03	Letter re: Approval of the Feasibility Study Operable Unit I, Thermo Chem Superfund Site	Jae Lee, USEPA	John Imes, ERM North Cent	Correspondence	52
	12	90/10/18	Thermo Chem Meeting Notes		Various	Meeting Notes	53
	23	83/03/14	Memorandum re: Preliminary Assessment	Claude Mays III, Ecology & Environment	USEPA File	Memorandum	54
	2	88/08/09	Memorandum re: Thermo Chem Health Consultation	Louis Fabinski, ATSDR	Bob Bowden, USEPA	Memorandum	55
	7	88/11/08	Memorandum re: Thermo Chem site Polrep 2	PC Lall, USEPA	Various	Memorandum	56
	2	89/02/08	Thomas Solvents- MID 017 274 093	David Ullrich, USEPA	Mary Gade, USEPA	Memorandum	57
	6	89/03/20	Memorandum re: Request for Removal Action at the Thermo Chem site	Partap Lall, Mary Gade, USEPA	Robert Bowden, USEPA	Memorandum	58
	10	89/07/10	Memorandum re:	John Imse,	Jae Lee, USEPA	Memorandum	59

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	4	90/02/10	Memorandum re: Technical Meeting held 1/17/90	John Imse, ERM-NC	Various	Memorandum	60
	14	90/05/29	Memorandum re: Dispute of 1/29/90 Accounting for Thermo Chem Inc. site	Maria Gonzalez, USEPA	Various	Memorandum	61
	1	90/06/26	Memorandum re: Approval of the First Draft, Fund Lead QAPP for additional Soil Sampling and Analysis of the Remedial Investigation/Feasibility Study Activity at the Thermo Chem Site	Valerie Jones, USEPA	John Kelley, USEPA	Memorandum	62
	8	90/11/14	Memorandum re: Summary of the Thermo Chem Meeting held 10/18/90	John Imse, ERM-NC	Various	Memorandum	63
	1	91/01/21	Memorandum re: Thermo Chem Site Baseline Risk Assessement	John Imse/ Elsie Millano, ERM-NC	Various	Memorandum	64
	2	91/04/19	Memorandum re: Polrep #1 for Thermo Chem RV2 site	Stavros Emmanouil, USEPA	Various	Memorandum	65
	2	91/04/24	Memorandum re: Polyrep #2 for Thermo Chem RV2 site	Stavros Emmanouil, USEPA	Various	Memorandum	66
	2	91/04/26	Memorandum re: Polrep #3 for Thermo Chem RV2	Stavros Emmanouil, USEPA	Various	Memorandum	67

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	2	91/05/01	Memorandum re: Polrep #5 for Thermo Chem RV2 site	Stavros Emmanouil, USEPA	Various	Memorandum	69
	10	90/12/11	Thermo Chem Additional Work Dispute Negotiation		Various	Other	70
	114	87/08/00	Thermo Chem, Inc. Administrative Order by Consent regarding Remedial Investigation and Feasibility Study	USEPA		Pleading/Orders	71
	13	90/01/12	Administrative Order Directing Compliance with Request for Access with cover letter	Maria Gonzalez, USEPA	James Sullivan	Pleading/Orders	7
	14	90/01/23	Administrative Order Directing Compliance with Request for Access to Conduct Remedial Investigation with cover letter	Maria Gonzalez, USEPA	James Sullivan	Pleading/Orders	73
	17	91/02/19	Thomas Solvent of Muskegon Property Unilateral Administrative Order	David Ullrich, USEPA	Various	Pleading/Orders	74
	24	00/00/00	National Priorities List - Thermo Chem Site	USEPA		Report/Studies	75
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	10	84/02/29	Pollution Incident Prevention Plan Thomas Solvent Co.	Donald Adams, Thomas Solvent Co.	Roger Przybysz, MDNR	Report/Studies	77
	71	86/03/07	III. Site Health and Safety Plan for Thermo Chem site - with cover letter	USEPA	USEPA	Report/Studies	78
	91	86/04/23	Hydrogeologic Study Thomas Solvent Co.	Keck Consulting Services, Inc.	USEPA	Report/Studies	79
	91	87/07/17	Detailed Statement of Work for Remedial Investigation Feasibility Study	Thermo-Chem Steering Committee	USEPA	Report/Studies	80
	8	88/07/27	Chemical Analysis of Water	MDPH		Report/Studies	81
	143	88/12/22	Sampling and Analysis Plan for Remedial Investigations and Feasibility Study Part 1 - Field Sampling Plan	Thermo-Chem Steering Committee	USEPA	Report/Studies	82
	305	88/12/22	Sampling and Analysis Plan for Remedial Investigation and Feasibility Study Part II - Quality Assurance Project Plan	Thermo-Chem Steering Committee	USEPA	Report/Studies	83
	41	88/12/22	Data Management Plan For Remedial Investigation	Thermo-Chem Steering Committee	USEPA	Report/Studies	84
	52	88/12/22	Health and Safety Plan for Remedial	Thermo-Chem Steering Committee	USEPA	Report/Studies	85

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			Investigation				
	90	88/12/22	Work Plan for Remedial Investigation Feasibility Study Revision 3	Thermo-Chem Steering Committee	USEPA	Report/Studies	86
	20	89/05/00	On Scene Coordinator's Report - Thermo Chem	USEPA		Report/Studies	87
	136	89/06/00	Technical Memorandum No 1. Remedial Investigation Task 1	Thermo-Chem Steering Committee	USEPA	Report/Studies	88
	387	89/12/22	Technical Assistance Work Plan Documents for the Thermo Chem site	USEPA		Report/Studies	89
	61	90/02/26	Thermo Chem RI/FS Technical Memorandum No. 2	John Imse, ERM-NC	Jae Lee, USEPA	Report/Studies	5
	9	90/03/07	Tes X Work Assignment No. C05068 Thomas Solvents Technical Assistance (TA) Field Activities Report: 3/1/90 and 3/5/90	James Strayton, Metcalf & Eddy	Jae Lee, USEPA	Report/Studies	91
	38	90/03/08	Appendum to Appendix G-Soil Gas SOP of the TA Work Plan QAPP Thomas Solvent	James Strayton, Metcalf & Eddy	Jae Lee, USEPA	Report/Studies	92
	26	90/05/11	Removal Action Plan for Thomas Solvents - with cover letter	Weston-Major Program Division	USEPA	Report/Studies	93
	12	90/05/25	Sampling and Analysis Plan Addendum for Remedial Investigation and Feasibility Study Part II - Quality Assurance	Thermo-Chem Steering Committee	USEPA	Report/Studies	94

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	15	90/06/11	The Determination of Volatile Organics in Water	Pace Inc.	USEPA	Report/Studies	96
	11	90/11/16	Transmittal of General Risk Assessment Requirements for the Thermo Chem RI/FS with cover letter	Cathy Pickrel, Metcalf & Eddy	Jae Lee, USEPA	Report/Studies	97
	153	91/01/00	Alternatives Array Document	Thermo-Chem Steering Committee	USEPA	Report/Studies	98
	10	91/02/25	Computer Modeling of Thermo Chem site with cover letter	Carl Stay, ERM-NC	Jae Lee, USEPA	Report/Studies	99
	100	91/03/00	Final Technical Assistance Report For Thomas Solvent Site	Metcalf & Eddy, Inc.	USEPA	Report/Studies	100
	84	91/03/28	Draft Remedial Investigation Report Review Comments Thermo Chem Superfund site with cover letter	Jae Lee, USEPA	John Imse, ERM-NC	Report/Studies	101
	5	91/04/00	EPA Includes Thomas Solvent in Thermo Chem Contamination Study; Plans to remove Underground Tanks	USEPA		Report/Studies	102
	362	91/05/00	Feasibility Study Thermo Chem Site	ERM North Central	USEPA	Report/Studies	103
	52	91/05/29	Analysis results for soils from Thomas Solvents P.N. 183	Barry Sperling, ITC	Stavros Emmanouil, USEPA	Report/Studies	104

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	25	91/05/31	Analysis results for the tenax air samples from Thomas Solvents P.N. 183	Barry Sperling, ITC	Stavros Emmanouil, USEPA	Report/Studies	106
	55	91/06/05	Final Analytical Report - Solvent Reclaiming Site	Richard Mauch/ Marvin Stephens, Wadsworth Alert Laboratories	USEPA	Report/Studies	107
	6	91/06/12	Letter re: Thermo Chem Corrections to Remedial Investigation Report	David Johnston, ERM - North Central	Jae Lee, UEPA	Report/Studies	108
	94	91/06/24	Thermo Chem Site Corrections to Section 6.0 of the Remedial Investigation Report	Elsie Millano, ERM North Central	Jae Lee, USEPA	Report/Studies	
	22	91/07/02	Transmittal of Explanation Baseline Risk Assessment Calculations for the Thermo-Chem and Thomas Solvent Sites	Cathy Pickrel, Metcalf & Eddy	Jae Lee, USEPA	Report/Studies	110

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	2	91/05/02	Letter re: Response to USEPA Comments - Thermo Chem RI/FS Sampling and Analysis Plan Addendum 2 Documents	D. Johnston-ERM North Central, Inc.	J. Lee-U.S.EPA, RPM	Correspondence	1
	11	91/07/02	Letter re: Thermochem Bottleware Issues	R. Camp-Compuchem Laboratories, Inc.	D.Johnston,ERM-North Cent	Correspondence	2
	2	91/07/03	Letter re: Approval of the Feasibility Study, Operable Unit I - Thermo Chem Site	J. Lee-U.S.EPA, RPM	J. Isme,ERM-North Central	Correspondence	3
	1	91/07/22	Letter forwarding 3 copies of the final revisions of the RI/FSP and Addendum 2 QAPP for both the Stream Sampling and Monitoring Well activities	D. Johnston,ERM-North Central, Inc.	J. Lee-U.S.EPA, RPM	Correspondence	4
	1	91/07/25	Letter re: Request for an additional 30 days to provide comments to the U.S.EPA's Proposed Plan	R. Murphy-Ross & Hardies	P. Schutte-U.S.EPA, OPA	Correspondence	5
	1	91/08/06	Letter re: The public comment period for the Thermo Chem Superfund Site has been extended until Sept. 9, 1991	M. Gonzalez-U.S.EPA, Atty for ORC	R. Murphy-Ross & Hardies	Correspondence	6
	2	91/08/08	Letter re: Requesting cooperation in assisting ERM with completing an environmental investigation	R. Boy,ERM-North Central, Inc.	Rev. W. Burrel	Correspondence	7

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	3	91/09/06	Letter re: Request for access to resident's wooded property with map attached	D. Johnston, ERM-North Central, Inc.	Bishop & Mrs. W. Burrel	Correspondence	9
	8	91/07/00	EPA Proposes Cleanup Plan for Thermo Chem Superfund Site	U.S.EPA-Region V		Fact Sheet	10
	1	91/08/01	RI/FS Sampling Locations	Metcalf & Eddy		Map	11
	2	91/07/03	Memo re: Contingent Approval of QAPjP Addendum 2 for RI Activities	V. Jones-U.S.EPA	J. Kelley-U.S.EPA	Memorandum	12
	2	91/09/03	Memo re: Remedy Delegation Report	D. Clay-U.S.EPA	V. Adamkus-U.S.EPA	Memorandum	13
	1	91/07/08	The U.S.EPA Announces a Public Meeting and Invites Public Comment on a Proposed Plan for Addressing Contamination Problems	The Muskegon Chronicle	Public	Public Comments	14
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	2	91/07/16	Letter re: Public Comment on Proposed Plan	D. Anderson-Citizens United for the Environment	P. Schutte-U.S.EPA, OPA	Public Comments	16

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	3	91/08/08	Letter re: EPA Proposed Plan to Correct Contamination Problems with comments attached	C. Barbieri-Foster, Swift, Collins, & Smith, P.C.	P. Schutte-U.S.EPA, OPA	Public Comments	18
	35	91/09/09	Letter re: Comments on the Thermo Chem Site Proposed Remedial Action Plan	E. Smary-Warner, Norcross & Judd	P. Schutte-U.S.EPA, OPA	Public Comments	19
	45	91/07/05	U.S.EPA Proposed Plan to Correct Contamination Problems at the Thermo Chem Superfund Site	U.S.EPA		Reports/Studies	20
	153	91/07/22	Surface Water and Stream Sediment Sampling and Analysis Plan Addendum 2 for Remedial Investigation and Feasibility Study Part II QAPP with Appendices	ERM-North Central, Inc.	Thermo-Chem Steering Comm	Reports/Studies	21
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