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# THE MEMPHIS DEPOT
# TENNESSEE

## ADMINISTRATIVE RECORD
## COVER SHEET

**AR File Number** 87

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# PROPOSED GROUNDWATER ACTION PLAN

FOR

DEFENSE DISTRIBUTION DEPOT MEMPHIS, TENNESSEE
MEMPHIS, TENNESSEE

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS
HUNTSVILLE DIVISION
Huntsville, Alabama

PREPARED BY

CH2M HILL
Montgomery, Alabama

December 1994

# Proposed Groundwater Action Plan
# Defense Depot Memphis, Tennessee

## Introduction

In 1992, the Environmental Protection Agency (EPA) placed the Defense Depot Memphis, Tennessee (DDMT) on the National Priorities List (NPL). A sitewide Remedial Investigation/ Feasibility Study (RI/FS) is being planned. An **Interim Remedial Action** (IRA) is planned for contaminated water beneath Dunn Field to stabilize the site until a permanent remedial action is identified.

This **proposed plan** identifies the preferred option for the IRA for the contaminated groundwater beneath Dunn Field at DDMT. In addition to identifying the preferred IRA, the proposed plan identifies other remedial options in detail. It solicits public review and comments, and provides information on how the public can be involved in the remedy selection process.

The proposed plan is issued by the DDMT, the lead agency for the cleanup operation. The EPA, along with the Tennessee Department of Environment and Conservation (TDEC), are the lead regulatory agencies for the site. A public comment period will be held, during which the public will have the opportunity to comment on this proposed plan. After the public comments have been received, they will be reviewed by the EPA, TDEC, and DDMT before a response action for the site is selected or approved. Terms in **bold** print are defined in a glossary at the end of the proposed plan.

This proposed plan is prepared by DDMT to comply with section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act** (CERCLA) as part of DDMT's public participation responsibility. Additional information and studies on this site can be found in the Administrative Record. The public is encouraged to review these documents to get a comprehensive understanding of the site and the activities that have been and may be conducted at DDMT.

The Administrative Record and an Information **Repository** for the DDMT site can be found at the following locations:

## Public Information

The Memphis/Shelby County Public Library
Main Branch–Government and Law Section
1850 Peabody Avenue
Memphis, TN 38104-4025
(901) 725-8877

HOURS:
Monday-Thursday 9-9
Friday and Saturday 9-6
Sunday 1-5

Cherokee Public Library
3300 Sharp Avenue
Memphis, TN 38111-3758
(901) 743-3655

HOURS:
Monday and Tuesday 10-7
Wednesday and Thursday 12-6
Saturday 12-6
Closed Friday and Sunday

The Memphis/Shelby County Public Health Department
Pollution Control Division
814 Jefferson Avenue
Memphis, TN 38106
(901) 576-7741

HOURS:
Monday-Friday 8-4:30

## For Further Information

To request further information, call (901) 775-4569 or write to:

Defense Distribution Depot Memphis
Environmental Protection and Safety Office, DDMT-DE
2163 Airways Blvd.
Memphis, TN 38114-5210

Send written comments before the close of the comment period or address questions to:

Ms. Christine Kartman
Defense Distribution Depot Memphis
Environmental Protection and Safety Office, DDMT-DE
2163 Airways Blvd.
Memphis, TN 38114-5210
Comment Hotline (901) 775-4569
Fax: (901) 775-4372

ATTENTION!

Public Comment Period

Date: December 12, 1994, to January 17, 1995

Purpose: to comment on the DDMT

Groundwater Action Plan

## Site Background

The Depot, established in 1942, was previously a cotton farm. On January 26, 1942, the facility opened as the Army General Supply Depot. In 1962, the Defense Logistics Agency (DLA) assumed command of the Depot with a primary mission of the receipt, storage, and

shipment of a variety of stock items such as clothing, medicines, construction supplies, and potentially dangerous materials (such as bulk quantities of household cleaners). Between 1954 and 1970, solid waste and chemicals were buried in the facility's landfill area, known as Dunn Field. In 1981, DLA began evaluating its past management of hazardous waste at DLA installations around the world.

Because of the size of DDMT (642 acres) and the site's complexity, it has been broken down into the following four manageable **Operable Units** (OUs), as agreed to by DDMT, EPA, and TDEC:

- OU-1: Dunn Field
- OU-2: Southwest quadrant, main installation
- OU-3: Southeast watershed and golf course, main installation
- OU-4: North area, main installation

This proposed plan addresses the contaminated groundwater beneath the northern portion of OU-1. The remainder of OU-1 and OUs 2, 3, and 4 will be addressed in future documents.

The IRA represents the first step in the remediation of the contaminated groundwater beneath the northern portion of OU-1. The remainder of OU-1 and OUs 2, 3, and 4 will be evaluated later. Additional actions will be necessary to provide long-term definitive protection for OU-1. The location of Dunn Field and its associated OUs are shown in Figure 1.

## Previous Studies

Several studies have been conducted at DDMT, as follows:

- Army Environmental Hygiene Agency (AEHA) Reports, 1982 and 1986
- U.S. Army Toxic and Hazardous Materials Management Agency (USATHAMA) Installation Assessment, 1981
- Summary Report On-site Remedial Activities at the Defense Depot Memphis, OH Materials Company, 1986
- **Remedial Investigation** (RI), Law Environmental, 1990
- **Feasibility Study** (FS), Law Environmental, 1990
- Pump Test, Engineering Science, 1991
- Focused Feasibility Study: Dunn Field, Engineering Science, July 1994

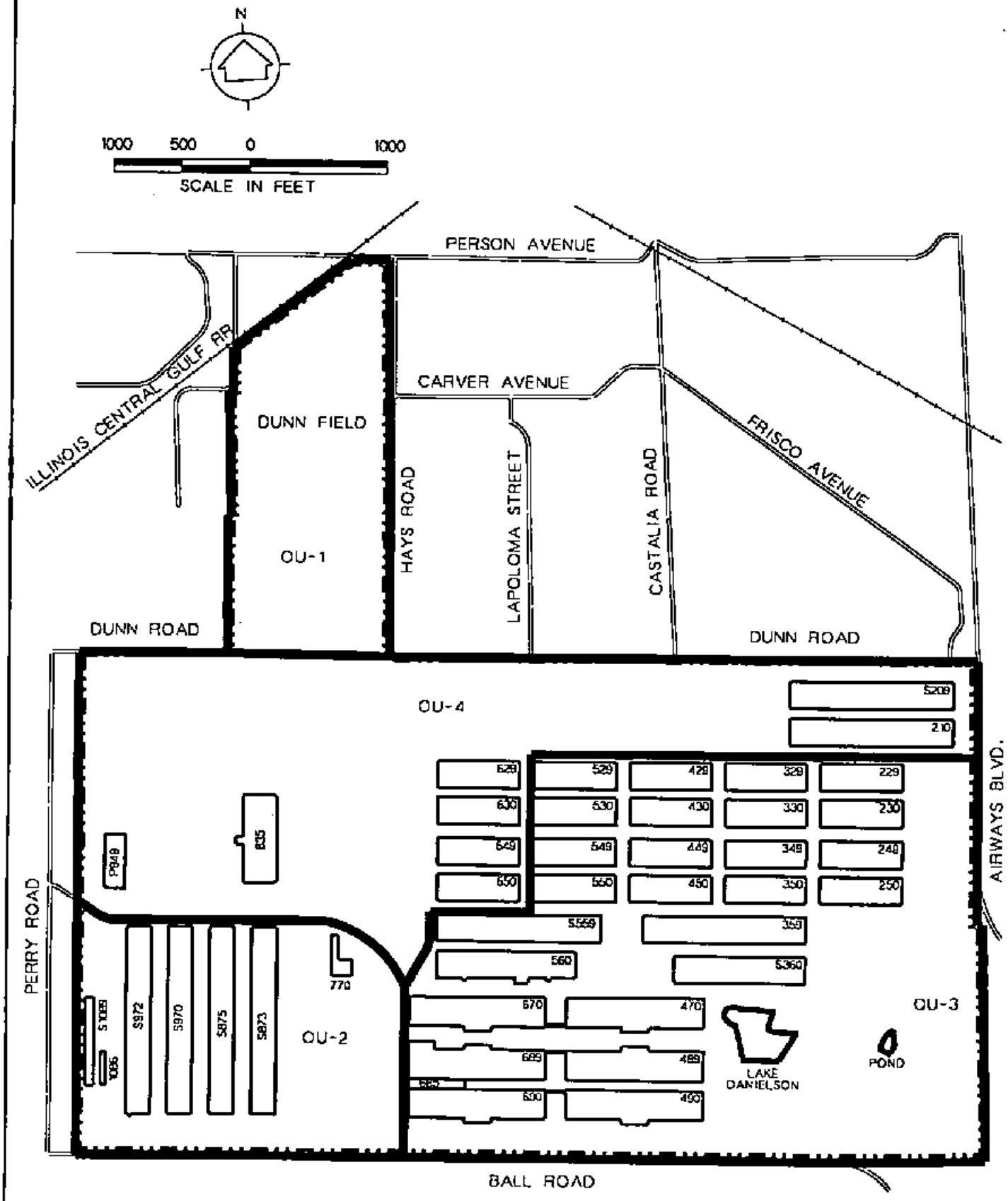


FIGURE 1
OPERABLE UNIT LOCATIONS
Defense Depot-Memphis, Tennessee

DDM-0008.DGN

- Environmental Assessment Removal Action for Groundwater, Engineering Science, 1993

- Groundwater Monitoring, Environmental Science and Engineering (ESE), 1993

The RI implemented by Law Environmental was conducted on a sitewide basis to confirm the presence or absence of contamination, to evaluate the extent and significance of detected contamination, and to provide a scientific foundation for cleanup alternatives.

During the groundwater investigation phase of the RI, monitoring wells were installed in the Fluvial Aquifer and Memphis Sand Aquifer beneath Dunn Field. These wells and existing wells were sampled and analyzed to determine the presence and extent of contamination in the groundwater. The results indicated that elevated levels of volatile organic compounds (VOCs) and heavy metals were present and that the contamination appears to be migrating to the west of Dunn Field.

Contaminants in the Fluvial Aquifer include solvents such as trichloroethylene (TCE). TCE in its concentrated form is a Dense Nonaqueous Phase Liquid (DNAPL). The source of solvent contaminants may have been a release of solvent in DNAPL form that migrated downward. If DNAPL is present beneath Dunn Field, it would represent a possible continuing source of groundwater contamination. DNAPL solvent has not been found in previous investigations. An objective of the RI currently being planned is to locate the source of the solvents (as well as other contaminants) and to evaluate the presence and extent of any DNAPLs. Specific future remedial action alternatives will be evaluated for contaminant sources and DNAPL cleanup during the RI/FS process.

The FS prepared by Law Environmental evaluated various cleanup alternatives for DDMT. The document discussed remedial action alternatives for three areas of DDMT: Dunn Field groundwater, surface soils, and Lake Danielson/Golf Course Pond. Because the proposed plan only addresses contaminated groundwater in Dunn Field, this proposed plan will be limited to that topic.

The objective of Engineering Science's *Focused Feasibility Study: Dunn Field* was to evaluate treatment alternatives for the contaminated groundwater beneath Dunn Field on an interim basis to below EPA and TDEC action levels in an effort to mitigate offsite migration of contaminants. Engineering Science developed the following seven alternatives to remediate the contaminated groundwater below Dunn Field:

- No action

- Extract groundwater using pumping wells located within Dunn Field and treat using air stripper techniques, followed by disposal into the municipal sewer system or Publicly Owned Treatment Works (POTW). Treat for heavy metals as required.

- Extract groundwater using pumping wells located within Dunn Field and off government property, treat using air stripping techniques and follow by disposal in the municipal sewer system or POTW. Treat heavy metals as required.

- Extract groundwater using pumping wells located within Dunn Field and treat using ultraviolet (UV)/oxidation techniques, followed by disposal into the municipal sewer system or POTW. Treat for heavy metals as required.

- Extract groundwater using pumping wells located within Dunn Field and treat using air stripper techniques, followed by disposal into surface drainage. Treat for heavy metals as required.

- Extract groundwater using pumping wells located within Dunn Field and treat using UV/oxidation techniques, followed by disposal into surface drainage. Treat for heavy metals as required.

- Extract groundwater using pumping wells located within Dunn Field and treat using air stripping techniques, followed by reinjection into the Fluvial Aquifer. Treat for heavy metals as required.

The alternatives were evaluated by Engineering Science using selection criteria (discussed in the "Evaluation of the Alternatives" section of this document). Engineering Science tentatively selected a preferred alternative, in which the groundwater is extracted onsite and treated using air stripping, followed by discharge to surface water drainage.

The environmental assessment conducted by Engineering Science evaluated the possible effects of the preferred alternative. The effects (positive and negative) of this action include the following:

- Control of groundwater contaminants beneath Dunn Field
- Reduction of future volumes of contaminated groundwater
- Indirect protection of the Memphis Sand Aquifer
- Short-term increase in noise levels from operation of construction equipment
- Release of low levels of VOCs into the atmosphere
- Increased noise levels from the operation of the water treatment system
- Release of metals to surface water
- Meeting National Pollutant Discharge Elimination System (NPDES) permit requirements

Currently available information on groundwater quality and discussions with the City of Memphis indicate that treatment may not be required to meet city discharge requirements. However, a treatment contingency has been included with the preferred alternative should treatment be needed to meet permit limits.

Engineering Science's assessment found no significant adverse effect on the environment as the result of the construction and operation of the proposed action.

In 1992, the EPA placed DDMT on the NPL primarily because of the potential for contamination from Dunn Field to reach the Memphis Sand Aquifer, from which the City of Memphis draws its drinking water. The NPL is EPA's list of hazardous waste sites identified for possible long-term remedial action under the Superfund. RIs must be conducted for all sites that are placed on the NPL.

## Scope and Role of Response Action

Data collected in the previously mentioned documents indicated the presence of VOCs and heavy metals in the Fluvial Aquifer. Because the contaminated Fluvial Aquifer poses a threat to the deeper Memphis Sand Aquifer, it is considered as a potential threat to human health and the environment. Thus, the objective of the groundwater IRA is to provide a quick response measure that will help prevent the possible contamination of the area's drinking water supply. Follow-on activities include monitoring the groundwater plume migration and response to the IRA. Once the plume has been characterized, subsequent action may be taken to provide long-term definitive protection, including remediation of source areas and potential DNAPL. To the extent possible, the interim action will not be inconsistent with, nor preclude implementation of, the expected final remedy.

## Summary of Site Risks

In 1990, as part of the RI/FS, Law Environmental performed a qualitative and a quantitative risk assessment based on EPA's risk assessment guidance in effect at that time. Information from this effort was included in the *Focused Feasibility Study: Dunn Field* (Engineering Science, July 1994).

Potential exposure points for contaminated groundwater from Dunn Field were identified as follows:

- Ingestion of groundwater through the public water supply
- Contact with potable water during bathing
- Inhalation of vapors from VOCs in potable water during household use

The transport medium and exposure pathway for the exposure scenarios identified above are identified in the Preliminary Risk Assessment as follows:

- Leaching from materials from past disposal activities at Dunn Field.
- Contaminants from leaching are present in the Fluvial Aquifer as a result of dispersion and infiltration.

- The Fluvial Aquifer potentially recharges the Memphis Sand Aquifer by leakage through what is otherwise considered a regional confining clay that separates the two aquifers. Potential future contamination resulting from this leakage could provide a pathway for contaminants to the deeper Memphis Sand Aquifer.

- Allen Well Field, located approximately 1 mile south of Dunn Field, is one of six pumping centers serving the Memphis area. With 35 wells, Allen Well Field pumps approximately 21 million gallons a day (mgd) of potable water from the Memphis Sand Aquifer and accounts for approximately 15 percent of the water used by the Memphis area. Contamination of the Memphis Sand Aquifer could affect this water supply source.

**Maximum Contaminant Levels** (MCLs) for groundwater have been established by the Safe Drinking Water Act. Ten of the groundwater contaminants present in the Dunn Field area exceed the MCLs. Table 1 lists the contaminants that have been found in the groundwater beneath Dunn Field above their respective MCLs.

Results of the Preliminary Risk Assessment indicate that there is a potential public health risk associated with the Fluvial Aquifer groundwater. Actual or threatened releases of hazardous substances from Dunn Field, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

The preferred alternative must increase the overall protection of human health and the environment. By implementing a groundwater IRA, contaminants 1) will be incrementally removed from the Fluvial Aquifer; 2) will be contained to mitigate migration toward the Allen Well Field; and 3) will have a reduced likelihood of creating a potential exposure pathway as identified in the Preliminary Risk Assessment.

Although this option will not immediately achieve compliance with MCLs, it is consistent with the objective to protect the Memphis Sand Aquifer. Long-term operation of a groundwater removal system will help to achieve MCLs by reducing the concentration of contaminants.

DDMT is taking a proactive approach for responding to the risks associated with the site. The following is a summary of alternatives that have been evaluated and analyzed. DDMT is seeking to implement the preferred alternative (Alternative 8) to accelerate the schedule for cleanup.

## Summary of Alternatives

The alternatives that have been evaluated for the IRA are listed in Table 2.

**Table 1**
**Maximum Concentration of**
**Contaminants Found in Dunn Field Groundwater**

| Constituent | MCL (µg/L) | Highest Level Detected During Law's RI (µg/L)/(location) |
|---|---|---|
| Volatile Organic Compounds | | |
| 1,1-Dichloroethylene | 7 | 160 (MW-10) |
| 1,2-Dichloroethylene (total) | 70 | 520 (MW-11) |
| tetrachloroethylene | 5 | 240 (MW-10) |
| trichloroethylene | 5 | 5,100 (MW-12) |
| carbon tetrachloride | 5 | 77 (MW-6) |
| Metals | | |
| arsenic | 50 | 210 (MW-14) |
| barium | 2000 | 3,740 (MW-14) |
| chromium | 100 | 1,240 (MW-7) |
| lead | 15[1] | 1,000 (MW-10) |
| nickel | 100 | 602 (MW-7) |

Source: Engineering Science, 1994. *Focused Feasibility Study: Dunn Field*

Notes:
[1]Action Level

Abbreviations:
MCL–Maximum Contaminant Level
µg/L–Micrograms per liter
MW–Monitoring well

**Table 2**
**Alternatives for Interim Remediation**

| Alternative | Extraction | Treatment | Disposal |
|---|---|---|---|
| 1 | No Action | none | none |
| 2 | Deep wells onsite | air stripping metals option | municipal sewer |
| 3 | Deep wells on- and offsite | air stripping metals option | municipal sewer |
| 4 | Deep wells onsite | UV/oxidation metals option | municipal sewer |
| 5 | Deep wells onsite | air stripping metals options | surface drainage |
| 6 | Deep wells onsite | UV/oxidation metals option | surface drainage |
| 7 | Deep wells onsite | air stripping metals option | reinjection upgradient onsite |
| 8 (preferred) | Deep wells on- and offsite | none | municipal sewer |

Alternative 8 is the preferred alternative.

### Alternative 1: No Action

Capital Costs: N/A
Annual Operation and Maintenance Costs (O&M): N/A
Present Worth (PW): N/A

The no action alternative assumes no further action at the site and is used as a baseline to measure the other alternatives. Under this alternative, no action would be taken in terms of containment and treatment of the groundwater plume.

### Alternative 2: Extraction Onsite, Air Stripping, POTW

Capital Costs: $600,000
O&M: $270,000
PW: $6,000,000

The groundwater extraction system for Alternative 2 consists of eight wells located in Dunn Field. The wells would be located to extract groundwater from the most contaminated portion of the plume based on existing data. The groundwater would be removed from the eight wells and stored in a holding tank.

The extracted groundwater would be pumped from the holding tank to an air stripping tower for removal of VOCs. On the basis of the concentration of VOCs in the air stripper exhaust, a carbon treatment system may also be necessary. Removal of heavy metals, if necessary, would be performed after VOC treatment. The treated groundwater would be released into the local sewer system, where it would be treated at the POTW.

### Alternative 3: Extraction On/Offsite, Air Stripping, POTW (Contingent Alternative)

Capital Costs: $600,000
O&M: $230,000
PW: $5,200,000

The pumping and treatment system for Alternative 3 is similar to Alternative 2 except for the placement and pumping rate of the wells. Like Alternative 2, this alternative has eight extraction wells, but with different locations. Two of the wells are located west of Dunn Field, downgradient of the property boundary, with the remainder on DDMT property. Alternative 3 would provide greater capture of the contamination groundwater offsite of Dunn Field. The treatment and handling of the groundwater would be similar to Alternative 2.

### Alternative 4: Extraction Onsite, UV/Oxidation, POTW

Capital Costs: $830,000
O&M: $300,000
PW: $6,900,000

The extraction well system would be identical to Alternative 2. The extracted groundwater would be treated by a UV/oxidation process using ultraviolet light, ozone, and hydrogen peroxide to break down the VOCs into carbon dioxide, water, and inorganic chlorides. Treatment for heavy metals, if needed, would follow UV/oxidation. The treated water would be discharged to the POTW.

### Alternative 5: Onsite Extraction, Air Stripping, Surface Discharge

Capital Costs: $470,000
O&M: $130,000
PW: $3,100,000

The extraction and treatment system of Alternative 5 is identical to Alternative 2. However, the treated water would be discharged into the existing surface water drainage system rather than to the POTW. Surface drainage channels exit from the north and west boundaries of Dunn Field. Both of these channels terminate at Crane Creek, located north of Dunn Field. A NPDES permit would be required before discharge would be allowed.

### Alternative 6: Extraction Onsite, UV/Oxidation, Surface Drainage

Capital Costs: $660,000
O&M: $160,000
PW: $3,900,000

Alternative 6 is similar to Alternative 4, except that the treated groundwater would be discharged into the surface water drainage system discussed in Alternative 5.

### Alternative 7: Extraction Onsite, Air Stripping, Reinjection

Capital Costs: $500,000
O&M: $150,000
PW: $3,500,000

Alternative 7 would extract groundwater from six wells on government property. The extracted water would be treated by air stripping (similar to the treatment method in Alternative 2), and treated for heavy metals, if needed. The treated water would be reinjected into the Fluvial Aquifer upgradient from the extraction wells at Dunn Field. Reinjection would be completed using four injection wells located on the eastern side of Dunn Field. Pumps and piping would have to be installed to transmit the water from the treatment site to the east side of Dunn Field.

**Alternative 8: Extraction On/Offsite, POTW (Preferred Alternative)**
Capital Costs: $500,000
O&M: $250,000
PW: $5,600,000

Alternative 8 is the preferred alternative and is a hybrid of Alternative 3. However, unlike Alternative 3, Alternative 8 places most of the groundwater recovery wells offsite along the leading edge of the plume. This placement will be more effective in protecting the Memphis Sand Aquifer from contaminants in the shallow aquifer at OU-1. Additionally, this alternative does not assume that pretreatment before discharge will be required. However, this alternative uses the treatment component of Alternative 3 as a contingency should pretreatment be required.

Alternative 8 would be used to contain the contaminated groundwater by inducing a hydraulic barrier. The hydraulic barrier will be achieved by pumping the groundwater from the containment wells placed along the leading edge of the plume. The leading edge of the plume will be located as part of the RI activities or IRA design activities planned for OU-1. Data gathered during the OU-1 RI will be used to develop the remedial design of the proposed IRA. Leading edge identification and containment of the plume will be achieved in the following manner:

- A groundwater recovery well will be installed onsite in the middle of the plume to determine aquifer characteristics.

- Additional monitoring wells will be installed to determine the western edge of the contaminant plume.

- Once the aquifer characteristics are determined and the leading edge of the plume is identified, additional groundwater recovery wells, which are located along the leading edge of the plume screened to the confining clay layer of the Memphis Sand Aquifer, will be installed as appropriate to contain the plume.

The groundwater and the associated contamination will be captured by the recovery wells (see Figure 2). The spacing and pumping rate of the wells will be such that the contamination should not move beyond the line of wells. Once the recovery wells are operating, the system will be checked frequently and any necessary adjustments made (including the installation of additional recovery wells if needed) to verify that the plume is contained.

DDMT will obtain a discharge permit to allow the groundwater pumped from the wells to be discharged into the T.E. Maxson Wastewater Treatment Plant POTW. The discharge permit will set maximum levels for groundwater constituent concentrations. If the extracted groundwater exceeds these limits, the treatment contained in Alternative 3 will be used. The cost of Alternative 8, without the use of a contingency treatment remedy, assumes that the groundwater will meet the City's permit limits and that no treatment will be needed.

# FIGURE 2

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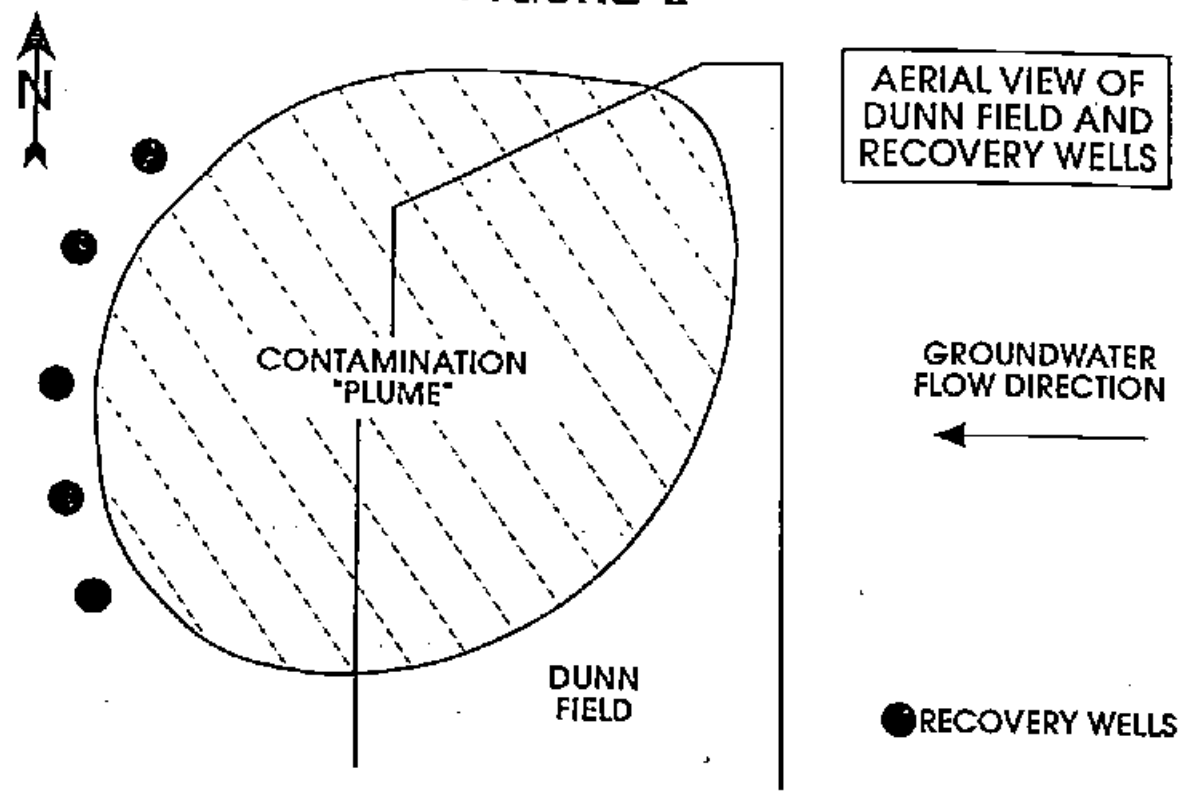


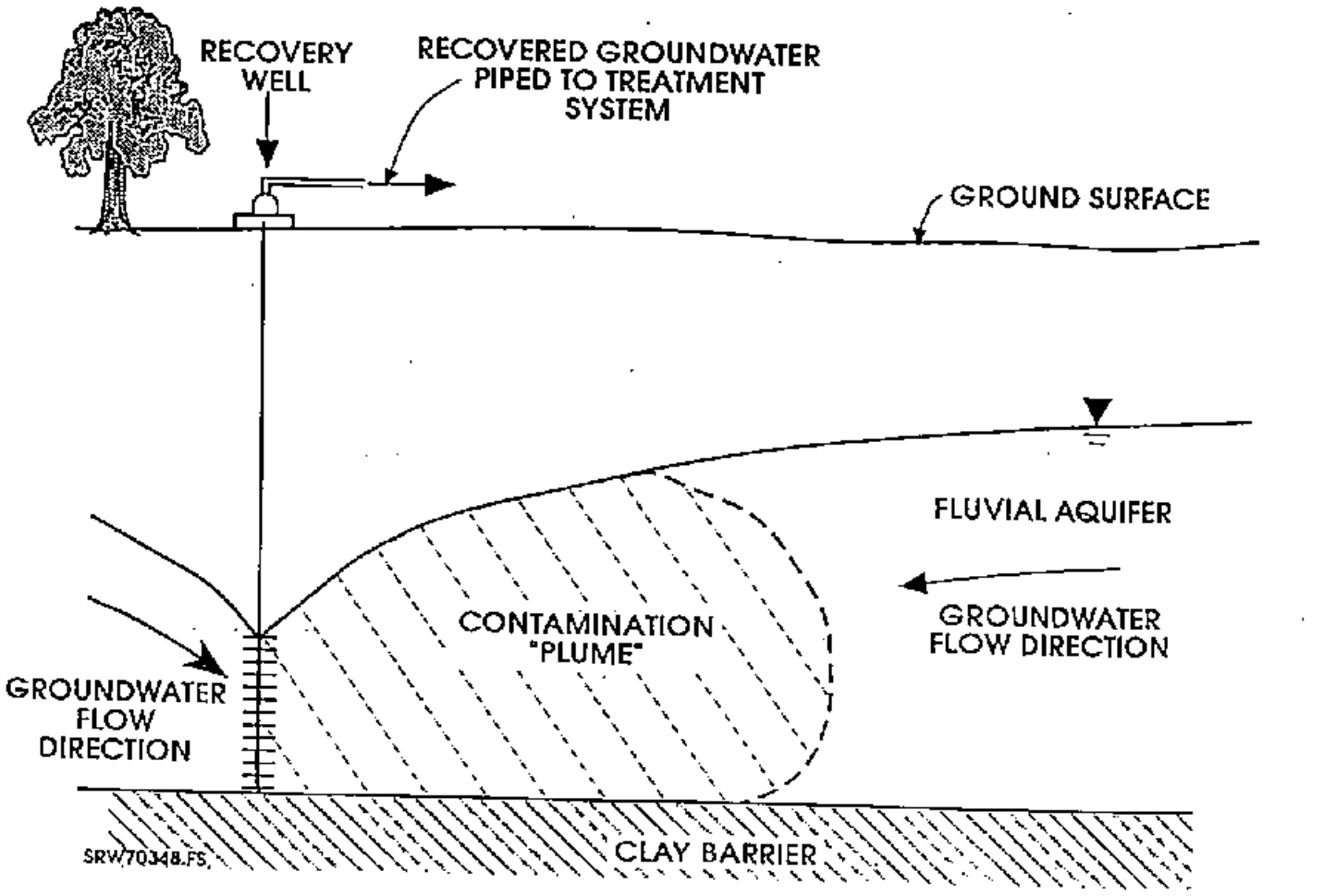

### *Cost Estimates*

Cost information is preliminary and is provided for making relative comparisons among different alternatives. Costs are based on information available at the time the estimate was made and are considered to be order of magnitude. These are estimates made without detailed engineering data. Estimates of this type are generally expected to be accurate within plus 50 percent and minus 30 percent. These costs do not represent government estimates for procurement.

Cost information will be evaluated further during design and implementation of the IRA. Costs presented for Alternatives 2 through 7 are taken from the *Focused Feasibility Study: Dunn Field* by Engineering Science. These costs are based on preliminary assumptions that will be verified during RI and IRA design activities. Present worth calculations in the Engineering Science report were revised to use a 30-year period of operation and a 2.8 percent discount rate.

## Implementation Time

The implementation time for each of the alternatives is approximately the same. Scheduled activities include three phases–preconstruction, construction, and operations. The activities within each phase and the approximate duration are as follows:

| Phase | Approximate Duration | Activities |
|---|---|---|
| Preconstruction | 8 to 12 months | • Respond to public comments on the proposed plan<br>• Select the IRA remedy<br>• Prepare a Record of Decision<br>• Permit application<br>• Obtain property access<br>• Perform RI to locate the western extent of the plume<br>• Perform a pump test to determine aquifer characteristics.<br>• Complete the Remedial Design for the IRA<br>• Construction Contractor Procurement |
| Construction | 3 to 6 months | • Install groundwater recovery wells and discharge piping |
| Construction Treatment System (if required) | 6 to 12 months | • Construct groundwater pretreatment system, if required, to meet discharge permit limits |
| Operations | Indefinite | • The system of recovery wells will be operated until the risk associated with the contaminants is reduced to acceptable levels or until the final remedy is in place |

## Evaluation of the Alternatives

This section evaluates the alternatives for the nine criteria set forth by the EPA. The criteria are as follows:

- Overall Protection of Human Health and Environment–Assesses degree to which alternative eliminates, reduces, or controls health and environmental threats through treatment, engineering methods, or institutional controls.
- Compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)**–Assesses compliance with federal and state requirements.
- Long-Term Effectiveness–Degree to which a remedy can maintain protection of health and environment once cleanup goals have been met.
- Reduction of Toxicity, Mobility, or Volume Through Treatment–Refers to expected performance of the treatment technologies to lessen harmful nature, movement, or amount of contaminants.
- Short-Term Effectiveness–Length of time for remedy to achieve protection and potential effects of construction and implementation of a remedy.
- Implementability–Refers to the technical feasibility and administrative ease of a remedy.
- Cost–Weighing the benefits of a remedy against the cost of implementation.
- State Acceptance–Consideration of the State's opinion of the preferred alternative.
- Community Acceptance–Consideration of public comments on the preferred alternative and the proposed plan.

### Analysis

**Overall Protection of Human Health and Environment.** The preferred interim action would contain the contamination plume and prevent it from migrating while removing a portion of the contaminated groundwater. Because the plume is believed to have migrated offsite, the preferred alternative must have extraction wells located offsite. All of the wells in Alternatives 2, 4, 5, 6, and 7 are located onsite and would not sufficiently contain the plume. This lack of containment would lead to further environmental effects and would be a continual threat to human health. Alternative 1 offers no protective measures for human health and the environment.

Alternatives 3 and 8 offer adequate degrees of protection by reducing and controlling the risks through removal and containment. Alternatives 1, 2, 4, 5, 6, and 7 are not options for this site because they do not adequately reduce the risks associated with the contaminated groundwater.

**Compliance with ARARs.** Under the preferred alternative, groundwater will be discharged to the POTW. Discharge to the POTW will be subject to both the substantive and administrative requirements of the national pretreatment program and all applicable state and local pretreatment regulations. Discharge to the POTW will only continue as long as the POTW is in compliance with EPA's offsite policy. Should treatment be required, Alternative 3 will be implemented as a contingency to provide groundwater treatment.

Alternative 3 uses an air stripper for the removal of VOCs from the extracted groundwater. Air stripping is a viable treatment process for removal of VOCs from water and will be used if treatment for VOCs is required.

**Long-Term Effectiveness and Performance.** Alternatives 3 and 8 should be effective in reducing long-term contaminated groundwater levels and associated health risks. Because of residual contamination, the size of the aquifer, and inherit complexities, it may not be possible to completely remediate the aquifer to its original condition using technology currently available. Additional actions will be necessary to provide long-term definitive protection for OU-1.

**Reduction of Toxicity, Mobility, or Volume of the Contaminants through Treatment.** The toxicity and volume of the contaminated groundwater would be reduced by the groundwater extraction in Alternatives 3 and 8. Mobility of the contamination plume would be restricted by the physical forces of the groundwater extraction. This hydraulic barrier should prevent lateral and vertical movement of the contaminated groundwater, thus reducing the threat to the Memphis Sand Aquifer.

**Short-Term Effectiveness.** Groundwater removal should contain the groundwater contamination plume fairly rapidly and help reduce further lateral contamination migration. Implementing the preferred alternative would result in a reduction of the potential effects to nearby residents from contaminants at Dunn Field.

**Implementablity.** The groundwater recovery systems will be relatively simple to implement. The technology and processes have been reliably demonstrated. Equipment and materials are readily available. However, as previously stated, the Fluvial Aquifer and the contaminated groundwater plume will have to be further characterized.

**Cost.** The cost analysis in Alternative 3 was conducted by Engineering Science and included the cost of well installation and operation and maintenance cost of the air stripper.

The cost of Alternative 8 is based on the installation of eight recovery wells. This cost estimate assumes a quarterly sampling plan to ensure that the system is operating efficiently and that no prior treatment before discharge will be required. However, because of the

uncertainties associated with groundwater recovery, additional wells may be required that would affect the estimated cost. Additionally, the cost of Alternative 8 does not include pretreatment costs.

**State Acceptance.** DDMT has been actively working with TDEC throughout the cleanup process. TDEC supports this approach. However, information obtained during the RI may suggest other alternatives that would involve the concurrence of the state.

**Community Acceptance.** The community will have an opportunity to comment on this alternative, and these comments will affect the proposed plan of action.

## Selection of the Preferred Alternative

Of the eight alternatives reviewed, only two were considered viable options. Because "no action" does not address or rectify the problem and Alternatives 2, 4, 5, 6, and 7 do not contain the contamination plume, they are not considered appropriate. The preferred alternative is Alternative 8, which is a hybrid of Alternative 3. However, Alternative 8 puts more emphasis on plume containment and does not assume that pretreatment before discharge will be required. The placement of groundwater recovery wells in Alternative 8 will be more effective in protecting the Memphis Sand Aquifer from contaminants in the shallow aquifer at OU-1.

If the remedy process yields information indicating that treatment before discharge is required, the treatment option contained in Alternative 3 will be used. The preferred alternative for the IRA of the contaminated groundwater below Dunn Field is Alternative 8–on/offsite extraction and POTW disposal.

On the basis of current information, this alternative appears to offer the most reasonable approach for the protection of the drinking water supply and containment of the plume. Currently, groundwater recovery is the only appropriate alternative to contain the plume. This alternative represents interim action and is intended only to stabilize the site and to prevent further degradation. However, with the additional information that will be collected during the RI, other alternatives may become available. No conditions are currently foreseen where the interim action will be inconsistent with, or preclude implementation of, the final remedy.

## Observational Approach

The approach used to design and implement the preferred alternative will consist of the following:

- Establishing the conditions that are believed to exist based on available information. Design will be based on expected conditions.

- Establish, in advance, conditions that are reasonable deviations from the probable conditions.
- Implement the base design and monitor conditions.
- Implement contingent designs as warranted by monitoring.

This approach is referred to as the **observational method.** The approach recognizes and manages uncertainties inherent in groundwater remediation. Table 3 illustrates the planned approach for managing uncertainties on this project.

The observational method will be used during design and implementation and is not part of the selection process for the interim remedial action alternative. If changes to the selected remedy are required based on information obtained through the observational approach, then the public will be made aware of these changes either through a fact sheet, explanation of significant differences, or ROD Amendment.

## Community Participation

Alternative 8 is the preferred alternative. However, changes to the preferred alternative, or a change from the preferred alternative to another alternative, may be made if public comments or additional data indicate that such a change would result in a more appropriate solution.

The public is encouraged to actively participate in the selection process of this proposed plan and any other actions that may or will be conducted at DDMT.

Send written comments before the close of the comment period or address questions to:

Ms. Christine Kartman
Defense Distribution Depot Memphis
Environmental Protection and Safety Office, DDMT-DE
2163 Airways Blvd.
Memphis, TN 38114-5210
Comment Hotline (901) 775-4569
Fax: (901) 775-4372

ATTENTION!

Public Comment Period

Date: December 12, 1994, to January 17, 1995

Purpose: to comment on the DDMT

Groundwater Action Plan

**Table 3**
**Observational Method for Dunn Field Groundwater Remediation**

| Probable Condition* | Reasonable Deviation* | Parameters to Observe | Contingency Plan |
|---|---|---|---|
| 8 recovery wells needed | 12 recovery wells needed | Capture zone extent. Observe water levels in monitoring wells. | Install additional wells |
| Pump at 75 gpm | Pump at 125 gpm | Capture zone extent. Observe water levels in monitoring wells. | Pump at increased rate; provide adequate sewer capacity |
| Groundwater meets City discharge limits | Limits not met | Permit parameters | Provide groundwater treatment |
| Plume extends 600 feet west of Dunn field | Plume extends 1,200 feet west of Dunn Field | Data from RI monitoring wells | Locate recovery wells at western extent of plume |
| *Will be updated as additional information becomes available | | | |

The public's comments will be reviewed by the EPA, TDEC, and DDMT and incorporated into the **Record of Decision** (ROD). Additionally, DDMT selected a **Restoration Advisory Board** (RAB), consisting of representatives from the Memphis area community and from the state and federal government, to discuss the ongoing restoration activities at DDMT. The RAB meets monthly and encourages public participation.

## Glossary of Terms

**Air Stripping**–The transfer of gas (volatiles) from liquid to air by the agitation of the air-water interface.

**Applicable or Relevant and Appropriate Requirements (ARARs)**–Any federal or state regulation or law (such as the Clean Water Act) that is and can be federally and state enforceable.

**Aquifer**–A saturated permeable geologic unit that can transmit significant quantities of water under normal hydraulic gradients.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**–Superfund law that provides for identification and cleanup of hazardous materials released over the land and into the air, waterways, and groundwater.

**Feasibility Study (FS)**–A study that evaluates cleanup alternatives for a site based on information gathered during a concurrently conducted remedial investigation of the site.

**Heavy Metals**–Metallic elements with high atomic weights, such as antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, or zinc. They can damage living things at low concentrations and tend to accumulate in the food web.

**Hydrocarbons**–Chemical compounds that consist entirely of carbon and hydrogen.

**Interim Remedial Action**–The actual construction or implementation phase of a site cleanup. Follows remedial design and is also known as Remedial Action.

**Maximum Contaminant Levels (MCLs)**–The maximum permissible level (concentration) of a contaminant in water that is delivered to any user of a public water system.

**Observational Method**–Traditionally applied in geotechnical engineering, the observational method incorporates several key elements applicable to hazardous waste site remediation including: (1) remedial design based on most probable site conditions; (2) identification of reasonable deviations from those conditions; (3) identification of parameters to observe so as to detect deviations during remediation; and (4) preparation of contingency plans for each potential deviation.

**Operable Unit**–Discrete parts of an entire response action.

**Pesticides**–Chemicals used to destroy insects or pests.

**Physio-Chemical Process**–The use of physical and chemical means for treating a specific media (most commonly water).

**POTW**–Publicly Owned Treatment Works, the City's Wastewater Treatment Plant.

**Plume**–A visible or measurable discharge of a contaminant from a given point of origin.

**Present Worth**–Value of project reduced to today's cost for equal comparison. Present worth computations use a 30-year planning period with a 2.8 percent discount rate (real interest rate).

**Proposed Plan**–One of several decision documents involved in Superfund's remedial process. The document provides a brief summary of all the alternatives studied in a site's RI/FS and highlights key factors that led to the identification of the preferred alternative for a site.

**Record of Decision (ROD)**–One of several public decision documents involved in Superfund's remedial process. This document certifies that the remedy complies with CERCLA, outlines the technical goals of the remedy, provides background information on the site, summarizes the analysis of alternatives, and explains the rationale for the remedy selected.

**Repository**–A facility where official Superfund documents are kept for public reference.

**Remedial Investigation (RI)**–An investigation that assess the extent and nature of the contamination and the potential risks associated with the contamination. Typically, an RI is conducted concurrently with a feasibility study.

**Restoration Advisory Board (RAB)**–A board of Memphis area community members, federal employees, and state employees selected by DDMT's technical advisory board to represent the public and community interests and concerns.

**Slurry Wall**–Barriers used to contain the flow of contaminated groundwater.

**Ultraviolet (UV)/Oxidation**–The use of ultraviolet light to supply the energy needed to remove hydrogen or electrons.

**Volatile Organic Compounds (VOCs)**–Potentially toxic volatile chemicals used as solvents, degreasers, paint thinners, and fuels.

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