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May 1993

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Superfund Record of Decision:

T. H. Agriculture & Nutrition (Albany Plant), GA

50272-101

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16. Abstract (Limit: 200 words)

The T.H. Agriculture & Nutrition (Albany Plant) site consists of two former pesticide formulation facilities in Albany, Georgia. Land use in the area is predominantly commercial and light residential. Since the 1950s, the site has been used as a formulation and packaging plant for agricultural chemicals. In 1967, the site was purchased by T.H. Agriculture & Nutrition (THAN). A small warehouse that formerly existed on the western portion of the site was used for chemical storage and distribution of agricultural chemicals; and a dry formulations building was used in the 1960s and 1970s to combine technical materials in specified proportions for products. A contiguous storage area to the west of the dry formulations was used to house technical materials. The liquid formulation area was used to blend and transfer the material to containers for distribution. Wettable powders replaced liquid formulations in 1976, and little pesticide formulating occurred after 1978. The blendings tank in the liquid formulation area was rinsed with xylenes between batches of different products, and the rinsate was discharged into the drainage site, which ran east to west of the site across the THAN parcel. Onsite operations at the site ceased in 1982. In 1984, the State required THAN to conduct extensive site actions, which included

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - T.H. Agriculture & Nutrition (Albany Plant), GA
First Remedial Action
Contaminated Media: soil, gw
Key Contaminants: VOCs (benzene, PCE, TCE, toluene, xylenes), other organics (pesticides)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 56
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

demolition of buildings, excavation and offsite disposal of site surface and subsurface soil, and establishment of a vegetative cover. During the RI, an onsite pit was discovered, which contained plastic vials of pure pesticide product and contaminated soil. As a result, in 1992, EPA conducted a second removal, which included demolition and removal of approximately 20,000 tons of contaminated onsite soil and debris from the western portion of the site; and onsite treatment of approximately 3,000 tons of soil containing greater than 100 mg/kg total pesticides using thermal desorption. Additionally, NAPLs were detected floating on the surficial aquifer in the eastern portion of the site. This ROD addresses remediation of contaminated soil in the western portion of the site and contaminated ground water in the residuum and upper aquifers, as OU1. A future ROD will address the contaminated soil on the eastern portion of the site, as OU2. The primary contaminants of concern affecting the soil and ground water include VOCs, including benzene, PCE, TCE, toluene, and xylenes; and other organics, including pesticides.

The selected remedial action for the site includes inspecting and maintaining the vegetative cover from the previous removal action; pumping and treating contaminated ground water onsite using UV/oxidation, based on the results of treatability studies, followed by treatment with granular activated carbon as a polishing step; discharging the treated water onsite to either an infiltration gallery or offsite to a POTW, based on the result of a treatability study; pumping ground water in the eastern portion of the site to extract NAPLs from the surficial aquifer, with subsequent offsite incineration of the recovered free product; monitoring ground water and surface water; and implementing institutional controls, including deed and land use restrictions. The estimated present worth cost for this remedial action is $4,100,000.

PERFORMANCE STANDARDS OR GOALS:

Chemical-specific ground water cleanup goals are based on SDWA MCLs and MCLGs or health-based levels, and include aldrin 0.000054 mg/l; alpha-BHC 0.0014 mg/l; beta-BHC 0.0051 mg/l; DDT 0.027 mg/l; dieldrin 0.00057 mg/l; EDB 0.00005 mg/l; and toxaphene 0.003 mg/l.

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

T H AGRICULTURE & NUTRITION SITE

OPERABLE UNIT ONE

ALBANY, DOUGHERTY COUNTY, GEORGIA

PREPARED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ATLANTA, GEORGIA

DECLARATION
of the
RECORD OF DECISION
OPERABLE UNIT ONE

SITE NAME AND LOCATION

T H Agriculture & Nutrition Site
Albany, Dougherty County, Georgia

STATEMENT OF BASIS AND PURPOSE

This decision document (Record of Decision), presents the selected remedial action for Operable Unit One for the T H Agriculture & Nutrition (THAN) Site, Albany, Georgia, developed 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) 42 U.S.C. Section 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP) 40 CFR Part 300. This decision is based on the administrative record for the THAN site.

The State of Georgia, as represented by the Georgia Environmental Protection Division (GaEPD), has been the support agency during the Remedial Investigation and Feasibility Study process for the T H Agriculture & Nutrition site. In accordance with 40 CFR 300.430, as the support agency, GaEPD has provided input during this process. The State of Georgia, as represented by GaEPD, has concurred with the selected remedy.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF SELECTED REMEDY

This operable unit is the first of two that are planned for the Site. This alternative calls for the design and implementation of response measures which will protect human health and the environment. The first operable unit addresses the source of the contamination on the western parcel of the Site as well as the principle threat of groundwater contamination across the entire Site. While this remedy does address the principal threats at the Site, the second operable unit will involve continued study and remediation of a second source of contamination on the eastern parcel of the Site.

The major components of the selected remedy for operable unit one include:

- Extraction of the free product Non-Aqueous Phase Liquid (NAPL) lens accumulating on top of the groundwater with off-site incineration;
- Extraction of the groundwater with subsequent onsite treatment by ultraviolet/oxidation treatment with granulated carbon adsorption as a polishing step if needed, with the treated water being discharged to an onsite infiltration gallery or to the local Publicly-Owned Treatment Works (POTW) with a permit from the City of Albany or to a local surface water body via an NPDES permit;
- Quarterly monitoring and maintenance of the vegetative cover that will be established as part of the removal order;
- Monitoring to determine the effectiveness of the dewatering in reducing the contaminant migration; and
- Institutional controls for land use and groundwater use restrictions.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element. Finally, it is determined that this remedy utilizes a permanent solution and alternative treatment technology to the maximum extent practicable.

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

for PATRICK M. TOBIN, ACTING REGIONAL ADMINISTRATOR

5-21-93
DATE

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Decision Summary
Record of Decision
Operable Unit One

T H Agriculture & Nutrition Site
Albany, Georgia

1.0 SITE LOCATION AND DESCRIPTION

The T H Agriculture & Nutrition (THAN) Site (hereinafter, "the Site") is located at 1401 and 1359 Schley Avenue in Albany, Georgia. For an area location map and general Site map, see Figures 1 and 2, respectively. The Site consists of two former pesticide formulation facilities where various liquids and dry formulations of pesticides and other chemical compounds were handled for a period of approximately thirty years. The Site is made up of property currently owned by T H Agriculture & Nutrition Company, Incorporated ("the western parcel"), and property currently owned by Mr. Larry Jones which contains an active welding supply store ("the eastern parcel"). The western parcel (1401 Schley Avenue) consists of approximately seven acres. Buildings were located in the southeastern portion of the THAN property; however, only one permanent structure remains onsite. This structure, commonly called the east warehouse, is located along the southeastern border of THAN parcel. The eastern parcel (1351 Schley Avenue) consists of approximately five acres, with several structures remaining in the central portion of the property. The Site is bordered on the east by residences, on the south by Schley Avenue, on the west by a Seaboard Coastline Railway line, and on the north by a construction company. To the west and southwest are lightly populated residential areas. Several motels are within a one mile radius of the Site, with the closest being located northeast of the Site. Located approximately 300 feet south of the Site is an elevated expressway and further south, a large commercial section of Albany.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The western parcel has been used as a formulation and packaging plant for agricultural chemicals since the 1950's. Thompson-Hayward Chemical Company (renamed THAN) purchased the property from Planters Chemical Company in 1967. Year end inventory records for the Thompson-Hayward Chemical Company are available beginning in 1973. Included on the list of products previously stored at the western parcel are the insecticides lindane, 4,4'-dichlorodiphenyl 1,1,1-trichloroethane (DDT), toxaphene, methyl parathion, malathion, and parathion. Herbicides included on the lists are the compounds 2,4-dichlorophenoxy butyric acid amine and dinitrobutylphenol (DNBP). The small warehouse that formerly existed on the western parcel was used for the storage and distribution of agricultural chemicals. The

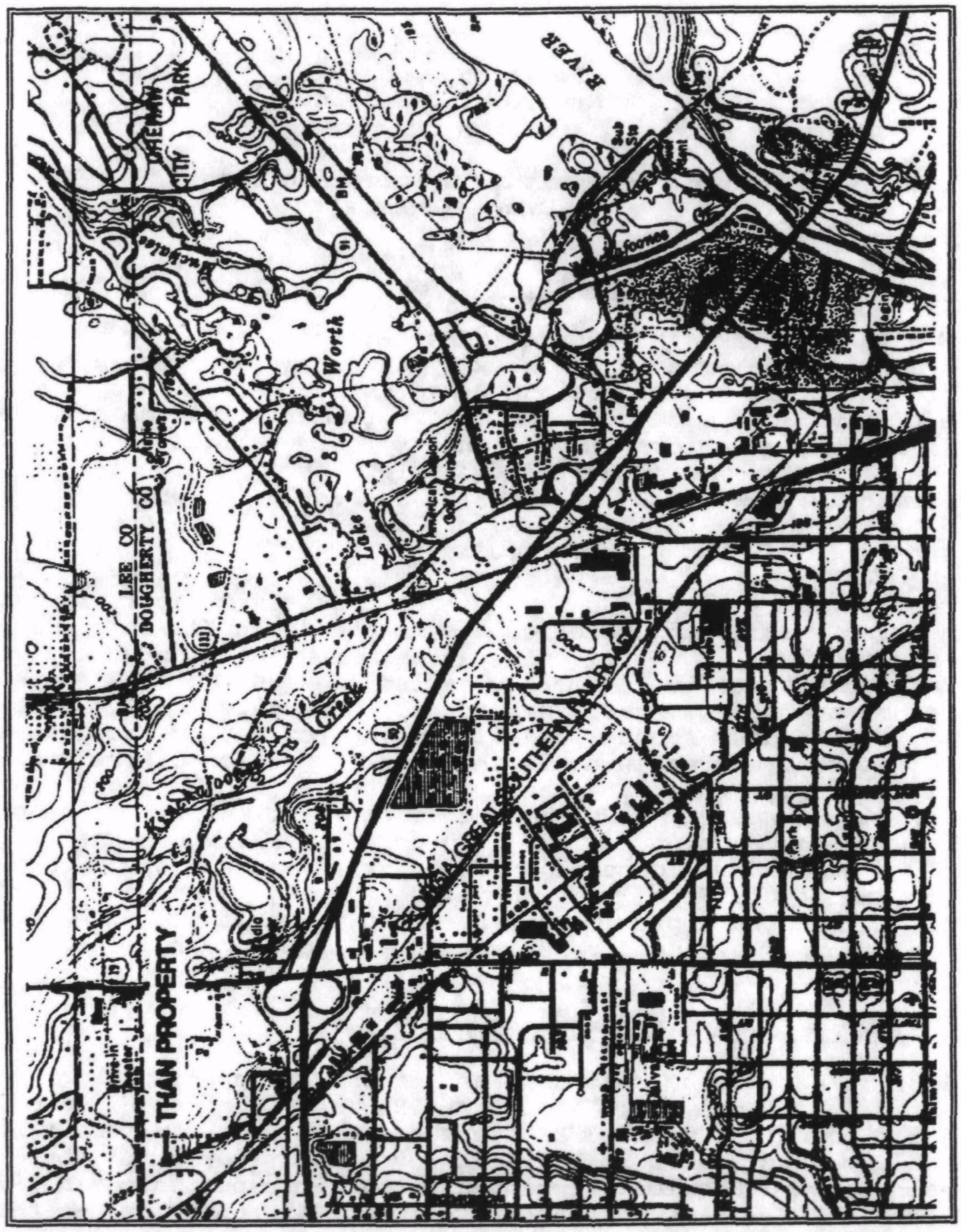

Figure 1
Area Map for Albany, Georgia

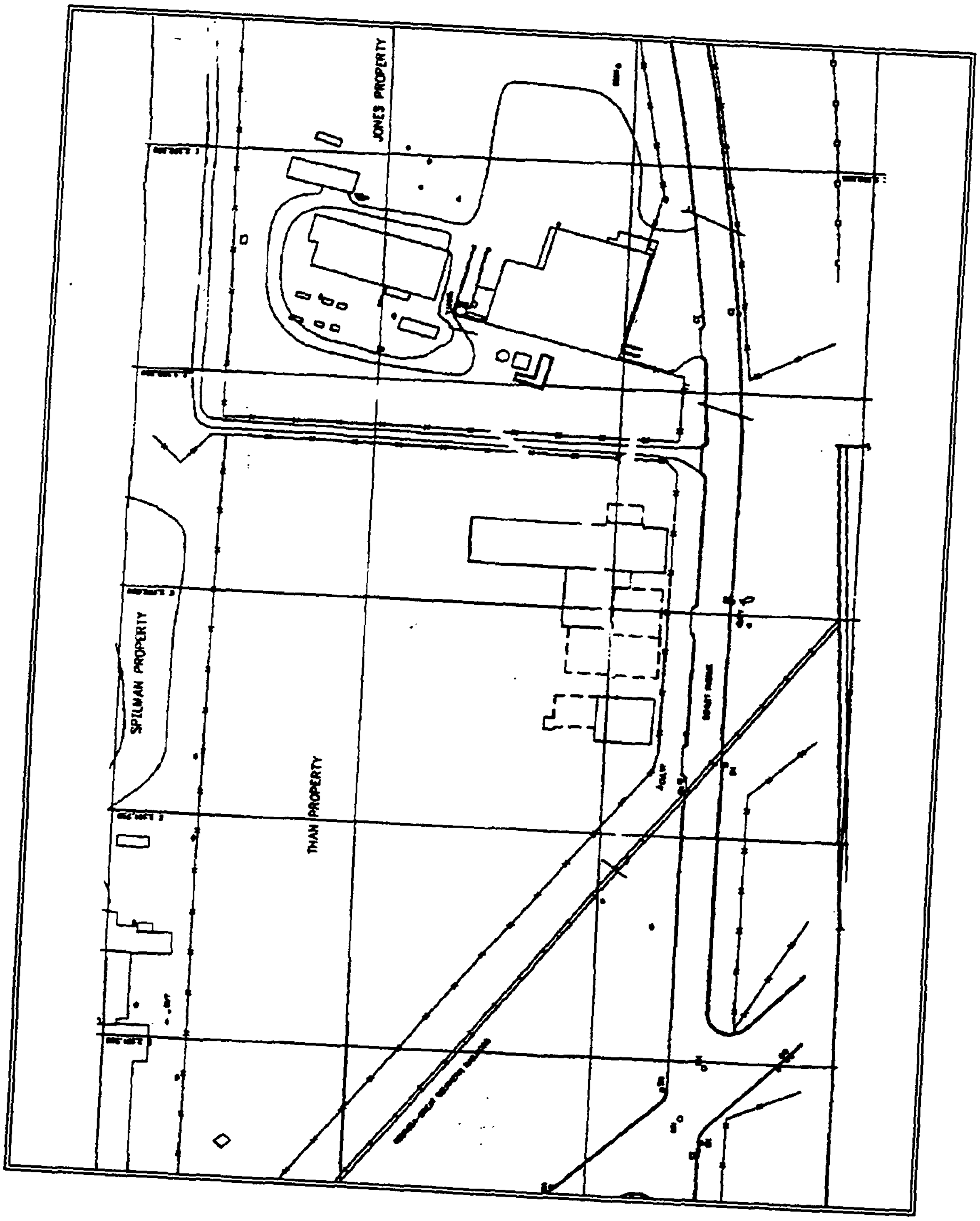

Figure 2
Site Map for the T H Agriculture & Nutrition Site

dry formulations building was used in the 1960's and 1970's to combine technical materials in the proportions specified for a particular product. The contiguous storage area to the west of the dry formulations building was used to warehouse technical materials prior to use in dry formulations. The liquid formulating area was used from approximately 1973 until approximately 1978 and contained a blending tank, a weigh scale, and a can filling apparatus. The correct amounts of liquid technical materials were combined in the blending tank, transferred to the holding tank, and the product was subsequently transferred via the can filling apparatus to containers for distribution. Wettable powders began replacing liquid formulations in approximately 1976. Very little, if any, pesticide formulating occurred at the THAN parcel after 1978. Housekeeping in the former dry formulations building on the western parcel included sweeping technical materials and dust from the floor. These sweepings were routinely bagged for disposal. Trucks used to carry technical materials or products were also swept clean as necessary. Typically, trucks were swept out in the eastern portion of the Site in the yard adjacent to the large warehouse. A drainage ditch ran east to west across the THAN parcel behind the liquid formulations building to the low-lying area in the southwestern portion of the property. The blending tank in the liquid formulating area was rinsed between batches of different products with xylene and was then discharged to the drainage ditch.

Business operations ceased in 1982. THAN conducted removal activities at the Site in 1984 to remove surficial soils in accordance with a cleanup plan approved by the Georgia Environmental Protection Division (GaEPD). The cleanup plan identified areas of soil exceeding cleanup criteria established by GaEPD based on leachable organochlorine insecticide concentrations as measured using the Extraction Procedure (EP) Toxicity test method. Extensive remedial activities were conducted on the THAN parcel in cooperation with GaEPD from July through September 1984. Major remedial activities included demolition of several buildings, excavation of selected surface soils and subsurface disposal areas, installation of a perimeter fence, and establishment of vegetative cover. Excavated soils and debris were removed and disposed off-site in a permitted hazardous waste landfill. During removal, soil excavation continued until the GaEPD-specified cleanup criteria were met. Soil samples were collected and analyzed during and after excavation activities to confirm satisfaction of the GaEPD cleanup criteria.

A second removal at the THAN parcel was initiated under a Unilateral Administrative Order (UAO) from EPA in March 1992. This removal action is currently ongoing. Figure 3 portrays the extent of the current removal on the western parcel. During the Remedial Investigation (RI) conducted at the Site, a pit containing pure product and high levels of contamination under the former wet mix building were found to exist. This pit contained plastic vials containing product with approximately 12,500 mg/kg. This pit was located in a former burial area on the western portion of the THAN

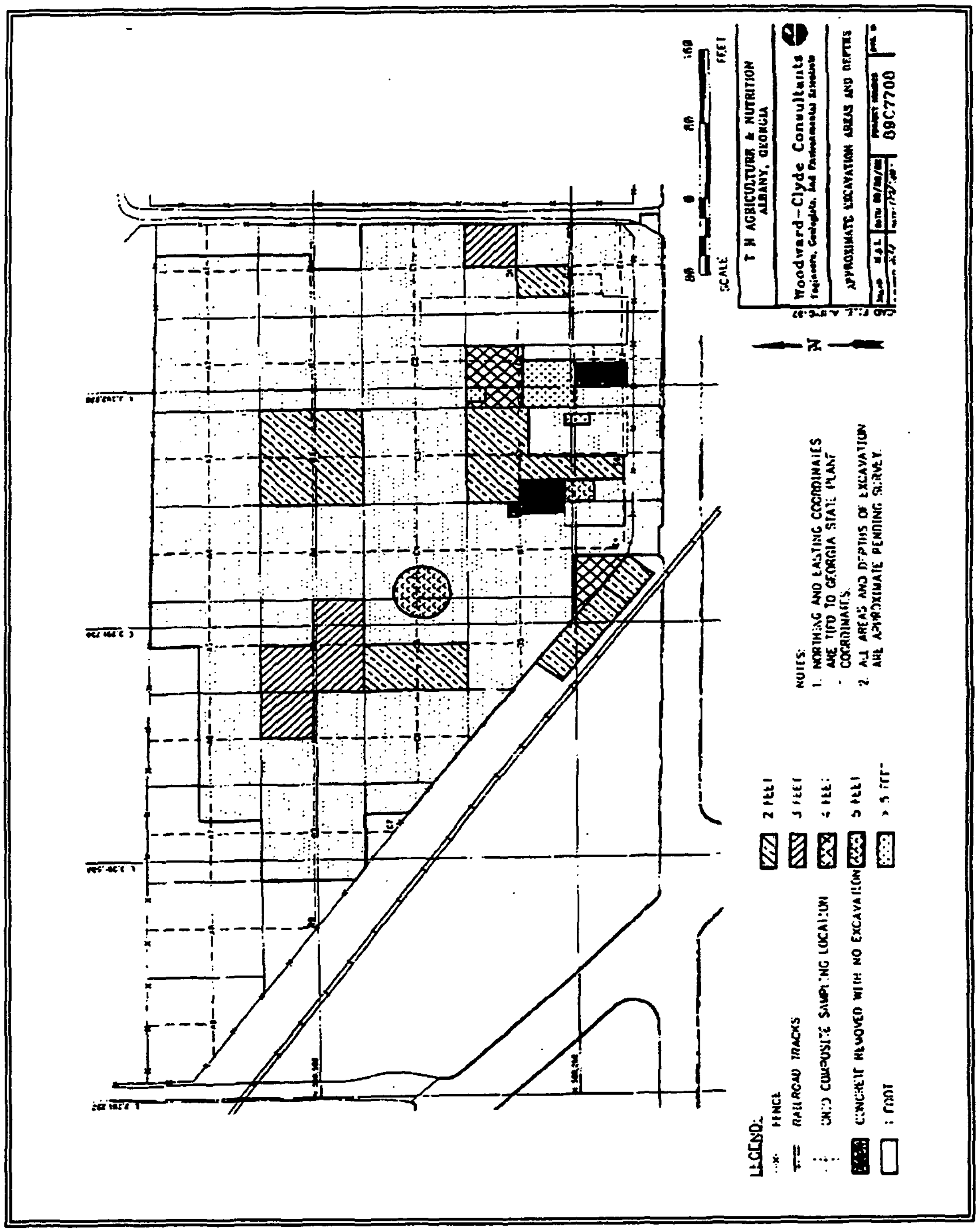

Figure 3
Map Showing Extent of 1992 Removal Action
(Excavated Areas are Shaded)

property. Due to the levels of soil contamination found across the western parcel, the second removal action was deemed necessary at this Site to protect human health and the environment. The removal included demolition and removal from the western parcel of several onsite structures and for the excavation and removal of soil and debris. According to the UAO, excavated areas are to be backfilled and a uniform engineered clay cover will be placed over the facility grounds. Due to the inability to find an off-site incinerator currently in compliance or capable of handling the volume of soil removed, onsite low-temperature thermal desorption of those soils which contain greater than 1000 ppm total pesticides is expected to be completed during 1993. Instead of completely incinerating the contaminated material, low-temperature thermal desorption separates the water vapor and organics from the contaminated media. The contaminated off-gases can then be treated by filtering through a bed of carbon. Post-removal confirmation samples show that levels of contamination in the in-situ soils on the western parcel have been decreased from greater than 1000 ppm of total pesticides to levels of less than 20 ppm total pesticides. The top foot of soil has been removed at approximately six of the seven acres on the THAN parcel, with specific areas being excavated to seven feet below land surface. Over 20,000 tons of soil have been removed from the western parcel of the Site. Excavated areas will be backfilled with common fill and revegetated pursuant to the removal order.

The eastern parcel has historically been owned by several agricultural chemical companies, beginning in 1964. The production of fertilizers and the formulation of pesticides has occurred on the eastern parcel. Although some soil samples have been collected on the eastern parcel as part of the RI for operable unit one, a second RI is planned for the eastern parcel to more fully characterize that parcel (operable unit two). However, the groundwater contamination that exists underneath the eastern parcel is addressed in this ROD.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

An availability session at a local library and community interviews with local officials was held at the start of field work for the RI for operable unit one on December 12, 1990. The main branch of the Dougherty Public Library at 300 Pine Street was chosen as the local information repository for the Site. On March 12, 1992, THAN held a public meeting to discuss the second removal action at the Site. In addition, a fact sheet concerning the RI for operable unit one was sent to the mailing list in May, 1992.

The public comment period on this ROD was September 14, 1992 through November 14, 1992. A public meeting was held on Thursday, September 24, 1992 where representatives for EPA answered questions regarding the Site and the proposed plan under consideration. The administrative record was available to the public at both the information repository maintained at the Dougherty Public Library and at the EPA Region IV Library at 345 Courtland Street in Atlanta, Georgia. The notice of availability of these two documents was published in the Albany News-Herald on September 10, 1992. Responses to the significant comments received during the public comment period and at the public meeting are included in the Responsiveness Summary, which is part of this ROD in Appendix A.

This decision document presents the selected remedial action for operable unit one of the THAN site, chosen in accordance with CERCLA, as amended by SARA, and the NCP. The decision for this Site is based on the administrative record. The requirements under Section 117 of CERCLA/SARA for public and state participation have been met for this operable unit.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

EPA has organized the work at this Superfund Site into two operable units (OUs). These units are:

- OU one: Contamination in the residuum and the upper Ocala aquifers underneath the entire Site and contamination of soils on the western portion (THAN property) of the Site.

- OU two: Contamination of the soils on the eastern portion (Jones property) of the Site.

OU #1 addresses both the source of groundwater contamination in the soils on the western parcel as well as the groundwater contamination underneath the entire Site. The NAPL plume is also being addressed in OU #1. The purpose of this operable unit is to initiate groundwater restoration, collect data on aquifer response to remediation, prevent current or future exposure to the contaminated soils, and reduce contaminant migration into the groundwater. Operable unit one will be consistent with any planned future actions.

The planned operable unit two will address the source of contamination on the eastern parcel of the property. This Site was divided into two operable units after the RI report showed that continuous groundwater contamination is present under both properties, and that source areas exist on the eastern parcel which need to be investigated further. Additional PRP's are involved on the eastern parcel since that property was owned and operated separately from the western parcel.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 GEOLOGY/SOILS

The sedimentary units outcropping in Dougherty County range from Quaternary to Cretaceous in age. Only the uppermost geologic units consisting of the Residuum, the Ocala Limestone, the Claiborne Group, and the Wilcox Group are pertinent to this study. The Residuum is typically a silty clay with minor varying amounts of sand, limestone fragments, and lignite. It has an average thickness onsite of approximately 26 feet and thickens to the northwest. The lithology and structure of the deposit is influenced primarily by the amount of weathering and the effect of precipitation on the highly soluble limestone. The Residuum overlies the Ocala Limestone. The Ocala consists of medium to fine-grained highly weathered, fossiliferous limestone with some silt and sand. The surface of the limestone gently undulates and contains depressions, typical of karst terrains. The limestone grades from a highly weathered material at the top of the formation to a more brittle rock approximately 30 feet (about 60 feet below ground surface) into the formation. The following table provides information concerning the generalized stratigraphy.

Table 1
Geologic and Hydrogeologic Equivalents, Albany Area

Approximate Thickness (Feet)	Geologic Sequence		Hydrogeologic Sequence
	Group	Formation	
15-50	Residuum		Upper water-bearing
175	Ocala		Floridan Aquifer
230	Claiborne	Lisbon	
		Tallahatta	
	Wilcox	Hatchetigbee	
120		Tuscahoma	Clayton Aquifer
180	Midway	Clayton	
80	Providence Sand		Providence Sand Aquifer
300	Ripley		Confining Unit

The primary organochlorine (OC) pesticides detected in soil on the western parcel include: toxaphene, 4,4'-DDT and its metabolites, beta-BHC, alpha-BHC, and dieldrin. The analytical results for the surface and subsurface soil samples indicated that the surface soils have the highest concentrations of the OC pesticides and that the concentrations decrease significantly with depth. However, some subsurface soil borings reflect an increase in OC pesticide concentration between the 10-foot and 15-foot intervals. The physical/chemical nature of the OC pesticides suggests that they are not readily biodegraded in the surface environment. The OC pesticides are generally not soluble in water. However, they are significantly more soluble in organic solvents, such as xylene. The OC pesticides also have more affinity for organic matter in soils, which is generally highest in concentration in the upper limits of the vadose zone. The higher concentrations of OC pesticides observed in subsurface soils also had detectable xylenes which suggests that the mobility of the OC pesticides in soil is probably related to the presence of the solvent. The presence of the OC pesticides and their relatively high concentrations in the surface soils attest to their relative immobility and non-biodegradability.

Organophosphorus (OP) pesticides are essentially absent from surface and subsurface soil samples. The OP pesticides were detected in subsurface soil samples collected underneath the former liquid formulation pad, an area that is not exposed to the atmosphere and does not receive direct surface infiltration.

The two major herbicides detected on the western parcel are dinoseb and MCPA. The highest concentrations of these compounds were detected in surface soil samples and, like the OC pesticides, decreased in concentration with depth. The frequency of detection of these compounds, however, was low and somewhat localized. The herbicides are also similar to the OC pesticides in their stability and immobility in soil. They are, however, more mobile in the presence of organic solvents.

Volatile and semivolatile organic compounds were generally found in subsurface soil samples, albeit infrequently and at low concentrations. Most of the surface soil samples were not analyzed for volatile organic compounds based on the knowledge that they are readily volatilized or biodegraded. Thus, since operations at the western parcel ceased several years ago and a removal of the surface soils took place in the early eighties, volatile organic compounds (VOCs) were assumed to not be present in the surface soil.

Surface Water and Sediments

The area surrounding the Site is drained by the Flint River and Kinchafoonee Creek systems. Kinchafoonee Creek, located approximately 0.4 miles to the east of the THAN site is the nearest natural body of surface water. However, there are no swales, drainage ditches, or intermittent streams that drain from the Site directly to surface waters.

The natural drainage patterns at the Site were altered during development of the Site and during the two removal actions that have occurred. Prior to the removal action that is currently ongoing, most of the runoff water from the western parcel flowed to a depression in the southwest portion of the property. This depression drains through a culvert beneath the Georgia-Great Southern tracks and into the storm sewer beneath Schley Avenue. This storm Sewer Connects to the storm sewer system beneath Palmyra Road.

Some drainage from the southeast portion of the western parcel enters a curb inlet on Schley Avenue and flows into a ditch south of Schley Avenue. Storm water flows south through the ditch to a point south of the Liberty Expressway where it joins a ditch draining the west side of the eastern parcel. From this point the storm water flows west through a culvert beneath the Georgia-Great Southern railroad tracks and into a depression south of the Liberty Expressway. Runoff from the Interstate Truck Leasing facility which is south of the depression also flows into this depression. The depression drains into the storm sewer system beneath Palmyra Road through an inlet.

OC pesticides such as DDT were detected in the sediment samples both on- and off-site. However, the concentrations of the pesticides dropped significantly in the off-site collection locations as compared to the onsite collections. As expected, the pesticides are bound to the sediments rather than to the surface water, since the water samples collected in the depression south of the Liberty Expressway did not detect any contamination.

Hydrogeology

The shallow groundwater system is contained in the residuum soils and the upper portion of the Ocala Limestone. Infiltration of rainfall runoff through the surface sands and residuum materials is the major source of recharge to the aquifers. Typically, the groundwater reservoirs are recharged most during the winter and spring months when precipitation is high and evapotranspiration is low. Conversely, little recharge is added to the groundwater system during the dry summer months in which heavy agricultural pumpage causes regional drawdowns in the water level elevations. Recharge rates are directly affected by the transmissivity and thickness of the overburden residuum.

Shallow water levels have been observed to rise more than 10 feet within hours of any intense rainfall event. The magnitude of the rise in water levels are unexpected since the Site is overlain by a low permeability clay layer similar to a "cap." The magnitude of the response is also unexpected since the volume of water infiltrating through this layer (cap) is very low. The increase in water levels are due to a hydraulic pressure increase transmitted laterally throughout the residuum and weathered Ocala from runoff infiltrating more permeable sediments in a topographically low areas where ponding of surface water temporarily occurs.

This Site has several unique hydrogeologic features. First, it is unusual for a very low permeability clay which effectively inhibits surface recharge to exist at land surface in the Dougherty Plains. Nevertheless, recharge occurs through numerous depressions which transmit water rapidly to a lower more transmissive unit (lower Floridan). Secondly, although the total porosity of the Residuum and upper Floridan Aquifer is high (30-50 percent), very little "drainage" of water (probably less than 5 percent) of these units takes place during drought periods.

A comparison of piezometric maps before and after a heavy rainfall event may suggest as though the storage in the aquifer "has been filled," which causes an increase in the gradient and that water is freely flowing. However, this is not the case. Based on the number of laboratory permeability tests and slug tests conducted within the upper 30 feet of Residuum and limestone, the actual physical movement of water (vertically or horizontally) is not significant. Except for the existence of some paths of preferential groundwater flow in the more brittle and permeable sections of the limestone, the volume of water moving laterally through the Site is relatively small.

Solution features such as joints, fractures, and solution channels are generally not present in the shallow aquifer. Based on the slug tests and aquifer pumping tests conducted onsite, there appears to be "channels" of preferred groundwater flow in the weathered upper Floridan aquifer. These channels are formed by unequal weathering of the limestone and are relatively narrow and few in number. Most of the upper Floridan is very fine grained and appears in large "islands" of low permeability separated by the more permeable channels. Most wells are screened into the islands; however, wells located near or in the channels will often have a much greater ability to produce water.

The most direct path of the contaminants to the groundwater was by the slow infiltration through the surficial sediments to the water table. Once the percolating water reached the water table, the horizontal rate of flow is toward the northeast at a very slow rate. Since most of the mobile contaminants were less dense than water, a NAPL lens accumulated on top of the groundwater. The lens has migrated only slightly east and northeast over the history of the Site.

The shallow groundwater monitoring wells reported the highest concentrations of the chemicals of concern. The major compounds detected were the OC pesticides and VOCs. The predominant OC pesticides in the groundwater are the BHC isomers and DDT (not toxaphene which was the predominant OC pesticide found in the soil). The presence of these OC pesticides in the westernmost wells was not always associated with the presence of a detectable concentration of an organic solvent or a significant concentration of the specific OC pesticides in the subsurface soil that was close to having contact with groundwater. However, the presence of 4,4'-DDT in the monitoring wells along the west edge of the eastern parcel was associated with the presence of an organic solvent, primarily xylene. The vertical and horizontal movement of the non-aqueous phase liquid (NAPL) and the interaction of the groundwater may influence the solubility of isolated pockets of NAPL left in the soil as the pressure from the groundwater movement vertically forces the NAPL upward.

The compound 1,2-dibromoethane (EDB) , was detected primarily in the western portion of the eastern parcel. EDB is water soluble, biodegradable, and volatile. When released to a surface soil environment, it generally undergoes rapid biodegradation. However, a large release would result in infiltration of EDB and its rapid

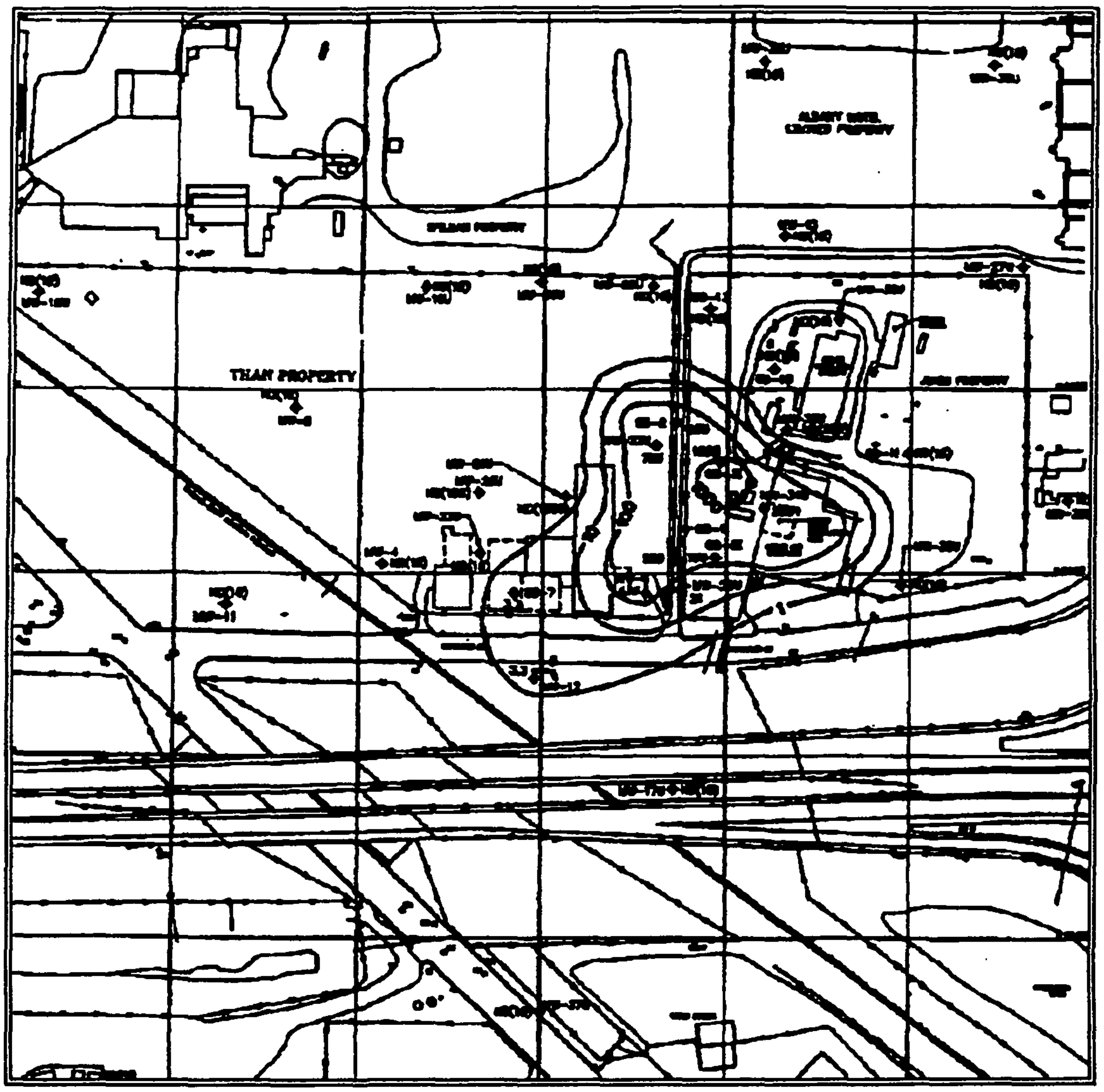

Figure 4
Map of Isopleths of 1,2-Dibromoethane (EDB) in Groundwater

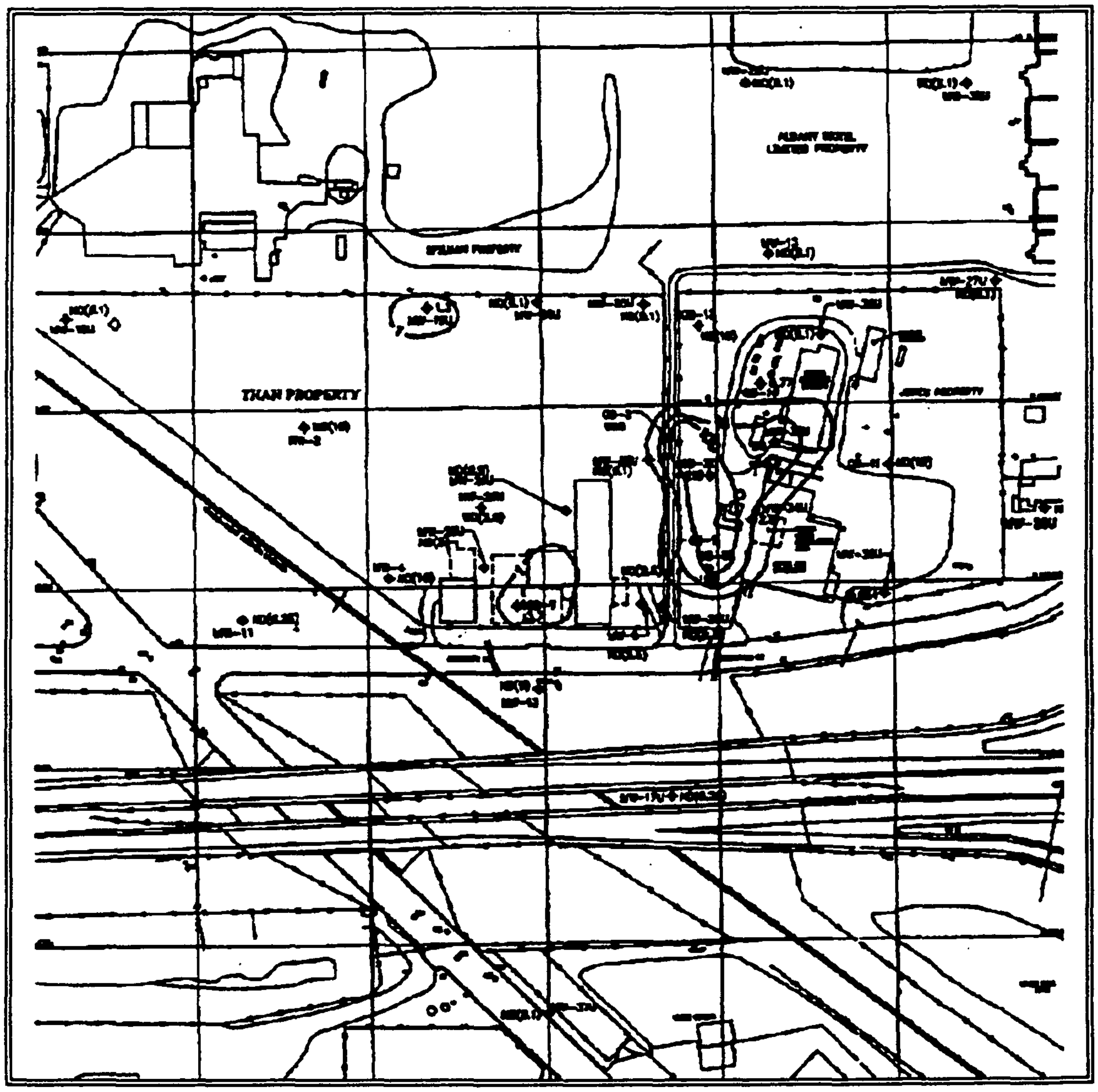

Figure 5
Map of Isopleths of DDT in Groundwater

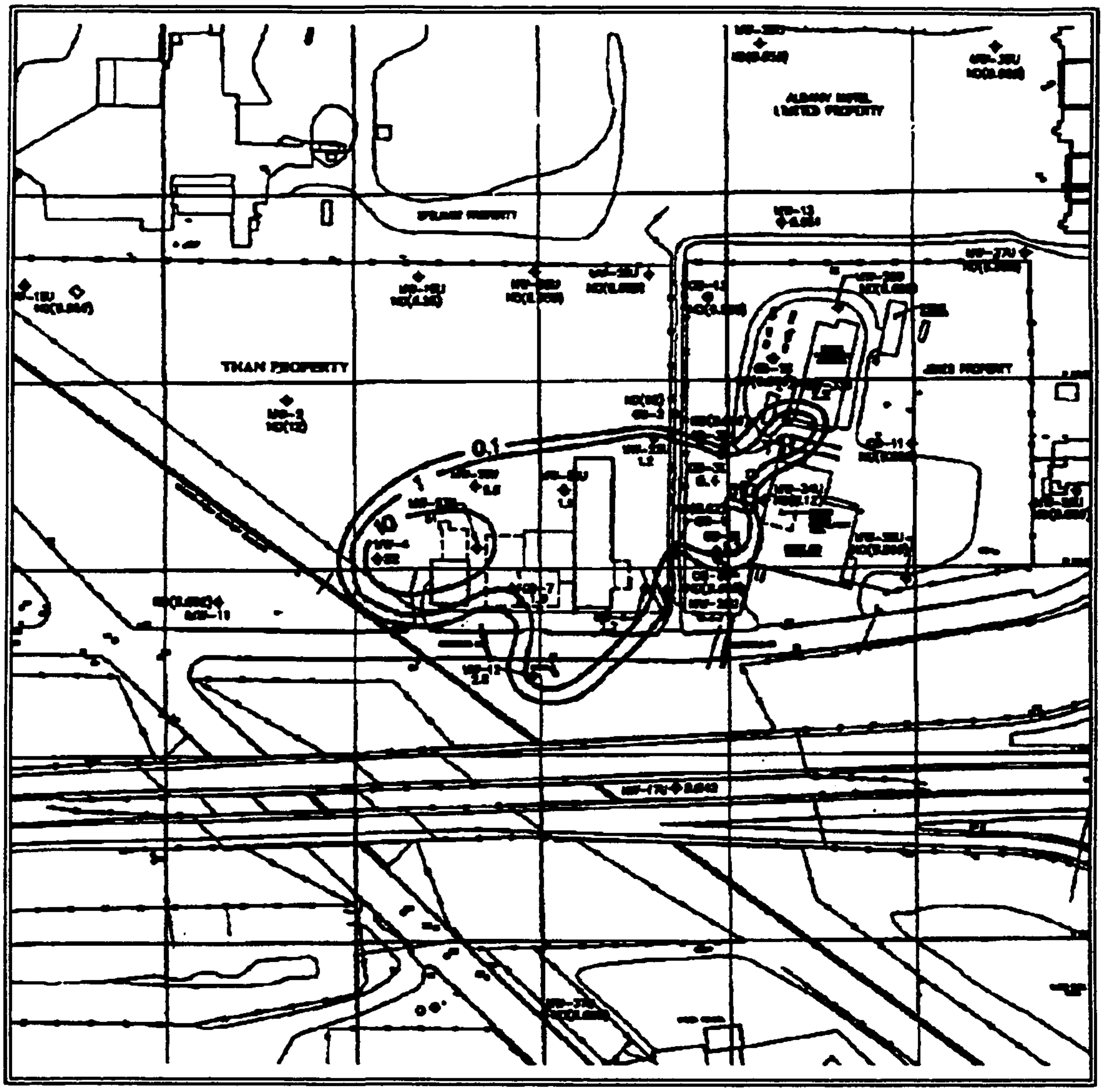

Figure 6
Map of Isopleths of α-BHC in Groundwater

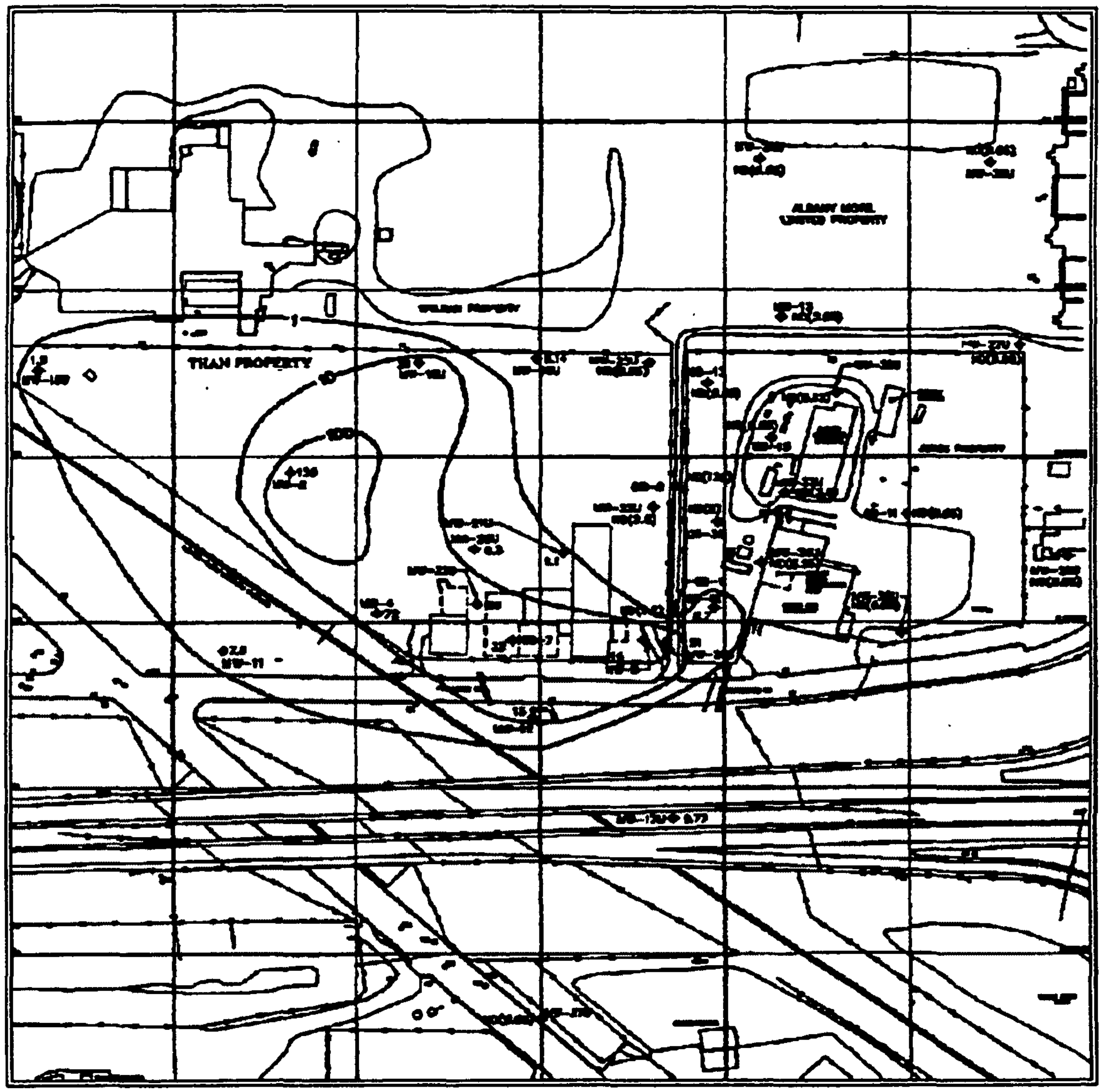

Figure 7
Map of Isopleths of ß-BHC in Groundwater

movement due to its low adsorption potential towards most soils. Figures 4 through 7 portray the extent of groundwater contamination across the Site of several prevalent contaminants such as EDB, DDT, alpha-BHC, and beta-BHC, respectively.

NAPL Contamination

One of the major contamination problems at the Site is a lens of a floating NAPL that was observed in the eastern portion of the site in grab samples from soil borings, development water, purge water, and in groundwater samples. The NAPL lens, also known as free product, consists of xylene and other solvents with various types of pesticides dissolved in it. The NAPL has been observed in monitoring wells located on the east-central portion of the western parcel. The locations in which NAPL has been reported include MW-8, MW-14, MW-15, MW-16, GB-2, GB-5, GB-6, GB-8I, GB-9I, GB-12, GB-14, GB-15, and OW-3. The approximate lateral extent of the NAPL is shown on Figure 4-8. Ethylbenzene and xylene are the most prevalent volatiles, with toxaphene and alpha-BHC being the most common organochlorine pesticides. Organophosphorus (OP) pesticides are also found in the NAPL. The NAPL has been measured to be over four feet in thickness at some locations on the THAN parcel. A dense (non-floating) NAPL (which would sink below the water table) has not been detected at the Site. The extent of the NAPL is shown in Figure 8.

In general, groundwater contamination is highest in central and eastern portions of the western parcel in the areas around the facility buildings. Highest concentrations are also found in the vicinity of the NAPL plume with concentrations generally decreasing markedly away from the NAPL.

6.0 SUMMARY OF SITE RISKS

CERCLA directs EPA to conduct a baseline risk assessment to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The baseline risk assessment provides the basis for determining whether or not remedial action is necessary and the justification for performing remedial action.

Ingestion of groundwater could result in exposure to various contaminants if the water was obtained onsite from the contaminated water-bearing unit. Exposure to contaminated groundwater may result if an off-site drinking water or domestic use water well is installed in a water bearing zone which is known to be contaminated. However, evidence suggests that this situation does not exist since perimeter wells have not shown any contamination. Monitoring will continue to assess the potential for off-site migration of contaminants via groundwater. It is not believed that contaminants in Site groundwater are discharging to surface water bodies since the closest water body is 0.4 miles from the Site. Current evidence shows that the zone of contamination beneath the Site does not extend far enough to impact

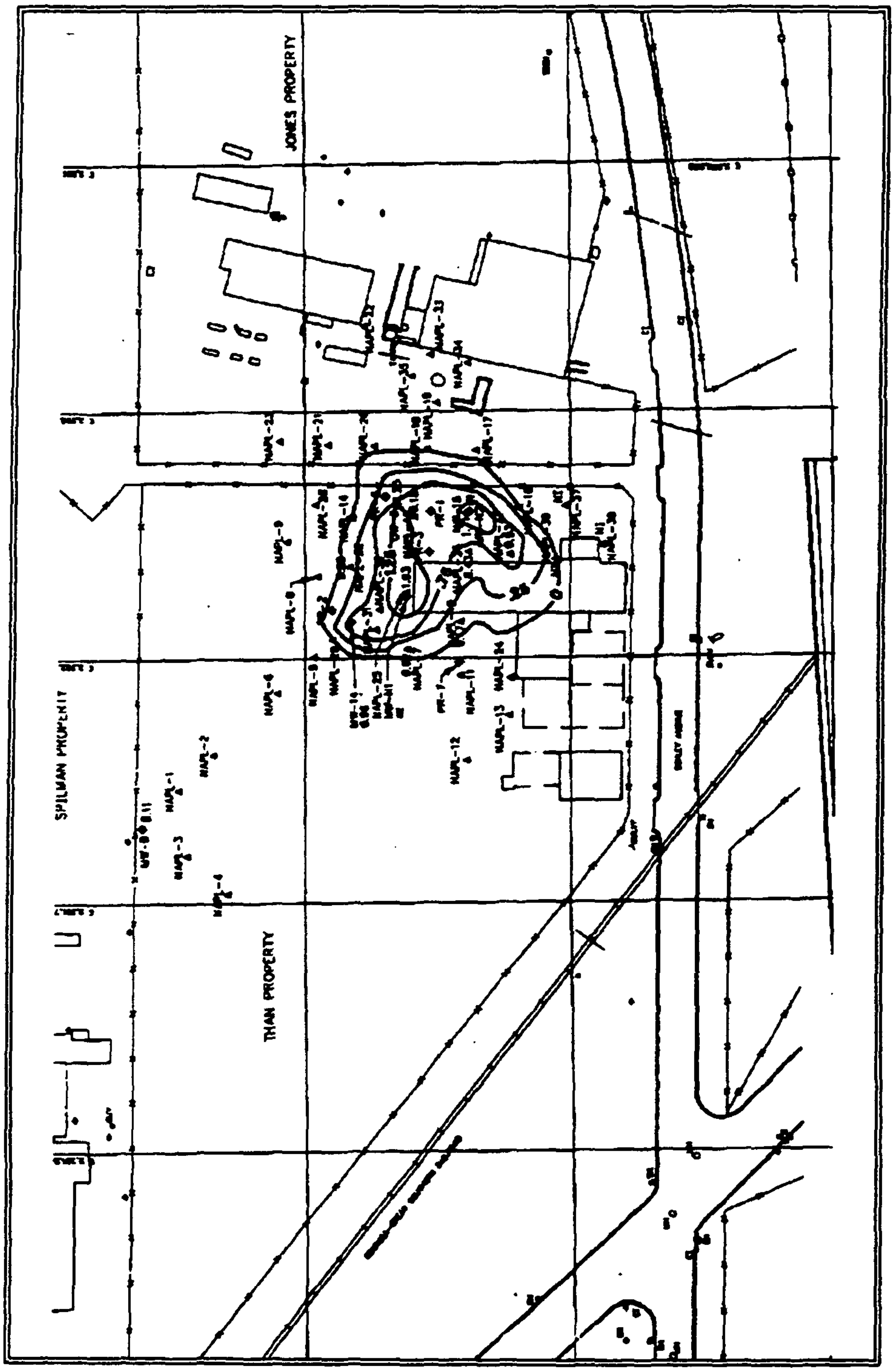

Figure 8
Location and Thickness of NAPL on January 28, 1991

local rivers or streams.

The major risk that is currently associated with the THAN site is a floating lens of NAPL that is located in the surficial aquifer.

At this time, the contamination has not been detected in the off-site, downgradient monitoring wells located to the east. However, if the contaminants are allowed to remain, the potential for migration and human exposure exists. As a potential source of pesticides and solvents, the NAPL provides a mechanism for the release of contaminants to groundwater. Most of the pesticides at the Site are not readily soluble in water. The NAPL, which can act as a solvent for pesticides, may increase the solubility of these compounds and, thus, the potential for their release to the groundwater.

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

6.1 CONTAMINANTS OF CONCERN

The majority of the wastes and residues generated by production operations at the facility have been managed, treated, and disposed of onsite throughout the Site's history. The chemicals measured in the various environmental media during the RI were evaluated for inclusion as chemicals of potential concern in the risk assessment by application of screening criteria. The criteria which resulted in elimination of chemicals included: Site contaminant concentrations below background concentrations; measurements below quantification limits; a combination of low toxicity and low concentration or low persistence and low concentration and low frequency of detection.

Table 2
Contaminants of Concern

Compound	Average Concentration*		
	Soil (µg/kg)	Groundwater (µg/L)	NAPL (mg/L)
2,4,5-T	ND	4	ND
Dicamba	ND	4	ND
Dinoseb	28	93	ND
MCPA	11,700	ND	ND
4,4'-DDD	47,038	11	ND
4,4'-DDE	4,356	1	ND
4,4'-DDT	100,868	19	8,700
Aldrin	515	1	ND

Dieldrin	3,479	1	ND
Endosulfan I	38,134	3	1,600
Endosulfan II	31,217	ND	ND
Endrin	14,057	4	ND
Endrin aldehyde	669	2	ND
Endrin ketone	6,319	2	ND
Toxaphene	341,149	80	48,000
α-BHC	4,582	5	420
α-Chlordane	3,250	1	ND
ß-BHC	4,741	11	ND
δ-BHC	514	3	ND
Lindane	321	3	ND
Γ-Chlordane	3,126	ND	ND
DEF	2,106	ND	ND
Ethyl parathion	10,664	1	25
Malathion	4,066	1	ND
Methyl parathion	34,379	1	25
1,2,4-Trichlorobenzene	805	43	ND
1,4-Dichlorobenzene	ND	41	ND
2-Methylnapthalene	6,806	127	5,800
4-Nitrophenol	ND	ND	ND
Isophorone	2,677	40	ND
Naphthalene	3,258	71	1,800
1,2-Dibromoethane (EDB)	ND	112	ND
1,2-Dichloropropane	ND	52	ND
Benzene	ND	36	ND
Chlorobenzene	ND	37	ND
Chloroform	ND	32	ND
Ethylbenzene	ND	1,419	60,000
Tetrachloroethene	ND	35	ND
Trichloroethene	ND	35	ND
Xylene	ND	4,922	30,000
Cyanide total	270	10	ND

* = Average concentration developed from Phase 1 data
ND = Not detected at laboratory reporting limits

6.2 EXPOSURE ASSESSMENT

Whether a chemical is actually a concern to human health and the environment depends upon the likelihood of exposure, i.e. whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- A source and mechanism of release from the source,
- A transport medium (e.g., surface water, air) and mechanisms of migration through the medium,
- The presence or potential presence of a receptor at the exposure point, and
- A route of exposure (ingestion, inhalation, dermal absorption).

If all four elements are present, the pathway is considered complete.

An evaluation was undertaken of all potential exposure pathways which could connect chemical sources at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using EPA's criteria. Three current potentially complete exposure pathways and four future exposure pathways remained after screening. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change. Exposure by each of these pathways was mathematically modeled using generally conservative assumptions.

The current pathways are:

- potential oral exposure by a trespasser to surface soils
- potential dermal exposure by a trespasser to surface water, and
- potential dermal exposure by a trespasser to surface soils.

The future pathways are:

- potential dermal exposure by Site workers to surface soil,
- potential oral exposure by Site workers to surface soil,
- ingestion of contaminated groundwater by near-site or onsite residents and,
- ingestion of soil by potential onsite residents.

The exposure point concentrations for each of the chemicals of concern and the exposure assumptions for each pathway were used to estimate the chronic daily intakes for the potentially complete pathways, with the exception of the groundwater pathway. The chronic daily intakes were then used in conjunction with cancer potency factors and noncarcinogenic reference doses to evaluate risk.

The major assumptions about exposure frequency and duration that were included in the exposure assessment were:

- Onsite residents were assumed to have an exposure frequency of 351 days per year. The hypothetical industrial worker is assumed to spend 250 days per year onsite for 30 years, based on a 5 day working week for 50 weeks per year. A 10-15 year-old juvenile trespasser who would enter the Site is assumed to have an exposure frequency of 24 days per year for 5 years.

- Soil ingestion rates for onsite residents include a rate of 200 mg/day for children aged 0-13 years and 100 mg/day for residents aged 14 to adult. Soil ingestion rates for a future industrial worker is 50 mg/day and 100 mg/day for a juvenile trespasser. Groundwater ingestion rates for an onsite resident adult is 2 liters/day, with 1 liter/day being assumed for a resident child or a hypothetical industrial worker.

- Dermal contact exposure parameters for surface water for a juvenile trespasser include contact for 12 days/year for 2 hours/day for 5 years.

- In all scenarios a standard body weight of 70 kg was used for adults.

The groundwater at the THAN site currently contains concentrations of the Site contaminants at levels which would pose an unacceptable risk to human health if the water was being used for human consumption. However, the extent of groundwater contamination has been delineated, and this contamination does not extend beyond the Site boundaries. As a result, this is not a current complete exposure pathway, since there are no wells onsite. The former pesticide formulation areas are the major contributors to the contaminated groundwater.

6.3 TOXICITY ASSESSMENT

Toxicity values are used in conjunction with the results of the exposure assessment to characterize site risk. EPA has developed critical toxicity values for carcinogens and noncarcinogens. These critical toxicity values are listed in Table 3. Cancer potency factors (CPFs) have been developed 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

TABLE 3

CRITICAL TOXICITY VALUES[1]
SLOPE FACTORS (SFs) AND REFERENCE DOSES (RfDs)

Contaminants	Slope Factor[2] (SFs)	Reference Dose (RFD)
Aldrin	$1.7x10^{1}$	$3x10^{-5}$
Benzene	$2.9x10^{-2}$	ND
α-BHC	6.3	ND
β-BHC	1.8	ND
δ-BHC	NC	ND
γ-BHC	1.3	$3x10^{-4}$
α-Chlordane[3]	1.3	$6x10^{-5}$
γ-Chlordane[3]	1.3	$6x10^{-5}$
Chlorobenzene	NC	$2x10^{-2}$
Chloroform	$6.1x10^{-3}$	$1x10^{-2}$
Cyanide	NC	$2x10^{-2}$
4,4'-DDD	$2.4x10^{-1}$	ND
4,4'-DDE	$3.4x10^{-1}$	ND
4,4'-DDT	$3.4x10^{-1}$	$5x10^{-4}$
DEF	NC	ND
1,2-Dibromoethane (EDB)	$8.5x10^{1}$	ND
Dicamba	NC	ND
1,4-Dichlorobenzene	NC	ND
1,2-Dichloropropane	$6.8x10^{-2}$	ND
Dieldrin	$1.6x10^{1}$	$5x10^{-5}$
Dinoseb	NC	$1x10^{-3}$
Endosulfan I[3]	NC	$5x10^{-5}$
Endosulfan II[3]	NC	$5x10^{-5}$
Endrin	NC	$3x10^{-4}$
Endrin Aldehyde	NC	ND
Endrin Ketone	NC	ND
Ethylbenzene	NC	$1x10^{-1}$
Ethyl Parathion	ND	$6x10^{-3}$
Isophorone	$4.1x10^{-3}$	$2x10^{-1}$
Malathion	NC	$2x10^{-2}$
MCPA (2-methyl-4-chlorophenoxyacetic acid)	NC	$5x10^{-4}$
Methyl Parathion	NC	$2.5x10^{-4}$
2-Methylnaphthalene	NC	ND
Naphthalene	NC	$4x10^{-3}$
4-Nitrophenol	NC	ND
Tetrachloroethene	$5.1x10^{-2}$	$1x10^{-2}$
1,2,4-Trichlorobenzene	NC	$1.3x10^{-3}$
2,4,5-T	NC	$1x10^{-2}$
Toxaphene	1.1	ND
Trichloroethene	$1.1x10^{-2}$	ND
Xylene	NC	2

Notes:

1 Critical toxicity values obtained from Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST) (USEPA, Fiscal Year 1991).
2 Slope factor for oral or dermal exposure.
3 HEAST does not differentiate between different isometric forms of chlordane or endosulfan.
NC Compound is not a known or suspected carcinogen.
ND No data

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 conservative 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.

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 can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

TABLE 4
SUMMARY OF UNCERTAINTIES ASSOCIATED WITH RISK ASSESSMENT

Assumption	Estimated Magnitude of Effect on Risk	Direction of Effect on Risk Estimate
Environmental Sampling and Analysis		
Errors in chemical analysis	Low	Over or underestimate risk
The majority of sampling wells are installed in the region of the suspected contaminant plume	Low-Moderate	Overestimate risk
Fate and Transport Modeling		
Chemical concentrations reported as "below method detection limit" are used at one-half detection limit when calculating mean chemical concentrations	Low	Over or underestimate risk
Toxicological Data		
Hazard indices (HIs) were developed assuming all toxic effects were additive	Low-Moderate	Overestimate risk
Exposure Parameters		
Conservative values were used for exposure duration, frequency, ingestion, and soil adherence factor	Low-Moderate	Overestimate risk

6.4 RISK CHARACTERIZATION

Human health risks are characterized for potential carcinogenic and noncarcinogenic effects by combining exposure and toxicity information. Excessive lifetime cancer risks are determined by multiplying the estimated daily intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper boundary , an individual has a one in one million additional (above their normal risk) chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the assumed specific exposure conditions at a site.

Throughout the risk assessment process, uncertainties associated with evaluation of chemical toxicity and potential exposures arise. For example uncertainties arise in derivation of toxicity values for reference does (RfDs) and carcinogenic slope factors (CSFs), estimation of exposure point concentrations, fate and transport modeling, exposure assumptions and ecological toxicity data. Because of the conservative nature of the risk assessment process, risk estimated in this assessment are likely to be overestimates of the true risk associated with potential exposure at OU #1 of the THAN Site. Uncertainties for the OU#1 at the THAN Site are enumerated in Table 4.

EPA considers individual excess cancer risks in the range of $1x10^{-4}$ to $1x10^{-6}$ as protective; however the $1x10^{-6}$ risk level is generally used as the point of departure for setting cleanup levels at Superfund sites. The point of departure risk level of $1x10^{-6}$ expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range. The health-based risk levels for OU #1 are shown in Tables 5, 6, and 7.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants's reference dose). A HQ which exceeds one (1) indicates that the daily intake from a scenario exceeds the chemical's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI which exceeds unity indicates that there may be a concern for potential health effects resulting from the cumulative exposure to multiple contaminants within a single medium or across media. The HIs for OU #1 are shown in Tables 6 and 7.

TABLE 5
POTENTIAL CANCER RISKS
ASSOCIATED WITH GROUNDWATER INGESTION
BASED ON REASONABLE MAXIMUM EXPOSURE (RME)

Compound[1]	**Exposure Scenario**					
	Industrial Worker	**On-Site Resident**				
		0-2[2]	**2-5**[2]	**5-13**[2]	**13-18**[2]	**Adult**
Toxaphene	8.9E-5	5.0E-5	5.6E-5	7.4E-5	3.8E-5	2.5E-4
DDT	1.4E-6	7.9E-7	8.9E-7	1.2E-6	6.0E-7	3.9E-6
α-BHC	4.5E-4	2.5E-4	2.9E-4	3.8E-4	1.9E-4	1.3E-3
Dieldrin	6.4E-5	3.6E-5	4.1E-5	5.4E-5	2.8E-5	1.8E-4
β-BHC	1.6E-4	9.1E-5	1.0E-4	1.3E-4	6.9E-5	4.5E-4
DDD	0	0	0	0	0	0
DDE	0	0	0	0	0	0
Aldrin	0	0	0	0	0	0
γ-BHC	5.5E-5	3.1E-5	3.5E-5	4.6E-5	2.4E-5	1.5E-4
α-Chlordane	0	0	0	0	0	0
Isophorone	1.4E-7	7.9E-8	8.9E-8	1.2E-7	6.0E-8	3.9E-7
Benzene	2.0E-5	1.1E-5	1.3E-5	1.7E-5	8.6E-6	5.6E-5
Chloroform	4.2E-6	2.4E-6	2.6E-6	3.5E-6	1.8E-6	1.2E-5
Dibromethane (EDB)	9.6E-2	5.4E-2	6.1E-2	8.0E-2	4.1E-2	2.7E-1
Dichloropropane	5.3E-5	3.0E-5	3.4E-5	4.5E-5	2.3E-5	1.5E-4
Tetrachloroethene	3.5E-5	2.0E-5	2.2E-5	2.9E-5	1.5E-5	9.8E-5
Trichloroethene	0	0	0	0	0	0
Σ[3]	9.7E-2	5.5E-2	6.1E-2	8.1E-2	4.2E-2	2.7E-1

Notes:

1 The subset of contaminants of concern found in groundwater which are carcinogens and for which slope factors are available.
2 Denotes years of age.
3 Cumulative cancer risk for all compounds.

TABLE 6
NON-CARCINOGENIC HAZARD QUOTIENTS
ASSOCIATED WITH GROUNDWATER INGESTION
BASED ON REASONABLE MAXIMUM EXPOSURE (RME)

Compound[1]	Exposure Scenario					
	Industrial Worker	On-Site Resident				
		0-2[2]	2-5[2]	5-13[2]	13-18[2]	Adult
DDT	2.1E-2	1.7E-1	1.3E-1	6.4E-2	5.3E-2	5.8E-2
Dieldrin	2.0E-1	1.7	1.3	6.3E-1	5.2E-1	5.7E-1
Aldrin	0	0	0	0	0	0
γ-BHC	3.5E-2	3.0E-1	2.2E-1	1.1E-1	9.1E-2	9.9E-2
α-Chlordane	0	0	0	0	0	0
Isophorone	4.3E-4	3.6E-3	2.7E-3	1.3E-3	1.1E-3	1.2E-3
Ethyl Parathion	0	0	0	0	0	0
Endosulfan I	0	0	0	0	0	0
Methyl Parathion	0	0	0	0	0	0
Endrin	1.7E-2	1.4E-1	1.1E-1	5.2E-2	4.3E-2	4.7E-2
Trichlorobenzene	1.1E-1	9.0E-1	6.8E-1	3.3E-1	2.8E-1	3.0E-1
Naphthalene	3.0E-1	2.5	1.9	9.3E-1	7.7E-1	8.3E-1
Malathion	0	0	0	0	0	0
Dinoseb	7.8E-2	6.6E-1	4.9E-1	2.4E-1	2.0E-1	2.2E-1
Cyanide	0	0	0	0	0	0
Chloroform	1.7E-1	1.5	1.1	5.4E-1	4.4E-1	4.8E-1
Tetrachloroethene	1.7E-2	1.5E-1	1.1E-1	5.4E-2	4.4E-2	4.8E-2
Chlorobenzene	8.8E-2	7.5E-1	5.6E-1	2.8E-1	2.3E-1	2.5E-1
Ethylbenzene	5.0E-1	4.2	3.2	1.6	1.3	1.4
2,4,5-T	0	0	0	0	0	0
Xylene	8.4E-2	7.1E-1	5.3E-1	2.6E-1	2.2E-1	2.4E-1
Σ[3]	1.6	13.7	10.2	5.1	4.2	4.5

Notes:

1 The subset of groundwater contaminants of concern for which RfD values are available.
2 Denotes years of age.
3 The summation of the Hazard Quotients is termed the Hazard Index.

Table 7
- Summary of Cumulative Potential Cancer Risks
and Non-Carcinogenic Hazard Indices

Exposure Scenario	**Reasonable Maximum Exposure (RME)**	
	Potential Cancer Risk	**Non-Carcinogenic Hazard Index**
Onsite		
Juvenile Trespasser	$3.2x10^{-5}$	1.1
Industrial Worker	$9.8x10^{-2}$	4.8
0-2 Resident[a]	$5.6x10^{-2}$	81.0
2-5 Resident[a]	$6.2x10^{-2}$	62.7
5-13 Resident[a]	$8.2x10^{-2}$	35.2
13-18 Resident[a]	$4.2x10^{-2}$	17.1
Adult Resident	$2.7x10^{-1}$	15.0
Child Resident[b]	$2.4x10^{-1}$	NA
Off-Site		
0-2 Resident[a]	$8.0x10^{-6}$	$3.5x10^{-1}$
2-5 Resident[a]	$9.0x10^{-6}$	$2.6x10^{-1}$
5-13 Resident[a]	$1.2x10^{-5}$	$1.3x10^{-1}$
13-18 Resident[a]	$6.1x10^{-6}$	$1.1x10^{-1}$
Adult Resident	$4.0x10^{-5}$	$1.2x10^{-1}$
Child Resident[b]	$3.5x10^{-5}$	NA

[a] = Denotes years of age
[b] = The total cancer risk for a child resident (0-18 years of age) is the summation of the cancer risk for each age group.
NA = Not applicable.

6.5 ENVIRONMENTAL RISK

Due to the removal action initiated in 1992, each of the source areas will be covered with fill; therefore, the contaminated areas on western parcel are not easily accessible to wildlife. Currently all of the contaminated surface material on the western parcel has been removed. The western parcel will be brought back to the original grade and will be revegetated. For this reason the source areas are not expected to have toxic effects on those terrestrial animals at this time. The selected remedy based on human health will eliminate the potential for toxic effects since the environmental exposure pathways will not exist. There are no known critical habitats or endangered species affected by Site contaminants.

6.6 CLEANUP GOALS

The establishment of health-based cleanup goals serves as an important means of guiding remedial activities. A health-based approach is warranted when cleanup standards promulgated by state or federal agencies are not available for contaminants in soil, as well as for certain groundwater contaminants. The approach to developing health-based goals is derived from the risk assessment process. The risk assessment is essentially a process by which the magnitude of potential cancer risks and other health effects at a site can be evaluated quantitatively. A cleanup goal is established by back-calculating a health protective contaminant concentration, given a target cancer risk or hazard index which is deemed acceptable and realistic. The concept of the cleanup goal inherently incorporates the concept of exposure reduction which allows remedial alternatives to be flexible.

The groundwater at the THAN site currently contains concentrations of Site-related contaminants at levels which would pose an unacceptable risk (cumulative risk in excess of $1x10^{-4}$) to human health if the water was being used for human consumption. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The cleanup levels for groundwater are contained in Table 8. The groundwater cleanup levels have been generated to ensure localized isolation and treatment of contaminated groundwater which exceeds the health-based groundwater cleanup levels established at the $1x10^{-4}$ risk level. The $1x10^{-4}$ risk level is protective in light of the current surface removal which remediated the surface soils to the $1x10^{-6}$ risk level and in light of the deed restrictions that are planned for this operable unit. Furthermore, no current ingestion of contaminated groundwater exists, and the deed restrictions are designed to prevent wells from being installed onsite. The extended time period that any pump and treat option is expected to be in operation and the prevention of migration of contamination off-site by a pump and treat system justify the $1x10^{-4}$ level. Cleanup levels for groundwater protection are based on a $1x10^{-4}$ risk level for carcinogens and a hazard quotient of 1 for noncarcinogens. Setting the cleanup levels for the groundwater contamination at the $1x10^{-4}$ risk level is consistent with the NCP's requirement for establishing cleanup levels within the $1x10^{-4}$ to $1x10^{-6}$ range. This cleanup level provides an acceptable exposure level that is protective of human health and the environment in a residential setting. Cleanup levels for contaminated surface soil are based on a child exposure scenario and assume a residential land use. These levels are based on the ingestion and inhalation exposure routes and represent a $1x10^{-6}$ risk level for carcinogens and a hazard quotient of 1 for noncarcinogens. The cleanup levels for groundwater and are listed in Table 8. The cleanup levels for $1x10^{-6}$ for surface soils has already been met by the current removal action at the Site.

TABLE 8
Summary of Remedial Action Objectives

Compound	Medium
	Groundwater (µg/L)
DDT	0.027
Toxaphene	0.003
α-BHC	0.0041
ß-BHC	0.0051
Aldrin	0.00054
Dieldrin	0.00057
EDB	0.00005

The groundwater cleanup levels will be applied at the Site to ensure that any future groundwater consumers will not be exposed to unacceptable concentrations of Site-related chemicals in the groundwater. The concentrations presented represent either the regulated Maximum Contaminant Level (MCL) or the health-based cleanup goal which was developed for those chemicals of concern which do not have MCLs.

Although the contaminants of concern are not the only contaminants at the Site, they were chosen based on toxicity, mobility and frequency of detection throughout the Site. It is anticipated that contaminants at the Site which do not have cleanup levels presented in this ROD will be reduced to acceptable levels when cleanup levels are met for the most toxic and most mobile contaminants for which cleanup levels have been established.

The remedial action objectives for the contaminated surface soil on the western parcel have been met by the currently ongoing removal action at the Site. All of the soil has been excavated, with approximately 20,000 tons of soil being landfilled off-site. Approximately 3000 tons of excavated material remain onsite in stockpiles. This excavated material could not be landfilled since the total pesticide concentration was greater than 1000 ppm. Currently, the excavated material is being treated onsite by a low-temperature thermal desorption technique.

Transport modeling was used to evaluate the contribution of contaminated subsurface soil to groundwater contamination. The PESTAN computer transport model was used to determine the levels of contamination which can exist in the subsurface soil and not create a condition in the groundwater whereby groundwater protection standards are exceeded.

PESTAN was developed by the EPA Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma for estimating the vertical migration of pesticides through soil to groundwater. The model presents an analytical solution to a solute transport equation, considering sorption, dispersion, and degradation. The model output consists of chemical concentrations at varying depths in the unsaturated soil profile for specified times. The model presents one-dimensional concentration profiles, assuming steady state flow conditions in a single layer soil with constant sorption and mass sink parameters. PESTAN is most applicable in the portions of vadose zone located between the bottom of the root zone and the water table.

The PESTAN model was found to be most appropriate for the evaluation of the subsurface soils at the western parcel since it considers many fate/transport properties, such as dispersion, sorption, and degradation. The model also allows for evaluation of a contaminant "front" as it passes through previously uncontaminated soil. In addition, the timing of the subsurface soil's contribution to groundwater contamination can be estimated from a transport model.

The PESTAN modeling indicates that, because of the low recharge and relatively low solubilities of the compounds found on the western parcel, most of the contaminants can exist in the subsurface soils at very high concentrations and not contribute to groundwater so that the groundwater protection standards are exceeded. In many instances, the model indicates that leachate produced from the volume of subsurface soil being modeled will reach a limiting concentration, which is a function of the constituent's solubility in water, its rate of degradation, and the depth of observation in the soil profile. At this limiting leachate concentration, higher levels of contaminant in the subsurface soil do not result in higher concentrations in the resulting leachate, but rather result in a longer slug of contaminant passing through a particular depth in the soil profile.

The PESTAN modeling, coupled with the results of the subsurface soil investigation performed during the RI, indicate that the subsurface soils on the western parcel would not contribute to groundwater contamination at concentrations exceeding the groundwater protection standards. Therefore, no remediation is deemed necessary for the subsurface soils and no alternatives or cleanup goals are proposed for the remediation of subsurface soil. Furthermore, since the groundwater cleanup is expected to last for several decades and the facility on the western parcel is inactive, further excavation on the western parcel would not add significantly to the protectiveness of the remedy.

7.0 DESCRIPTION OF ALTERNATIVES

Two alternatives for the remediation of contaminated groundwater in OU#1 at the THAN site were evaluated in the Feasibility Study Report and listed in the Proposed Plan for the Site. These alternatives are complete and address the remediation of all the media.

Table 9
Operable Unit #1 Alternatives

Alternative Number	Medium	Remedial Action	Present Worth[a]
1	All Media	No Action	0
2	Soil	Vegetative Cover and Institutional Controls	4.1
	Groundwater	Pump & Treat[b]	
	NAPL	Pump & Incinerate[c]	

a = In $Millions
b = Pump & Treat of Groundwater would include Onsite Treatment
c = Pump & Incineration of NAPL would include Off-site Incineration

The assembled site-specific alternatives represent a range of distinct waste-management strategies addressing the human health and environmental concerns. Although the selected remedial alternative will be further refined as necessary during the predesign phase, the analysis presented below reflects the fundamental components of the various alternatives considered feasible for this Site.

7.1 ALTERNATIVE No. 1 - No Action

The no action alternative is carried through the screening process as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This alternative is used as a baseline for comparison with other alternatives that are developed. Under this alternative, EPA would take no further action to minimize the impact groundwater contamination has on the area. Groundwater contamination would remain and possibly migrate. There is no cost associated with this alternative since no additional activities would be conducted.

7.2 ALTERNATIVE No. 2 - Pump and Treat

This alternative consists of a vegetative cover and associated drainage controls for the soils. Institutional controls such as fencing and deed restrictions would be implemented. Groundwater would be extracted by pumping, treated onsite, and disposed of onsite by a shallow infiltration gallery if a treatability study indicates this method of disposal to be practical. If an onsite infiltration gallery is not practical, the water will be disposed of off-site by the use of an existing discharge permit to the local publicly-owned treatment works (POTW) or an NPDES permit to discharge to the Flint River. The NAPL would be extracted by pumping and incinerated off-site. The present worth cost of this alternative is estimated at $4,100,000.

This alternative includes:

- Extraction and onsite treatment of groundwater
- Extraction and off-site incineration of NAPL; and
- Vegetative cover over the contaminated area with institutional controls.

Considering the hydrogeological characteristics of the Site (i.e., hydraulic conductivity of 10^{-7} cm/sec, heterogeneity of soils), it is expected to take several pore volumes of groundwater before the cleanup goals are met. It may be necessary to pump groundwater only intermittently to achieve effective extraction. This will be determined during the design phase based on the pump tests. The extracted groundwater will be stored in an equalization tank from which it would be pumped to a treatment system. The objective of using the equalization tank is to dampen flow and loading variations and to provide storage during times when the downstream treatment system may be shut down.

Preliminary process flow diagrams for ultraviolet/oxidation treatment is shown in Figure 9. The spent carbon which would be generated during the polishing treatment step would either be regenerated or disposed in an authorized facility. The treated water would be reinjected onsite and/or discharged off-site with an NPDES permit or to the City of Albany municipal sewers through a City permit. The relative volumes of treated water that would be reinjected onsite or discharged off-site would be determined during the Remedial Design (RD) phase. The details of the reinjection system would also be investigated during the RD phase.

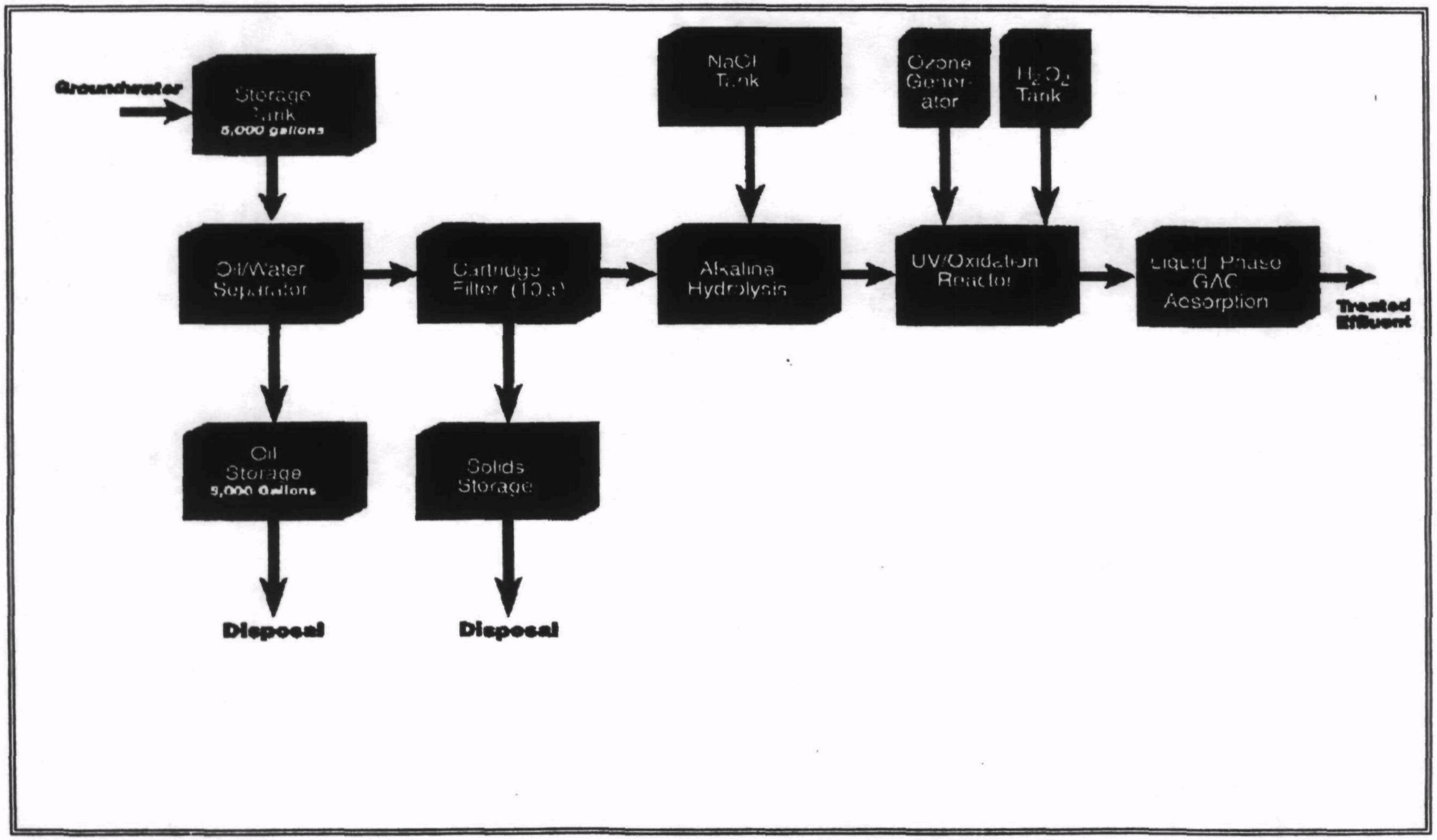

Figure 9
Diagram of Ultraviolet/Oxidation Treatment Train

The NAPL would be extracted and then treated in an off-site incinerator. The remedial action objective for the NAPL lens is its removal. The number of NAPL extraction wells that would be used is not known at this time. It is likely that some extraction wells would be used for extraction of both NAPL and groundwater. Preliminary indications are that the total NAPL extraction rates would be very small, ranging between 5 to 10 gallons per day. It is anticipated that the pumping of NAPL would take place on an intermittent basis. After the NAPL is extracted, it would be stored in a tank until ready for final disposal. The NAPL may have to be shipped a long distance, since a permitted incinerator does not currently exist near the Site.

Pursuant to the removal, the remaining total organochlorine pesticide levels are less than 30 parts per million. A vegetative cover will be placed on the western parcel. The cover would include clean, compacted soil materials with natural vegetation on the top. Drainage controls would be installed, so that the runoff would be diverted from the Site. The permeability of the existing soil at the THAN property is approximately 10^{-7} cm/sec, which would allow little infiltration. The vegetative cover will be compacted so that the permeability of the cover will be equivalent to the native Site soils. The vegetative cover will be inspected quarterly, at a minimum, and be maintained in good condition.

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA and in Section 300.430 of the NCP. The major objective of the FS was to develop, screen, and evaluate alternatives for the remediation of Operable Unit One at the THAN site. The remedial alternatives selected from the screening process were evaluated using the following nine evaluation criteria:

- Overall protection of human health and the environment.
- Compliance with applicable and/or relevant Federal or State public health or environmental standards.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants.
- Short-term effectiveness, or the impacts a remedy might have on the community, workers, or the environment during the course of implementing it.
- Implementability, that is, the administrative or technical capacity to carry out the alternative.
- Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project, including additional costs should it fail.

- Acceptance by the State.
- Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) Threshold Criteria - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) Primary Balancing Criteria - long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability, and cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) Modifying Criteria - state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan and incorporated in the ROD.

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

The following analysis is a summary of the evaluation of alternatives for remediating the THAN Superfund Site under each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

Threshold Criteria

8.1 Overall Protection of Human Health and the Environment

Alternative #1 would not contain or remediate the groundwater contamination. Cleanup levels for groundwater would not be achieved with Alternative #1, and Alternative #1 therefore would not provide adequate protection of human health and the environment. Alternative #2 would isolate the contamination from the surrounding uncontaminated area and would prevent human and ecological contact. Alternative #2 would provide adequate overall protection of human health and the environment.

8.2 Compliance with ARARs

The potential ARARs for this Site are listed in Table 10, 11, and 12. Alternative #1 would not meet all ARARs because it would not meet

MCLs. Alternative #2 would comply with all Federal or State ARARs. Chemical specific ARARs would be met through compliance with the groundwater protection standards (i.e., MCLs). During treatment, air emissions from the Site would be monitored to ensure compliance with the Clean Air Act. Fence-line air monitoring will be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures will be employed to prevent harmful levels of air emissions from leaving the Site. RCRA design standards will be incorporated into the remedial design of all remedial activities.

Primary Balancing Criteria

8.3 Long-Term Effectiveness and Permanence

Both Alternative #1 and #2 would provide long-term effectiveness and permanence with respect to the contaminated soils at the Site, which have already been addressed to a $1x10^{-6}$ risk level in the removal action. Alternative #1 would not provide long-term effectiveness with respect to groundwater contamination, however, because groundwater contamination exceeds MCLs and would be unaddressed. Contaminated groundwater could migrate off-site and be used as drinking water. Alternative #2 would provide long-term effectiveness through limiting the migration of contaminated groundwater through treatment of the contaminated groundwater at the Site.

8.4 Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative #1 would not reduce mobility, toxicity or volume at the source of the contamination. Alternative #2 would reduce mobility, toxicity, and volume of groundwater contamination through withdrawal and treatment. Toxicity and volume have been reduced by the current removal action.

8.5 Short-Term Effectiveness

Alternative #1 would not require construction or excavation that would cause a health risk to workers. However, Alternative #1 would be the least effective in achieving the overall groundwater cleanup levels in the shortest time period. Alternative #2 will require approximately 12 months to implement. No threshold toxicity criteria would be exceeded by implementing Alternative #2 and the health risks to remedial workers is unlikely, particularly when appropriate monitoring and engineering controls are applied.

8.6 Implementability

The No Action alternative would require no action to implement. Technological expertise, services, equipment and materials are adequately available for the implementation of Alternative #2.

TABLE 10

POTENTIAL CONTAMINANT-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description
Federal		
Safe Drinking Water Act	40 USC Section 300	
National Primary Drinking Water Standards	40 CFR Part 141	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water systems.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to ensure the aesthetic quality of the water.
Maximum Contaminant Level Goals (MCLGs)	PL No. 99-339 100 Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects with an adequate margin of safety.
Clean Water Act	33 USC Section 1251-1376	
Ambient Water Quality Criteria	40 CFR Part 131 Quality Criteria for Water, 1976, 1980, 1986	Requires the states to set ambient water quality criteria (AWQC) for water quality based on use classifications and the criteria developed under Section 304(a) of the Clean Water Act.
National Pollutant Discharge Elimination System Permit Regulations	40 CFR Parts 122, 125	Requires permits for the discharge of pollutants from any point source into waters of the United States.
Underground Injection Control Regulations	40 CFR Parts 144-147	Provides for protection of underground sources of drinking water.
National Pretreatment Standards	40 CFR Part 403	Sets standards to control pollutants which pass through or interfere with treatment processes in publicly-owned treatment works or which may contaminate sewage sludge.
Clean Air Act	42 USC Section 7401-7642	
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes standards for ambient air quality to protect public health and welfare.
State		
Georgia Department of Natural Resources Environmental Protection Division; Water Quality Control	Chapter 391-3-6 Section 03	Establishes water quality standards and includes instream concentrations for toxic priority pollutants.
Georgia Hazardous Site Response Act (HSRA)		Establishes State Superfund activities
Georgia Department of Natural Resources Environmental Protection Division; Air Quality Control	Chapter 391-3-1 Section 02	Establishes air quality standards.

TABLE 11
PRELIMINARY ARARS FOR
CONTAMINANTS OF CONCERN FOUND IN GROUNDWATER

Media	Constituent	MCL[a] (mg/L)	MCLG[c] (mg/L)
Groundwater	Aldrin		
	Benzene	5.0×10^{-3}	0.000
	α-BHC		
	β-BHC		
	δ-BHC		
	γ-BHC	2.0×10^{-4}[b]	2.0×10^{-4}
	Chlorobenzene		
	α-Chlordane	2.0×10^{-3}	0.00
	Chloroform (THM)	1.0×10^{-1}	
	Cyanide	2.0×10^{-1}	
	4,4'-DDD		
	4,4'-DDE		
	4,4'-DDT		
	1,2-Dibromoethane (EDB)	5.0×10^{-5}	0.00
	Dicamba		
	1,4-Dichlorobenzene	7.5×10^{-2}	7.5×10^{-2}
	1,2-Dichloropropane	5.0×10^{-3}	0.00
	Dieldrin		
	Dinoseb	7.0×10^{-3}	7.0×10^{-3}
	Endosulfan I		
	Endrin	2.0×10^{-3}	2.0×10^{-3}
	Endrin Aldehyde		
	Endrin Ketone		
	Ethyl Benzene	7.0×10^{-1}	7.0×10^{-1}
	Ethyl Parathion		
	Isophorone		
	Malathion		
	Methyl Parathion		
	2-Methylnaphthalene		
	Naphthalene		
	4-Nitrophenol		
	2,4,5-T		
	Tetrachloroethene	5.0×10^{-3}	0.00
	1,2,4-Trichlorobenzene	9.0×10^{-3}	9.0×10^{-3}
	Trichloroethene	5.0×10^{-3}	0.00
	Toxaphene	3.0×10^{-3}[b]	0.00
	Xylene, total	10.0	10.0

Notes:

[a] National Primary Drinking Water Standards, 40 CFR, Parts 141 and 143.

[b] National Primary Drinking Water Regulations. Synthetic Organic Chemicals and Inorganic Chemicals; Monitoring for Unregulated Contaminants; National Primary Drinking Water Regulations Implementation; National Secondary Drinking Water Regulations. Final Rule Federal Register, 56:20:3526 (1/30/91).

[c] Drinking Water Regulations and Heath Advisories, Office of Water U.S Environmental Protection Agency, Washington, D.C., April 1991.

TABLE 12

POTENTIAL ACTION-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description
Federal		
Solid Waste Disposal Act (SWDA)	42 USC Section 6901-6987	
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health, and thereby constitute prohibited open dumps.
Hazardous Waste Management Systems General	40 CFR Part 260	Establishes procedure and criteria for modification or revocation of any provision in 40 CFR Parts 260-265.
Identification and Listing of Hazardous Wastes	40 CFR Part 261	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 263-265 and Parts 124, 270, and 271.
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous waste.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Establishes standards which apply to persons transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR part 262.
Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264	Establishes standards which apply to the storage and handling of hazardous wastes.
Occupational Safety and Health Act	20 USC Section 651-678	Regulates worker health and safety.
Clean Air Act	42 USC Section 7401-7642	
National Ambient Air Quality Standards	40 CFR Part 50	Treatment technology standard for emissions to air •incinerators •surface impoundments •waste piles •landfills •fugitive emissions
Hazardous Materials Transportation Act	49 USC Section 1801-1813	
Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.
Land Disposal Restrictions	40 CFR 268	Establishes a timetable for restriction of land disposal of wastes and other hazardous materials.
Hazardous Waste Permit Program	40 CFR Part 270	Establishes provisions covering basic EPA permitting requirements.
State		

Standard, Requirement, Criteria, or Limitation	Citation	Description
Georgia Department of Natural Resources Environmental Protection Division; Water Quality Control	Chapter 391-3-6 Section 06	Established the uniform procedures and practices to be followed relating to the application for issuance, modification, revocation, and reissuance and termination of permits for the discharge of any pollutant into the waters of the State.
	Section 08	Establishes the degree of wastewater pretreatment required and the uniform procedures and practices to be followed relating to the application for, and the issuance or revocation of, any pollutant into a publicly-owned treatment works and then into the waters of the State.
Georgia Department of Natural Resources Environmental Protection Division; Water Quality Control (Continued)	Section 10	Establishes the procedures and practices to be followed for the determination or categorization of industrial users and requests for variances for fundamentally different factors.
	Section 11	Establishes the degree of pollutant treatment required and the uniform procedures and practices to be followed relating to the application for, and the issuance or revocation of, permits for the discharge of pollutants into land disposal or land treatment systems and then into the waters of the State.
Georgia Hazardous Waste Management Act	Code of Georgia, Title 12 - Chapter 8, Article 3 Section 62	Defines the meaning designated hazardous waste based on the federal act; 40 CFR Section 261.
	Section 66	Establishes the need for a hazardous waste facility permit.
	Section 67	Establishes standards for Hazardous Waste in Transit to be accompanied by a manifest.
	Section 69	Establishes that variances may be granted from the requirements of this law unless such variances are prohibited by the federal act or standards.
Georgia Hazardous Site Response Act		Establishes State Superfund Activities.
Georgia Hazardous Waste Management Rules	Rules and Regulations of the State of Georgia, Title 391, Article 3, Chapter 11	Establishes the policies, procedures, requirements, and standards to implement the Georgia Hazardous Waste Management Act.

8.7 Cost

Alternative #1 would not require any additional cost. The present worth cost of Alternative #2 is estimated to be $4,100,000. These costs include operation and maintenance during the implementation of the alternative as well as post remediation monitoring. While Alternative #2 is more costly, the added effectiveness justifies the additional cost.

Modifying Criteria

8.8 STATE ACCEPTANCE

The State of Georgia, as represented by the Georgia Environmental Protection Division (GaEPD), has been the support agency during the Remedial Investigation and Feasibility Study process for the T H Agriculture & Nutrition site. In accordance with 40 CFR 300.430, as the support agency, GaEPD has provided input during this process. The State of Georgia, as represented by GaEPD, has concurred with the selected remedy.

8.9 COMMUNITY ACCEPTANCE

The majority of the community concern raised with respect to this Site are related to the removal action in which low-temperature thermal desorption is planned. Most of the community concerns expressed over the proposed groundwater remedy (alternative #2) relate to the length of time the remediation is expected to take (30+ years). Based on the comments expressed at the September 24, 1992 public meeting and the written comments received during the comment period; however, it appears that the Albany community generally agrees that a pump and treat system is necessary at this Site and supports Alternative #2.

9.0 SUMMARY OF SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected a remedy for Operable Unit #1 of the Site. The selected remedy provides for the following:

1. No action with respect to soils because the removal action has fully addressed the threat posed by the contaminated soils;

2. Pumping and onsite treatment by ultraviolet/oxidation with granular activated carbon as a polishing step for groundwater if needed;

3. Pumping and off-site incineration of NAPL;

4. Institutional controls.

5. The vegetative cover stalled by the removal action will be inspected quarterly, at a minimum, and be maintained in good condition.

At the completion of this remedy, the risk associated with this Site has been calculated at 10-[4] which is determined to be protective of human health and the environment. The total present worth cost of the selected remedy, Alternative #[2], is estimated at $[4,100,000].

A. GROUNDWATER REMEDIATION

Groundwater remediation will address the contaminated groundwater in the residuum and the upper Ocala aquifers at the Site. Groundwater remediation will include extraction of contaminated groundwater, treatment, and discharge to an onsite infiltration gallery.

A.1. The major components of groundwater remediation to be implemented include:

- Fencing of the Site and treatment facility;
- Extraction and onsite treatment of groundwater by ultraviolet/oxidation treatment with granulated carbon adsorption as a polishing step if needed;
- Extraction and off-site incineration of NAPL;
- Drainage controls to divert runoff from Site;
- Maintenance of the vegetative cover installed by the removal action; and,
- Institutional controls, such as deed and land-use restrictions.

Air emissions during the cleanup will be monitored to ensure safety of workers and residents near the Site.

A.2. Extraction, Treatment, and Discharge of Contaminated Groundwater

Contaminated groundwater will be pumped from the surficial aquifer for on-site treatment. A treatability study will be conducted during the Remedial Design phase of this project to determine if an infiltration gallery is feasible at the Site. If an infiltration gallery is feasible, the treated water will be discharged to the infiltration gallery. If the infiltration gallery is not feasible, the treated water will be discharged to a local publicly-owned treatment works (POTW). If a POTW permit is unattainable, a National Pollutant Discharge Elimination System (NPDES) permit to discharge the treated groundwater to a nearby surface water body would be pursued. Pumping operations may need to be done only intermittently to achieve maximum withdrawal. The withdrawn groundwater will be stored in an equalization tank from which it would be pumped to a treatment system. The equalization tank will provide storage during times when a downstream treatment system may be shut down.

During the remedial design for this project, treatability studies would be conducted to determine the effectiveness of ultraviolet/oxidation treatment on the extracted groundwater. Such treatability studies will concentrate on determining if the site soil, which has a low permeability, will inhibit surface recharge. Additional piezometers may be necessary during Remedial Design to determine if the infiltration gallery could cause any groundwater flow down to the lower aquifers instead of increasing flow across the Site. Ultraviolet/oxidation treatment would be utilized (possibly in combination with granular activated carbon adsorption treatment as a polishing step) for groundwater treatment if it is proven effective by these treatability studies in reducing the contamination in the extracted water. Other treatment technologies for groundwater such as granular activated carbon by itself may be found to be effective and may be implemented if the time frame for remediation can by retained. Final methods would be determined during the remedial design of the cleanup remedy. The spent carbon would be disposed of at a regulated facility or regenerated.

The number of NAPL extraction wells that would be used is not known at this time. It is likely that some extraction wells would be used for extraction of both NAPL and groundwater. Preliminary indications are that the total NAPL extraction rates would be very small, anticipated to be less than five-to-ten gallons per day. It is anticipated that the pumping of NAPL could take place on an intermittent basis. After the NAPL is extracted, it would be stored in a tank until ready for final disposal. The NAPL may be shipped a long distance, since a permitted incineration facility does not currently exist near the THAN Property.

A.3. Performance Standards

a. Treatment Standards

Groundwater shall be treated until the following maximum concentration levels are attained at the wells designated by EPA as compliance points.

DDT	0.027 mg/L
Toxaphene	0.003 mg/L
alpha-BHC	0.0014 mg/L
beta-BHC	0.0051 mg/L
Aldrin	0.00054 mg/L
Dieldrin	0.00057 mg/L
EDB	0.00005 mg/L

b. Discharge Standards

Discharges from the groundwater treatment system shall comply with all ARARs, including, but not limited to, substantive requirements of the NPDES permitting program under the Clean Water Act, 33 U.S.C. { 1251 et seq., and all effluent limits established by EPA.

c. Design Standards

The design, construction and operation of the groundwater treatment system shall be conducted in accordance with all ARARs, including but not limited to the RCRA requirements set forth in 40 C.F.R. Part 264 (Subpart F).]

B. Compliance Monitoring

Groundwater and surface water monitoring shall be conducted at this site. After demonstration of compliance with Performance Standards, the Site including soil and groundwater shall be monitored for five years. If monitoring indicates that the Performance Standards set forth in Paragraph A.3(a) are being exceeded at any time after pumping has been discontinued, extraction and treatment of the groundwater will recommence until the Performance Standards are once again achieved. If monitoring of the treated soil indicates Performance Standards have been exceeded, the effectiveness of the source control component will be re-evaluated.

Alternative #2 will achieve substantial risk reduction through treatment of the principal threat at Operable Unit #1 of the THAN Superfund Site. The principal threat is the NAPL lens and the groundwater contamination since the soils have been removed from the western parcel in the ongoing removal action.

Pursuant to the removal, the remaining total organochlorine pesticide levels are less than 30 parts per million. The area excavated during the removal action will be backfilled with clean fill and revegetated. Quarterly monitoring and maintenance of this cover will occur. The vegetative cover will be compacted so that the permeability of the cover will be equivalent to the native Site soils. The vegetative cover will be inspected quarterly, at a minimum, and be maintained in good condition. Institutional controls, such as deed restrictions, will be established to preclude usage of groundwater and minimize land use.

Air emissions from the Site will be monitored to ensure compliance with the Clean Air Act. Air monitoring will be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures such as dust suppression or vapor capture will be employed to prevent harmful levels of air emissions from leaving the Site.

The selected alternative for Operable Unit #1 of the THAN site is consistent with the requirements of Section 121 of CERCLA and the National Contingency Plan. The selected alternative will reduce the mobility, toxicity, and volume of contaminated groundwater at the Site. In addition, the selected alternative is protective of human health and the environment, will attain all Federal and State applicable or relevant and appropriate requirements, is cost-effective and utilizes permanent solutions to the maximum extent practicable. The selected alternative for OU #1 is consistent with previous and projected remedial actions at the Site.

Based on the information available at this time, the selected alternative represents the best balance among the criteria used to evaluate remedies, especially in light of the ongoing removal action. Alternative #2 is believed to be protective of human health and the environment, will attain ARARs, would be cost effective, and would utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The goal of this remedial action is to restore the groundwater in the residuum and upper Ocala aquifers to its beneficial use (as drinking water) at this Site. The cleanup goals for this remedial action are listed in Table 8 in this ROD. Based on information obtained during the remedial investigation, and the analysis of all remedial alternatives, the selected remedy should be able to achieve this goal. Groundwater contamination may be especially persistent in the immediate vicinity of the contaminants' source, where concentrations are relatively high. The ability to achieve cleanup goals at all points throughout the area of attainment, or plume, cannot be determined until the extraction system has been implemented, modified as necessary, and plume response monitored over time. If the selected remedy cannot meet the specified remediation goals, at any or all of the monitoring points during implementation, the contingency measures and goals described in this section may replace the selected remedy and goals for these portions of the plume. Such contingency measures will, at a minimum, prevent further migration of the plume and include a combination of containment technologies, typically, groundwater extraction and treatment and institutional controls. These measures are considered to be protective of human health and the environment, and are technically practicable under the corresponding circumstances.

The selected remedy will include groundwater extraction and monitoring, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- at individual wells where cleanup goals have been attained, pumping may be discontinued;
- alternating pumping at wells to eliminate stagnation points;
- pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater; and
- installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that cleanup goals continue to be maintained, the aquifer will be monitored at least annually for five years following discontinuation of groundwater extraction for those wells where pumping has ceased.

The decision to invoke any or all of these measures may be made during a periodic review of the remedial action, which will occur at least every five years in accordance with CERCLA section 121 (c) and the NCP.

10.0 STATUTORY DETERMINATION

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action for this Site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment through isolating and treating a principal threat remaining at Operable Unit #1 of the Site, the contaminated groundwater and NAPL plume. The selected remedy provides protection of human health and the environment by eliminating, reducing, and controlling risk through treatment, engineering controls and/or institutional controls. The surface and subsurface soils at Operable Unit #1 of the Site are not deemed to be a threat, since the surface soils have been removed previously and site-specific PESTAN modeling indicates that the subsurface soils are not considered a source of contamination to groundwater.

10.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Remedial actions performed under CERCLA must comply with all applicable or relevant and appropriate requirements (ARARs). All alternatives considered for the THAN site were evaluated on the basis of the degree to which they complied with these requirements. The selected remedy was found to meet or exceed all ARARs, including those listed in Tables 10, 11, and 12, and the following:.

Clean Air Act

Air emissions from the remedial activities at the Site, including thermal treatment, would be monitored to ensure compliance with the substantive requirements of the Clean Air Act. Air monitoring will be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures such as dust suppression or vapor capture will be employed to prevent harmful levels of air emissions from leaving the Site.

Chemical-Specific ARARs

Maximum Contaminant Levels (MCLs) and non-zero MCLGs (where each is available) are the Groundwater Protection Standards set out in Table 8 of this ROD as the remedial action goals.

Waivers

Section 121 (d)(4)(C) of CERCLA provides that an ARAR may be waived when compliance with an ARAR is technically impracticable from an engineering perspective. No waivers are necessary with respect to the selected remedy.

Other Guidance To Be Considered

Other Guidance To Be Considered (TBCs) include health based advisories and guidance. TBCs have been utilized in estimating incremental cancer risk numbers for remedial activities at the sites. The risk numbers are evaluated relative to the normally accepted point of departure risk range of $1x10^{-4}$ to $1x10^{-6}$.

10.3 COST EFFECTIVENESS

The estimated cost of EPA's selected remedy is $4,100,000. Cost effectiveness is determined by comparing the cost of all alternatives being considered with their overall effectiveness to determine whether the costs are proportional to the effectiveness achieved. EPA evaluates the incremental cost of each alternative as compared to the increased effectiveness of the remedy. The selected remedy, Alternative #2, does cost more than the no action alternative; however, effectiveness achieved by Alternative #2 justifies the higher cost. The remedy is considered cost effective.

10.4 UTILIZATION OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

EPA believes the selected remedy is the most appropriate cleanup solution for the THAN site and provides the best balance among the evaluation criteria for the remedial alternatives evaluated. This remedy provides effective protection in both the short-term and long-term to potential human and environmental receptors, is implementable, and is cost-effective.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The statutory preference for treatment will be met because the selected remedy treats the highly contaminated NAPL and groundwater which are the principal threats posed by the Site.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan was released for public comment in September 1992. The plan identified alternative #2, pump and treat through ultraviolet/oxidation with discharge to a POTW, as the preferred alternative for groundwater remediation. The selected remedy calls for onsite reinjection of the treated groundwater instead of discharge to a POTW. Onsite reinjection was described as an alternative in the Feasibility Study. During the public comment period, new information indicated that the State of Georgia would allow a shallow, infiltration gallery onsite for disposal of the treated groundwater. Therefore, EPA and the State decided to select discharge of the treated groundwater onsite to an infiltration gallery onsite if a treatability study deems such a process to be practical. If an onsite infiltration gallery is not practical, treated groundwater will be discharged to a POTW or discharged to a local surface water body through and NPDES permit, as originally provided in the Proposed Plan.

Additionally, in consultation with the Georgia Environmental Protection Division, the vegetative cover for the Site which is described in the Proposed Plan will be compacted so that the permeability of the cover will be equivalent to the native Site soils. The vegetative cover will be inspected quarterly, at a minimum, and be maintained in good condition.

Georgia Department of Natural Resources
205 Butler Street, S.E., Suite 1252, Atlanta, Georgia 30334
Joe D. Tanner, Commissioner
Harold F. Reheis, Director
Environmental Protection Division

May 17, 1993

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EPA - REGION IV
ATLANTA, GA.

Mr. Richard D. Green
Associate Director
Superfund and Emergency Response
U.S. Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

RE: Revised Draft Record of Decision
TH Agriculture & Nutrition Site
Operable Unit One
Albany, Dougherty County, Georgia
May 12, 1993

Dear Mr. Green:

The Georgia Environmental Protection Division has reviewed the above referenced document and concurs with the Record of Decision and the Environmental Protection Agency's selected remedial action for the TH Agriculture & Nutrition Site.

If we can be of further assistance to you, please contact Bill Mundy at (404) 656-7802.

Sincerely,

Harold F. Reheis
Director

HFR/sse

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APPENDIX B
CONCURRENCE LETTERS