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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

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File: 541.460.0004
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The Memphis Depot – Main Installation
Proposed Plan

Memphis Depot Caretaker
August 2000

MEMPHIS DEPOT ANNOUNCES PROPOSED PLAN

This Proposed Plan identifies the Preferred Alternative for the cleanup of contaminated soil and groundwater at the Memphis Depot Main Installation (MI) and provides the rationale for the selection. In addition, this plan summarizes other cleanup alternatives evaluated for the site.

This document is issued by the Defense Logistics Agency (DLA), the lead agency for site activities. DLA, in consultation with U.S. Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC), will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. Based on new information or public comments that provide substantive new information, DLA, in consultation with EPA and TDEC, may modify the Preferred Alternative or select another remedial action presented in this Proposed Plan.

Therefore, the public is encouraged to review and comment on all the alternatives and on the rationale for the Preferred Alternative presented in this Proposed Plan. DLA issues this Proposed Plan as part of its public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Final MI Remedial Investigation (RI), the Final Soils and Groundwater Feasibility Study (FS) Reports, and other documents contained in the Administrative Record file for this site. DLA, EPA and TDEC encourage the public to review these documents to gain a better understanding of the site and remedial investigation activities that have been conducted.

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD
August 14 – September 13, 2000
DLA will accept written, electronic and verbal comments on this Proposed Plan during the public comment period

PUBLIC MEETING
August 24, 2000
DLA will hold an availability session and public meeting to explain the Proposed Plan and all the alternatives presented in the Feasibility Study Oral and written comments will also be accepted at the meeting, which will be held at

Memphis Depot Business Park "J" Street Café
2163 Airways Blvd., Memphis, TN
Availability Session begins 5:00 p.m.
Public Meeting begins 6:00 p.m.
Contact Persons Shawn Phillips (901) 544-0611
Alma Black Moore (901) 544-0613

OTHER WAYS TO COMMENT
Leave comments on the Environmental Information Line at (901) 544-0618 or send comments to:
Memphis Depot Caretaker Division
BRAC Environmental Coordinator
2163 Airways Blvd., Bldg. 144
Memphis, TN 38114-5210
Comrel@ddc.dla.mil

For more information, see the Information Repositories at the following locations:

Memphis Depot Caretaker Division
2163 Airways Blvd., Bldg. 144
Memphis, TN
(901) 544-0613
Community Outreach Room is in Building 144

Memphis/Shelby County Health Department
Pollution Control Division
814 Jefferson Avenue
Memphis, TN
(901) 576-7775
Hours. Monday to Friday, 7 30 a m -4 30 p m

Memphis/Shelby County Public Library
Cherokee Branch
3300 Sharpe Avenue
Memphis, TN
(901) 743-3655
Hours Monday to Wednesday, 10 a m -6 30 p m
Thursday, noon-6 30 p m , Saturday, noon-6 p m

Hillview Village Neighborhood Network Systems
2119 Alcy Road
Memphis, TN
(901) 743-0500
Hours. Monday to Friday, 8 a m -5 p m.

SITE HISTORY

Starting in the 1940s, the Memphis Depot received, warehoused, and distributed supplies common to all U.S. military services and some civil agencies. Activities at the MI included storing and shipping various materials including food, clothing, medical supplies, and industrial supplies including hazardous materials. Hazardous materials were used for facility maintenance. Types of past activities that lead to the presence of hazardous materials in the environmental media at the facility include pesticide application, painting and sandblasting, vehicle maintenance, and hazardous material storage. Other historical activities in open and enclosed storage areas included storing transformers with polychlorinated biphenyls (PCBs), storing and using pesticides/herbicides, and treating wood products with pentachlorophenol (PCP).

These industrial activities (e.g., spent sandblasting material with lead paint, over application of pesticides, spills) resulted in the presence of metals, pesticides, and other less frequently detected chemicals in surface soil, surface water, and sediment above background concentrations. Interim actions have been taken to remove soils containing pesticides and PCBs surrounding the Depot's housing area and cafeteria, respectively. The removal of soils containing elevated lead and other metals near the southwest corner of the MI is ongoing. These interim actions are detailed in the *Scope and Role of the Response Action* section of this Proposed Plan.

Groundwater in the uppermost fluvial aquifer is contaminated beneath the MI, and offsite to the southeast and to the southwest by volatile organic compounds (VOCs), primarily trichloroethene (TCE) and tetrachloroethene (PCE). The offsite concentrations of TCE and PCE to the southeast and southwest appear to be originating from offsite sources. The groundwater in the fluvial aquifer (the water table under the site) is not a drinking water source for area residents.

Important dates for the Memphis Depot as part of the cleanup process are as follows:

- The site was placed on the National Priorities List (NPL) on **October 14, 1992.**
- On **March 6, 1995**, a Federal Facilities Agreement (FFA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 120, and Resource Conservation and Recovery Act (RCRA), Sections 3008(h), and 3004(u) and (v), was reached by EPA, TDEC, and the Memphis Depot. The FFA outlined the terms by which the investigation and cleanup would be conducted.
- In **July 1995**, the Depot was identified for closure under the Base Realignment and Closure (BRAC) process, which requires environmental restoration at the Depot to comply with requirements for property transfer under Public Law 101-510 of Title XXIX Defense Base Closure and Realignment.

The Memphis Depot has performed major public participation activities throughout the CERCLA site cleanup process prior to this Proposed Plan. This includes monthly Restoration Advisory Board (RAB) meetings since 1994, numerous Community Involvement Sessions and public hearings, a bi-monthly newsletter, and the establishment of three information repositories and one Depot Community Outreach Room. The importance of the environmental justice issues have been addressed through the Memphis Depot's community outreach programs which consider the needs, interest and concerns of those most directly impacted by the site cleanup activities. As part of the public participation activities, the findings from the remedial investigation, including the baseline risk assessment, were presented to public during the June and July 2000 RAB meetings.

The Depot Redevelopment Corporation (DRC) was established to plan and coordinate the reuse of the Depot. The DRC conducted several public meetings during the preparation of its Memphis Depot Redevelopment Plan to obtain community feedback on future land use. The plan outlines intended future land and groundwater use for the Memphis Depot. The DRC board of directors, the City of Memphis and the County of Shelby approved the Memphis Depot Redevelopment Plan in 1997.

SITE CHARACTERISTICS

From 1995 through 1999, the Memphis Depot conducted a Remedial Investigation/ Feasibility Study (RI/FS) under EPA, TDEC, and DLA oversight. The RI/FS identified the types, quantities, and locations of contaminants and developed ways to address contamination problems. The MI was divided into seven geographic areas, termed Functional Units (FUs), to facilitate the investigation (see Figure 1 and the description below).

MI FUNCTIONAL UNIT DEFINITIONS AND ACTIVITIES

FU1 Twenty Typical Warehouses – Transportation to and storage in closed warehouses, light industrial

FU2 Southeast Golf Course/Recreational Area – Golf, ball fields, and playgrounds

FU3 Southwest Open Area - Transportation to and storage in open warehouses, sandblasting/ painting, light industrial

FU4 Northern and Open Areas – Transportation to and storage in open and closed warehouses, light industrial

FU5 Newer Warehouses – Transportation to and storage in closed warehouses, light industrial

FU6 Administrative and Residential Areas – Offices, equipment storage/maintenance, housing

FU7 MI Groundwater – Groundwater beneath the MI (not including Dunn Field)

The FUs are a refinement of the Operable Unit (OU) designation and are based on common past and anticipated future use of the land under a light industrial land-use scenario.

The RI indicated that:

- The surface soils across the MI contain low level concentrations of arsenic slightly above the background value as a result of historical application of pesticides. However, these levels do not exceed acceptable risk levels for an industrial worker. Arsenic levels in surface soil present an unacceptable risk level to the hypothetical future resident.

- The southwest quadrant of FU3 has lead concentrations in surface soil at levels that exceed the risk-based industrial health-protective level of 1,536 milligrams per kilogram (mg/kg). A soil removal action is currently underway at this portion of FU3 and will be completed in the summer of 2000. Other areas of unacceptable lead concentrations that exceed the risk-based industrial health protective level in surface soil are located in FU4, south of Building 949. Lead concentrations exceeding the residential child health-protective level of 300 mg/kg were detected in the surface soil in FU3 northwest of Building 770, and in FU4 south and west of Building 949, and south of Building 702.

- The pesticides dichlorodiphenyl-dichloroethene (DDE), dichlorodi-phenyltri-chloroethane (DDT), and dieldrin are found in the surface soil throughout the MI as a result of historical application, but not at levels that present unacceptable risk to industrial workers across the MI or recreational users in FU2 (the golf course area). However, dieldrin, together with arsenic in FU2, does present an unacceptable exposure risk for any hypothetical future resident.

- In FU7, two distinct VOC groundwater plumes were delineated in the southwestern and southeastern portions of the MI. These plumes appear to be joining in the central portion of the MI. The VOCs TCE and PCE were detected at the greatest concentrations off the southeast and southwest corners of the MI in groundwater that is offsite, upgradient and flowing onto the MI. Thus, these detections may have resulted from offsite sources of groundwater contamination. TDEC has initiated a Site Assessment to investigate offsite sources in the vicinity of the southeast and southwest corners of the MI. Metals including arsenic, lead, and cadmium were detected sporadically above background levels throughout the immediate vicinity of the sandblasting area in the southwestern corner of the MI. There is no use of the shallow aquifer in the area at this time, nor is such use anticipated in

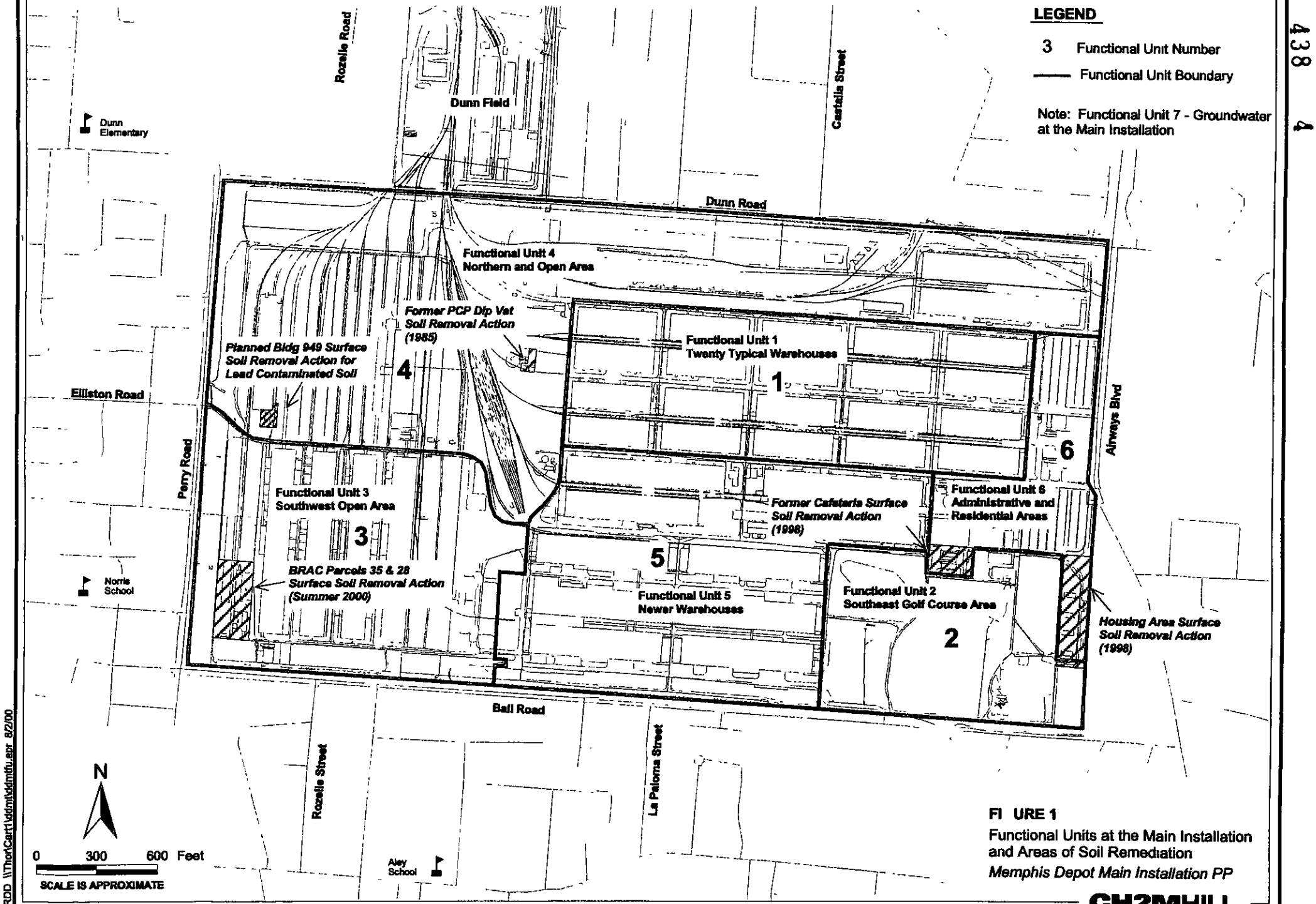

FIGURE 1

Functional Units at the Main Installation and Areas of Soil Remediation

Memphis Depot Main Installation PP

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the foreseeable future. VOCs in groundwater are not moving offsite from the MI Figure 2 shows the configuration of the TCE and PCE groundwater plumes on the basis of recent data (October/November1998 and March 2000).

• Recently, the geologic and hydrogeologic data from the MI and Dunn Field has been reviewed and a conceptual model of the site hydrogeology revised from the one presented in the MI RI report has been developed and presented in the Groundwater Feasibility Study (FS) report for the MI. The consultants and government agencies involved have established that additional soil borings and groundwater wells are needed to continue refining the conceptual model and provide necessary information on the site hydrogeology. This fieldwork will be conducted prior to the final Record of Decision (ROD) and prior to the design/implementation of the preferred alternative.

WHAT ARE THE "CONTAMINANTS OF CONCERN"?

The Memphis Depot, EPA and TDEC have identified five contaminants in the surface soil or groundwater that pose the greatest potential risk to human health at this site

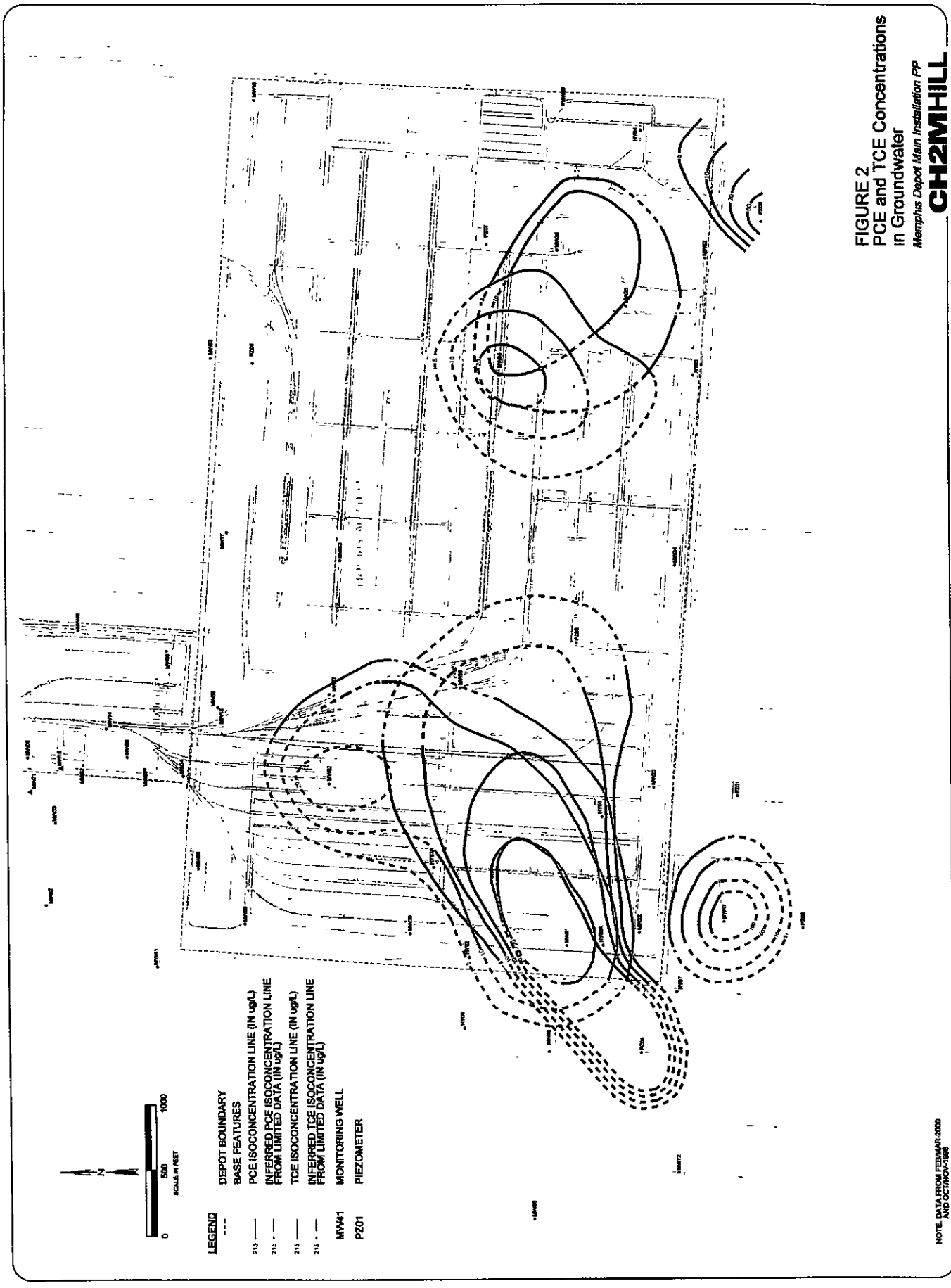
Arsenic: Detected in site soils at concentrations ranging from 0 43 to 101 mg/kg, arsenic is an inorganic chemical that occurs naturally It is released to the environment through metal smelting, combustion, and waste disposal, and as arsenical pesticides In soils it is relatively nonmobile. Arsenic is found at relatively low levels in many types of food, including seafood, meats, and grains Symptoms of acute inorganic arsenic poisoning in humans are nausea, anorexia, vomiting, epigastric and abdominal pain, and diarrhea Long-term exposures to high levels of arsenic in drinking water are known to cause cancers and "black-foot" disease in humans.

Dieldrin: Detected onsite in surface soils at concentrations ranging from 0 0012 to 10 mg/kg, dieldrin is an organochlorine compound widely used from the 1950s to 1970s as an insecticide in agriculture, for subsurface termite treatment, and for control of disease vectors such as mosquitoes Most uses of dieldrin (termite control was an exception) were banned in 1974 because of its adverse environmental and health effects. In 1987 EPA banned all uses of dieldrin. Dieldrin is a probable human carcinogen Short-term exposure to high concentrations of dieldrin chemical can cause headaches, dizziness, loss of consciousness, nausea, and loss of appetite Bound to soils, dieldrin can persist for a long time in the environment Binding to soil makes it less bioavailable compared to the pure chemical used in the toxicity studies.

Lead: Detected in site soils between 10 and 4,150 mg/kg, lead is a naturally occurring, bluish-gray metal found in small amounts in the earth's crust It does not dissolve in water and does not burn Lead has been used commercially in batteries, sheet metal, soldering, ceramic glazes, and paints Low levels of lead are common in human food, air, and water. Adult exposures to high levels of lead are known to adversely affect blood pressure, memory, the brain, and kidneys, and to cause anemia and blood disorders Lead is not known to cause cancer in humans. High exposures to lead are toxic to unborn and young children by affecting their intelligence quotient (IQ) EPA regulates lead as a special case using a blood-lead uptake model to determine target concentrations protective of children and adults.

Tetrachloroethene (PCE): This VOC was detected in groundwater at concentrations ranging from non-detections to 200 micrograms per liter (µg/L) (offsite to the southwest), PCE is most commonly used for dry-cleaning textiles and for metal degreasing Occupational exposures are most common among workers at dry cleaning facilities High exposures can cause effects on the central nervous system, leading to dizziness, headache, sleepiness, confusion, nausea, and difficulty in coordination and speech. Exposure of PCE at high levels (considerably higher than detected at the Depot) can cause unconsciousness and death In animal experiments with exposure to long-term higher-than-typical environmental concentrations, PCE is shown to cause liver and kidney damage, developmental effects, liver cancer, and leukemia. Based on animal evidence PCE is presumed to be capable of causing cancer in humans, however, human exposure data do not conclusively indicate that it is carcinogenic

Trichloroethene (TCE): This VOC was detected in groundwater at concentrations ranging from non-detection to 58 µg/L (offsite to the southeast), TCE is a halogenated organic compound used historically as a solvent and degreaser in many industries. Exposure to this compound has been associated with deleterious health effects in humans, including anemia, skin rashes, diabetes, liver conditions, and urinary tract disorders Based on laboratory studies, TCE is considered a probable human carcinogen


LEGEND
DEPOT BOUNDARY
BASE FEATURES
PCE ISOCONCENTRATION LINE (IN ug/L)
INFERRED PCE ISOCONCENTRATION LINE FROM LIMITED DATA (IN ug/L)
TCE ISOCONCENTRATION LINE (IN ug/L)
INFERRED TCE ISOCONCENTRATION LINE FROM LIMITED DATA (IN ug/L)
MW41 MONITORING WELL
PZ01 PIEZOMETER
0
500
1000
SCALE IN FEET
N
NOTE: DATA FROM FEB/MAR-2000 AND OCT/NOV-1998
ATLANTA/CAD1/PROJECTS/148071 DDMT 04-AUG-2000 8071mi32.dgn
FIGURE 2
PCE and TCE Concentrations in Groundwater
Memphis Depot Main Installation PP
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WHAT IS A "PRINCIPAL THREAT" WASTE" AND A "LOW-LEVEL THREAT WASTE"?

Principal threat wastes are highly toxic or highly mobile source materials that generally cannot be reliably contained, or that are a significant risk to human health or the environment if exposure occurs.

Low-level threat wastes are those source materials that generally can be reliably contained or managed through institutional controls, and that would present only a low risk in the event of exposure They include source materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels

Wherever practical, treatment is used to address the principal threats posed by a site (National Contingency Plan, Section 300 430(a)(1)(iii)(A)). This *principal threat* concept characterizes *source materials* at a site A source material is any material that includes or contains hazardous substances, pollutants, or contaminants and acts as a reservoir for moving contamination to groundwater, surface water, or air, or that serves as a source for direct exposure to contamination While contaminated groundwater is not usually considered a source material, non-aqueous phase liquids (NAPLs) in groundwater may be. The decision to treat these wastes is made for each site by analyzing the alternatives in detail with nine remedy selection criteria (these criteria are provided in the three tables at the end of this Proposed Plan) This detailed analysis provides a statutory basis for a remedy with treatment as a principal element

Surface and subsurface soils across the MI are **not** considered to be principal threat wastes as defined by EPA guidance (See the definition above.) No evidence of non-aqueous phase liquid (NAPL) has been discovered on the MI. Although contaminated groundwater poses a slight risk, it is not considered a "principal threat."

SCOPE AND ROLE OF THE RESPONSE ACTION

The overall strategy for remediating the MI is to select the most effective response action to address surface soil and groundwater contamination that will allow transfer or lease of the property for its intended land use. This intended land use is industrial for FU1 and FU3 through FU6, and unlimited recreational for FU2. Although unrestricted reuse (residential land use scenario) was evaluated in the FS for a cost comparison purpose, only the industrial alternative scenarios are being considered in this Proposed Plan. This is due to the current and planned future land use of the MI (as detailed in the Memphis Depot Redevelopment Plan), and the current zoning for the MI (Light Industrial), which prohibits residential use.

Interim soil removal actions have taken place at four locations at the MI (Figure 1):

- Surface soil in FU3, which was contaminated with metals and polynuclear aromatic hydrocarbons (PAHs) from painting and sandblasting activities, has been removed as part of an ongoing removal action (to be completed in summer of 2000).
- Surface soil in the housing area of FU6 has been removed because of the presence of dieldrin (completed in 1998). The housing area is an exception to the overall industrial land use for MI and it is acceptable for residential reuse.
- Surface soil surrounding the former cafeteria (Building 274) in FU6 has been removed because of elevated levels of PCBs (completed in 1998).
- Soil has been removed from the PCP dip vat area in FU4 (Building 737) because of elevated levels of PCP (completed in 1985).

SUMMARY OF SITE RISKS

As part of the RI/FS, the Memphis Depot conducted a baseline risk assessment to determine possible current and future effects of contaminants on human health and the environment. The baseline risk assessment focused on health effects for both children and adults, in industrial, recreational, and hypothetical residential settings that could result from contact with contaminated soil or groundwater. Examples include children ingesting soil while playing in the area or adults using groundwater for drinking water The current judgment is that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Human Health Risks

Analysis of soil sampling data indicates that probable exposure concentrations in different areas of the MI ranged from 0.43 to 101 mg/kg for arsenic, from 10 to 4,150 mg/kg for lead, and from 0.0.0012 to 10 mg/kg for dieldrin. The excess lifetime cancer risk (ELCR) levels due to intake of contaminated surface soil by a future receptor under industrial land use are within acceptable limits of 1 to 100 in a million. Hazard quotients associated with non-cancer-causing chemicals (ratio of chemical intake to a reference dose is the hazards index) for future industrial workers are below a target value of 1.0. Lead is above the industrial health protective level of 1,536 mg/kg in selected areas. The site has a predominantly industrial and recreational (golf course and playground areas) setting, which is likely to remain in the future. Dieldrin and arsenic levels in surface soil in some areas and unacceptable lead in surface soil in selected areas present unacceptable risks for hypothetical future residents.

Similarly, the analysis of groundwater sampling data (as presented in Section 34 of the Baseline Risk Assessment for FU7 in the RI report) found that the average PCE concentrations from the three organic contamination plumes ranged from 5.5 to 39 micrograms per liter (µg/L) and from 6.8 µg/L to 9.3 µg/L, respectively The maximum PCE concentration was 120 µg/L and the maximum TCE concentration was 58 µg/L. Both PCE and TCE were in excess of the Safe Drinking Water Act maximum contaminant levels (MCLs) of 5 µg/L each. Arsenic in groundwater had an average concentration of 2.3 µg/L, which is well below an MCL of 50 µg/L The maximum arsenic concentration was 91 µg/L. Exposure to average organic contaminants of potential concern (COPCs) concentrations present risks to future industrial workers and hypothetical future residents that are within the acceptable risk range of 1 to 100 in a million. HIs for a future industrial worker are within the acceptable level of 1.0, whereas the HIs for a hypothetical future residential adult and child were at 1.0 and above 1.0, respectively. Exposure to maximum COPCs concentrations present risks to future industrial workers that are within the acceptable range, but present risks for the hypothetical future residential adult that are in the unacceptable range. HIs for a future industrial worker are within the acceptable level, whereas the HIs for a future hypothetical residential child were above 1 0 Currently, there are no users of the shallow, fluvial aquifer beneath the Memphis Depot. Future concentrations of the VOCs are likely to decrease with time due to natural attenuation processes, although monitoring will be necessary to confirm this.

These risks and hazard levels indicate that there are significant potential risks to industrial workers from lead in the soil. Although PCE and TCE occur in groundwater above MCLs, they do not present significant current health risks because no one is drinking the water and the water table is approximately 80 feet below land surface. These risk estimates are based on future reasonable maximum exposure scenarios and were developed by taking into account conservative assumptions about the frequency and duration of an individual's exposure to the soil and groundwater, as well as the toxicity of the compounds.

Ecological Risks

A screening level ecological risk assessment conducted across the MI indicated little potential for significant ecological impacts or adverse effects to wildlife The golf course and the extensive industrialized areas do not provide natural habitat for wildlife. These land uses will remain unchanged in the future; therefore, the potential for wildlife exposure is low. In addition, there were no ecological contaminants of concern (COCs) identified at the facility.

REMEDIAL ACTION OBJECTIVES

The groundwater Remedial Action Objectives (RAOs) describe the goals that the remedial actions identified in this Proposed Plan are expected to accomplish. The RAOs are expected to:

- Prevent ingestion of water contaminated with VOCs in excess of MCLs from potential future onsite wells; and

- Prevent migration offsite of groundwater contaminants in excess of MCLs.

The MCLs for TCE (5 µg/L) and PCE (5 µg/L) are the appropriate cleanup standards for groundwater beneath the MI.

The surface soil RAO for protection of industrial workers is to prevent direct contact/ingestion of surface soils contaminated with lead in excess of industrial worker risk-based criteria (1,536 mg/kg).

No future residential development is planned for the property. RAOs and alternatives for remediation to residential standards were included in the FS for comparison purposes only and are not presented in this Proposed Plan.

The RAOs would reduce the excess cancer risk and HI associated with exposure to contaminated soil to acceptable levels to future workers and to prevent future residential development of the site. This will be achieved by reducing the exposure concentration of lead to the target cleanup level of 1536 mg/kg (calculated using blood-lead uptake models)and by imposing land use restrictions.

Because there are no federal or state cleanup standards for soil contamination, these cleanup standards where established based on the baseline risk assessment (BRA). Targets were selected that would both reduce the risk associated with exposure to soil contaminants to an acceptable level, and ensure minimal migration of contaminants into the groundwater.

SUMMARY OF REMEDIAL ALTERNATIVES

The remedial alternatives for the Depot MI that are presented in the following text and are numbered as shown below to correspond with the numbers in the MI FS Reports.

LIST OF REMEDIAL ALTERNATIVES		
Medium	Feasibility Study (FS) Alternative	Description
Soil	SS1	No Action
	SS2	Institutional Controls
	SS3	Soil Containment
	SS4	In-situ Soil Treatment
	SS7	Excavation and Offsite Disposal
Ground-water	GW1	No Action
	GW2	Monitored Natural Attenuation
	GW3	Enhanced Bioremediation
	GW4	Air Sparging
	GW6	Extraction and Discharge to POTW
SS = Surface Soil	*GW = Groundwater*	

Many of these alternatives have common components. Some soil may be characterized as a hazardous waste by RCRA and is therefore subject to RCRA land disposal restrictions (LDRs) if the waste is excavated and treated or removed from the area of contamination. All remedies involving these activities must comply with the LDR (63 *Federal Register* 28555, May 26, 1998) and meet 90 percent removal efficiency or 10 times the universal treatment standard for that contaminant in the material before disposal in a RCRA-permitted landfill. The groundwater at the site does not contain RCRA hazardous waste; therefore, the LDR standards are not applicable

Although the Soils FS evaluated residential reuse, it is not being carried forward because it is not part of the planned reuse of the MI. Several of the remedies require institutional controls, such as deed restrictions, to limit the use of parts of the property or to make sure that the groundwater is not used as drinking water. These resource-use restrictions, along with existing land use and groundwater use controls (such as zoning restrictions and Memphis-Shelby County groundwater use restrictions) provide protective layers of land use restrictions. They are discussed in each alternative if appropriate.

The type of restriction, monitoring, and enforceability will need to be determined for the selected remedy in the Record of Decision (ROD). As described in CERCLA regulations, none of the alternatives rely on institutional controls alone to achieve protectiveness. Monitoring to ensure the effectiveness of the remedy, including deed restrictions, is part of each alternative, except for the 'No Action' alternative. Natural attenuation is part of each groundwater alternative.

In each soil alternative except the 'No Action'alternative, the Soils FS evaluated levels of protectiveness for residents, for indoor and outdoor industrial workers, and for an unlimited recreational user in FU2 only. The Soil Alternatives SS2, SS3, SS4, and SS7 presented in this plan assume that the land use will allow indoor and outdoor industrial workers in all FUs and unlimited recreational users in FU2, but not residents. All soil and groundwater alternatives, except the 'No Action' alternatives, are expected to attain the RAOs. As presented in the Soil FS, no soil alternative was evaluated for the housing area in FU6. A previous surface soil removal action was conducted and the area is acceptable for residential reuse.

Soil Alternatives

Alternative SS1: No Action (FUs 1-6)

Capital Costs:	*$0*
Present worth (PW) O&M Costs:	*$0*
Total PW Costs:	*$0*
Duration to Achieve RAOs:	*Unknown*

Regulations governing CERCLA require that the 'No Action' alternative be evaluated to establish a baseline for comparison. Under this alternative, the Memphis Depot would take no action at the site to prevent exposure to soil contamination.

Alternative SS2: Institutional Controls

Capital Costs:	*$19,000*
PW O&M Costs:	*$64,000*
Total PW Costs:	*$83,000*
Duration to Achieve RAOs:	*6 months*

This alternative would leave low-level contaminated surface soils in place but would involve permanent deed restrictions prohibiting residential use (including day care operations) in FUs 1 through 6; prohibiting fishing and swimming in the lakes in FU2 for safety reasons; precluding casual access from adjacent offsite residents through maintenance of a boundary fence surrounding FU2; regulation of intrusive activities during which potential industrial users could encounter contaminants in FU4; maintenance of access barriers and signage to limit entry into contaminated area in FU4; and periodic monitoring of the controlled area in FU4 Institutional controls are applicable for industrial use across the MI and unlimited recreational use of FU2.

Alternative SS3: Soil Containment

Capital Costs:	*$51,000*
PW O&M Costs:	*$310,000*
Total PW Costs:	*$361,000*
Duration to Achieve RAOs:	*<1 year*

This alternative involves the placement of a protective soil cover over approximately 7,200 square feet of lead contaminated surface soils to act as a physical barrier against direct contact under an industrial land use scenario. Surface controls would be necessary to prevent erosion damage or other disturbances to the protective cover. Under an industrial land use scenario, this alternative would involve permanent deed restrictions prohibiting residential use (including day care operations) in FUs 1 through 6 and intrusive activities into the protective cover in FU4; maintenance of the cover; access barriers and signage in FU4; and periodic monitoring of the controlled area in FU4.

Alternative SS4: In-situ Soil Treatment

Capital Costs.	*$51,000*
PW O&M Costs:	*$72,000*
Total PW Costs:	*$123,000*
Duration to Achieve RAOs.	*6 months*

This alternative includes in-situ treatment for lead contaminated surface soils. Approximately 7,200 square feet (or 270 in-place cubic yards) of lead contaminated surface soils with would be treated with a stabilizing chemical to fix, or immobilize, the contaminant. These solidification agents physically bind contaminants within a stabilized mass. Tilling and injector head systems would be used to apply stabilization agents to in-situ soils. Under this alternative, site surface soils would have to be evaluated through laboratory analyses to confirm that treatment met cleanup standards. Under an industrial land use scenario, this alternative would involve permanent deed restrictions prohibiting residential use (including day care operations) in FUs 1 through 6.

Alternative SS7: Excavation, Transportation, and Offsite Disposal

Capital Costs:	*$183,000*
PW O&M Costs:	*$57,000*
Total PW Costs.	*$240,000*
Duration to Achieve RAOs:	*<6 months*

This alternative includes excavation of approximately 270 cubic yards of lead contaminated surface soils, transport offsite and permanent disposal in a RCRA-permitted landfill as a non-hazardous waste or hazardous waste depending on levels of contamination. Following excavation of the contaminated soil, clean backfill (laboratory-tested) would be placed in all areas excavated, and the site would be restored to its original condition. Under an industrial land use scenario, surface soil containing lead at concentrations of ≥1,536 mg/kg in FU4 would be required to be removed. This alternative would also involve permanent deed restrictions prohibiting residential use (including day care operations) in FUs 1 through 6.

Groundwater Alternatives

Alternative GW1: No Action

Capital Costs:	*$0*
PW O&M Costs:	*$0*
Total PW Costs:	*$0*
Duration to Achieve RAOs.	*unknown*

This alternative is required by CERCLA as a baseline for other alternatives. The 'No Action' alternative does not include any institutional controls, groundwater monitoring, or active remedial activities. This alternative allows natural attenuation to reduce the contaminant plume in groundwater, but the lack of monitoring may allow plume migration to offsite areas or into deeper aquifers. The lack of institutional controls may allow unauthorized future development of groundwater within the MI after the Depot is transferred to new owners. Both uncontrolled plume migration and future groundwater development within the MI would pose unacceptable risks to humans.

This alternative relies solely on existing groundwater use controls established by the Memphis-Shelby County Health Department, Water Quality Branch, which prevent the installation of water wells within 0.5 mile of the designated boundaries of a listed federal CERCLA site.

Alternative GW2: Institutional Controls with Long-Term Monitoring

Capital Costs:	*$162,000*
PW O&M Costs:	*$676,000*
Total PW Costs:	*$838,000*
Duration to Achieve RAOs:	*30 years*

This alternative relies on deed restrictions, coupled with existing groundwater use controls established by the Memphis-Shelby County Health Department, Water Quality Branch, prohibiting installation and use of groundwater production wells until groundwater plume concentrations meet MCLs. This alternative also relies on natural attenuation (dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials) to reduce groundwater plume concentrations.

The limited biodegradation processes will require between 15 and 50 years to reduce plume concentrations to MCLs. The assumed duration of this alternative is 30 years; therefore, long-term monitoring of approximately 20 groundwater monitoring wells would be needed to record the progress of natural attenuation, to document changes in plume concentrations, and to detect potential plume migration to offsite areas or into deeper aquifers. The wells would be monitored biannually for years 1 through 5 and then annually for years 6 to 30 (or until groundwater MCLs are met). A contingency plan for more aggressive plume treatment would be developed and implemented, if an unacceptable risk were indicated during the implementation of the alternative, including not meeting the RAO time frame.

Alternative GW3: Enhanced Bioremediation

Capital Costs:	*$1,019,000*
PW O&M Costs:	*$1,203,000*
Total PW Costs:	*$2,222,000*
Duration to Achieve RAOs:	*10 years*

This alternative uses injection of nutrients/chemicals to enhance the natural biodegradation processes. The remedy would accelerate biodegradation in the most contaminated parts of the groundwater plume. Untreated parts of the groundwater plume will degrade under natural attenuation processes (as described in Alternative GW2). Without pilot test data, a conservative assumption was made that the nutrients/chemicals would triple the biodegradation rate within the aquifer, and that the duration of the remedial action was assumed to be 10 years. Therefore, enhanced bioremediation must also include institutional controls and groundwater monitoring similar to Alternative GW2.

Nutrient/chemical injection into the fluvial aquifer would occur via approximately 120 wells. Treatment zones would be established in the most contaminated parts of the groundwater plume within the MI. Pilot tests would be required to determine nutrient/chemical type, injection volumes, spacing, and depth. Nutrient/chemical re-injection would occur at intervals determined by pilot tests and monitoring results.

Groundwater monitoring would occur to document changes in plume concentrations, and to detect potential plume migration to offsite areas or into deeper aquifers. A contingency plan for more aggressive plume treatment would be developed and implemented if an unacceptable risk were indicated during the implementation of the alternative. The alternative also includes deed restrictions prohibiting installation and use of production and consumptive use wells during the life of the remedy. These restrictions may be removed at the completion of the remedy.

Alternative GW4: Air Sparging

Capital Costs:	*$3,429,000*
PW O&M Costs.	*$876,000*
Total PW Costs:	*$4,305,000*
Duration to Achieve RAOs:	*10 years*

This alternative treats groundwater through a network of approximately 80 air injection wells. The remedy would remove contaminants from the most contaminated parts of the groundwater plume through the injection of air, which volatilizes the PCE and TCE from the groundwater into the vadose zone. Untreated parts of the groundwater plume will degrade under natural attenuation processes. Without pilot test data, a conservative assumption was made that air sparging would remediate the plume in 10 years. Therefore, this alternative would include institutional controls and groundwater monitoring similar to Alternative GW2 (Institutional Controls with Long-Term Monitoring).

Groundwater monitoring would be required to document changes in plume concentrations, and to detect potential plume migration to offsite areas or into deeper aquifers. A contingency plan for more aggressive plume treatment would be developed and implemented if an unacceptable risk were indicated during the implementation of the alternative. The alternative also includes deed restrictions prohibiting installation and use of production and consumptive use groundwater wells during the life of the remedy. These restrictions may be removed at the completion of the remedy. Pilot tests would be required to determine air injection rates, spacing, and zone of influence. Pilot test data would also be used to determine the need for offgas collection and treatment of the volatized PCE and TCE to meet air emissions standards.

Alternative GW6: Extraction and Discharge to POTW

Capital Costs:	*$2,228,000*
PW O&M Costs:	*$2,582,000*
Total PW Costs.	*$4,810,000*
Duration to Achieve RAOs:	*10 years*

This alternative consists of pumping groundwater from approximately 12 extraction wells in the most contaminated parts of the plume and discharging the water offsite to the City of Memphis publicly owned treatment works (POTW). Untreated parts of the plume will degrade under natural attenuation processes (as described in Alternative GW2). The estimated life of the remedial action was set at 10 years. Therefore, the alternative includes institutional controls and groundwater monitoring similar to Alternative GW2 (Institutional Controls with Long-Term Monitoring).

Groundwater monitoring would be required to document changes in plume concentrations, and to detect potential plume migration to offsite areas or into deeper aquifers. A contingency plan for more aggressive plume treatment would be developed and implemented if an unacceptable risk were indicated during the implementation of the alternative. The alternative also includes deed restrictions prohibiting installation and use of production and consumptive use groundwater wells during the life of the remedy These restrictions may be removed at the completion of the remedy. Pilot tests at the MI would be required to determine groundwater extraction rates, well spacing, and zone of influence. Effluent monitoring would be performed as required by the discharge permit from the City of Memphis.

CRITERIA FOR EVALUATING REMEDIAL ALTERNATIVES

The selection of the preferred alternative for the surface soil and groundwater at the Memphis Depot MI, as described in this Proposed Plan, is the result of a comprehensive screening and evaluation process. The FS identified and analyzed appropriate alternatives for addressing the contamination at the MI. The FS and other documents describe, in detail, the alternatives considered, as well as the process and criteria used to narrow the list of the potential remedial alternatives to address the contamination at the MI. These documents are available for public review in the Information Repositories.

The nine criteria used to evaluate the different remediation alternatives individually and against each other in order to select a remedy are discussed below.

Threshold Criteria

1. ***Overall Protection of Human Health and the Environment*** - Addresses whether a remedy provides adequate protection of human health and the environment, and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. ***Compliance with ARARs*** - Addresses whether or not a remedy will meet the ARARs for federal and state environmental statues and/or provide grounds for invoking a waiver.

Evaluating Criteria

3. ***Long-Term Effectiveness and Permanence*** - Refers to the expected magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4. ***Reduction of Toxicity, Mobility, or Volume through Treatment*** - Refers to the anticipated performance of the treatment technologies that may be employed in a remedy

5. ***Short-Term Effectiveness*** - Addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. ***Implementability*** - Refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. ***Cost*** - Includes estimated capital and operations and maintenance (O&M) costs, also expressed as net present worth costs.

Modifying Criteria

8. ***State Acceptance*** - Indicates whether, based on its review of the FS and Proposed Plan, the state concurs with, opposes, or has no comment on the preferred alternative. The assessment of state concerns may not be complete until after the public comment period on the FS and Proposed Plan.

9. ***Community Acceptance*** - Summarizes the general response to the alternatives described in the FS and Proposed Plan on public comments received. Like state acceptance, evaluations under this criterion usually will not be completed until after the public comment period is held. Community acceptance will be assessed in the ROD following a review of the public comments received on the FS and Proposed Plan.

Each of the alternatives is evaluated by the nine criteria in the following tables. Note that the costs listed in this table are order-of-magnitude estimates, meaning that they are typically accurate within plus 50 to minus 30 percent. The "Detailed Analysis of the Alternatives" and the "Comparative Analysis of the Alternatives" can be found in the MI Groundwater and Soils FSs, Section 4.

	Soil Remedial Alternatives – Industrial/Recreational Use				
Evaluation Criteria	**SS1 No Action**	**SS2 Institutional Controls**	**SS3 Soil Containment**	**SS4 In-situ Soil Treatment**	**SS7 Excavation and Offsite Disposal**
Protective of Human Health and Environ.	No	Yes	Yes	Yes	Yes
Complies with ARARs	No	Yes	Yes	Yes	Yes
Effective and Permanent	No	Yes	Yes	Yes	Yes
Reduces Toxicity, Mobility or Volume through Treatment	No	No	No	Yes	No
Short-term Effectiveness	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Implementable	Yes	Yes	Yes	Yes	Yes
Cost	$0	$83,000	$361,000	$123,000	$240,000
State Acceptance	Unlikely	Likely for FU1, 2, 3, 5, and 6 Unlikely for FU4	Unlikely	Likely	Likely
Community Acceptance	Will be determined after comment period	Will be determined after comment period	Will be determined after comment period	Will be determined after comment period	Will be determined after comment period

	Groundwater Remedial Alternatives – All Users				
Evaluation Criteria	**GW1 No Action**	**GW2 Institutional Controls with Long-Term Monitoring**	**GW3 Enhanced Bioremediation**	**GW4 Air Sparging**	**GW6 Extraction and Discharge to POTW**
Protective of Human Health and Environ	No	Yes	Yes	Yes	Yes
Complies with ARARs	No	Yes	Yes	Yes	Yes
Effective and Permanent	No	Yes	Yes	Yes	Yes
Reduces Toxicity, Mobility or Volume through Treatment	No	Yes	Yes	Yes	Yes
Short-term Effectiveness	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable
Implementable	Yes	Yes	Yes	Yes	Yes
Cost	$0	$0.84 million	$2 2 million	$4 3 million	$4.8 million
State Acceptance	Unlikely	May be likely	Likely	Likely	Likely
Community Acceptance	Will be determined after comment period	Will be determined after comment period	Will be determined after comment period	Will be determined after comment period	Will be determined after comment period

PREFERRED ALTERNATIVE

After conducting a detailed analysis of all the feasible cleanup alternatives based on the criteria described in the previous sections, the following cleanup plan to address surface soil and groundwater contamination at the MI of the Depot is proposed.

The preferred soil alternative is.

***Alternatives SS2 and SS7,* Institutional Controls, and Excavation, Transportation, and Offsite Disposal, at a present worth cost of $240,000.**

The preferred groundwater alternative is:

***Alternative GW3,* Enhanced Bioremediation, at a present worth cost of $2,222,000.**

The Preferred Alternative for cleaning up the MI of the Memphis Depot combines:

- Alternative SS2 (Institutional Controls) for each FU to prevent a residential land use scenario;
- Alternative SS7 (Excavation, Transportation and Offsite Disposal) to remove approximately 270 cubic yards of surface soil containing lead at concentrations ≥1,536 mg/kg at FU4 (see Figure 1), allowing unrestricted industrial use; and
- Alternative GW3 (Enhanced Bioremediation) accelerate biodegradation in the most contaminated part of the groundwater plume.

Deed restrictions, in conjunction with existing land use controls, are the main types of institutional controls, but they differ slightly from FU to FU. The deed restrictions for the MI are:

- Prevention of residential development land use on the MI
- Daycare restriction controls
- Production/consumptive use groundwater well controls for the fluvial aquifer, and for drilling into aquifers below the fluvial aquifer
- No fishing or swimming in the FU2 lakes for safety reasons
- Preclude casual access from adjacent offsite residents through maintenance of a boundary fence surrounding FU2 (recreational area)

SS7 was chosen as the preferred alternative for remediation to industrial uses due to its expediency, permanency, and moderate cost.

Alternative SS2 was chosen for each FU, but with slight variations. For FU1, FU3, FU4, FU5 and FU6, deed restrictions will be used to prevent residential land use, including day care operations. The same deed restrictions and site controls apply in FU2, but future unlimited recreational activities may occur. The preferred soil alternative was selected over other alternatives because deed restrictions and site controls can be implemented quickly, and they provide additional layers of protectiveness above existing land use restrictions and controls. SS7 provides permanent reduction through removal verses treatment as described in SS4. This alternative is expected to allow the property to be used for the anticipated industrial land use, and does not preclude future removal actions if warranted.

The preferred groundwater alternative was selected over the other alternatives because it is expected to achieve risk reduction through the injection of nutrients/ chemicals into the groundwater plume to enhance the natural biodegradation processes. Groundwater monitoring would occur to document changes in plume concentrations, and to detect potential plume migration to offsite areas or into deeper aquifers. It also provides use restrictions to prevent future exposure to currently contaminated groundwater during the life of

the remedy. Hence, the combination of Alternatives SS2 and SS7, and GW3, hereafter referred to as the Preferred Alternative, reduces the risk within a reasonable time frame and provides for long-term reliability of the remedy. A contingency plan for more aggressive groundwater plume treatment would be developed and implemented if an unacceptable risk were indicated during the implementation of this alternative (i.e., concentrations of PCE and/or TCE migrating offsite or deeper into underlying aquifers greater than the MCLs or not meeting the cleanup time frame). Because the proposed plan leaves waste in place at levels that do not allow for unrestricted future use at the site, CERCLA requires that the protectiveness of the remedy be reviewed at least every 5 years.

Based on the information available at this time, the Memphis Depot, EPA and TDEC believe the Preferred Alternative will be protective of human health and the environment, will comply with ARARs, will be cost-effective, and will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The Preferred Alternative can change in response to public comment or new information, such as a detected change in groundwater contaminant concentrations that would require an additional or more active remedy.

COMMUNITY PARTICIPATION

The Memphis Depot, EPA and TDEC provide information regarding the cleanup of the Memphis Depot to the public through public meetings, the Administrative Record file for the site that can be found in the Information Repositories, and announcements published in the *Commercial Appeal, Tri-State Defender* and *Silver Star News.* The Memphis Depot, EPA and TDEC encourage the public to gain a more comprehensive understanding of the site and the remedial investigation activities that have been conducted at the site.

The dates for the public comment period, the date, location, and time of the public meeting, and the locations of the Information Repositories, are provided on the front page of this Proposed Plan.

For further information on the Memphis Depot's environmental cleanup program, please contact:

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ACRONYMS

ARAR	Applicable or relevant and appropriate requirement
BCT	BRAC Cleanup Team
BRA	Baseline risk assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of concern
COPC	Contaminant of potential concern
DDE	Dichloro-diphenyldichloroethene
DDT	Dichloro-diphenyltrichloroethane
DLA	Defense Logistics Agency
ELCR	Excess lifetime cancer risk
EPA	U S Environmental Protection Agency
FFA	Federal Facilities Agreement
FR	*Federal Register*
FS	Feasibility Study
FU	Functional unit
GW	Groundwater
HI	Hazard index
IQ	Intelligence quotient
LDR	Land disposal restriction
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MI	Main Installation
MNA	Monitored natural attenuation
NAPL	Non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NPL	National Priorities List
O&M	Operation and maintenance
OU	Operable unit
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PCP	Pentachlorophenol
POTW	Publicly owned treatment works
PRG	Preliminary remediation goal
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SS	Surface soil
TCE	Trichloroethene
TDEC	Tennessee Department of Environment and Conservation
VOC	Volatile organic compound

GLOSSARY OF TERMS

Terms used in this Proposed Plan are defined below.

Administrative Record: A file that is maintained and contains all information used by the lead agency to make its decision on the selection of a method to be utilized to clean up/treat contamination at a CERCLA site. This file is held in the information repository for public review

Air Sparging: An in-situ technology in which air is bubbled through a contaminated aquifer, creating an underground treatment zone that removes contaminants by volatilization

Applicable or relevant and appropriate requirements (ARARs): The federal and state environmental laws that a selected remedy will meet. These requirements may vary among sites and alternatives.

Aquifer: An underground geological formation, or group of formations, containing usable amounts of groundwater that can supply wells and springs

Background value: Concentration level of a chemical that is not attributed to current site activities

Bioremediation or Biodegradation: The use of microorganisms to transform or alter, through metabolic or enzymatic action, hazardous organic contaminants into nonhazardous substances

Contaminant plume: A column of contamination with measurable horizontal and vertical dimensions that is suspended in and moves within groundwater.

Ex-situ: The removal of a medium (for example, water or soil) from its original place, as through excavation, in order to perform the remedial action.

Groundwater: Underground water that fills pores in soils or openings in rocks to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells

Information Repository: A file containing accurate up-to-date information, technical reports, reference documents, information about the Technical Assistance Grant, and any other materials pertinent to the site This file is usually located in a public building such as a library, city hall or school that is accessible for local residents.

In-Situ: The in-place remediation of a medium (for example, groundwater or soil) at its original place, as through the addition or nutrients, chemicals or processes, in order to perform the remedial action.

Land Disposal Restriction (LDR): The land disposal restrictions program requires certain wastes to be treated before they may be disposed of in the land.

Long term Monitoring: Periodic sampling and analysis of groundwater for the purpose of monitoring contaminant concentrations over time.

Monitoring: Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action (for instance, monitoring wells drilled into the different water-bearing zones or aquifers at the Depot would be used to detect any contaminant movement away from the area of remediation)

Natural Attenuation: Natural subsurface processes, such as dilution, volatilization, biodegradation, adsorption and chemical reactions with subsurface material, that reduce contaminant concentrations

Organic compounds: Carbon compounds, such as solvents, oils, and pesticides. Most are not readily dissolved in water Some organic compounds can cause cancer.

Operations and maintenance (O&M): Activities necessary to maintain and operate a treatment system.

Present worth analysis: A method to evaluate expenditures that occur over different time periods By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared on the basis of a single figure for each alternative. When calculating present worth cost for CERCLA sites, total operations and maintenance costs are included.

Resource Conservation and Recovery Act (RCRA): The federal act that established a regulatory system to track hazardous wastes from the time they are generated to their final disposal RCRA also provides for safe hazardous waste management practices and imposes standards for transporting, treating, storing, and disposing of hazardous waste

Safe Drinking Water Act Maximum Contaminant Level (SDWA MCL): The maximum permissible level of a contaminant in water that is delivered to any user of a public water system

Volatile organic compound (VOC): An organic compound that is characterized by being highly mobile in groundwater and which is readily volatized into the atmosphere

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the Memphis Depot is important. Comments provided by the public are valuable in helping select a final cleanup.

You may use the space below to write your comments, then fold and mail Comments must be postmarked by September 13, 2000.

If you have any questions about the comment period, please contact Alma Black Moore at (901) 544-0613.

Those with electronic communications capabilities may submit their comments via Internet at the following e-mail address:

comrel@ddc.dla.mil.

You may also provide comments via voice mail on the Memphis Depot Environmental Line at (901) 544-0618.

Name: _____

Address: _____

City: _____

State Zip: _____

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ADMINISTRATIVE RECORD

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