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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 956

The Former Memphis Depot – Dunn Field
Revised Proposed Plan

Defense Distribution Center (Memphis, TN)
October 2008

FORMER MEMPHIS DEPOT PROPOSES REVISED CLEANUP PLAN

This Revised Proposed Plan identifies recommended changes to components of the Selected Remedy for the cleanup of environmental impacts found in soil and groundwater at Dunn Field and provides the rationale for the changes in cleanup methods. The Proposed Plan for Dunn Field was completed in May 2003. The public comment period was held May 8 to June 6, 2003, with a public meeting on May 15, 2003. The Preferred Alternative identified in the Proposed Plan was approved in the Dunn Field Record of Decision, with final authorization on April 12, 2004. Additional information developed through remedial design investigations and remedy implementation has identified technical issues affecting implementation of some components of the selected remedy which have resulted in recommended changes. One change to the groundwater remedy is considered fundamental and has led to this Revised Proposed Plan:

- Use of air sparging with soil vapor extraction (AS/SVE) for the Off Depot groundwater plume instead of a permeable reactive barrier.

This document is issued by the Defense Logistics Agency (DLA), the lead agency for site activities at the Memphis Depot. DLA and U.S. Environmental Protection Agency (EPA), in consultation with Tennessee Department of Environment and Conservation (TDEC), acting as support agencies, will consider the recommended change to the selected remedy after reviewing and considering all information received from the Depot community during a 30-day public comment period. Based on substantive new information or public comments, DLA, in consultation with EPA and TDEC, may modify the recommended change as described in this Revised Proposed Plan. The approved changes to the remedy will be included in a Record of Decision (ROD) Amendment for Dunn Field.

Therefore, the public is encouraged to review and comment on the recommended fundamental change and the rationale presented in this Revised Proposed Plan. DLA issues this Revised 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 Revised Proposed Plan summarizes information that can be found in greater detail in the Final Dunn Field Remedial Investigation (RI), the Final Feasibility Study (FS) Report, the Dunn Field ROD, the Source Areas Final Remedial Design, the Off Depot Groundwater Final Remedial Design and other documents contained in the Administrative Record. DLA, EPA and TDEC encourage the public to review these documents to gain a better understanding of the site and remedial investigation and design activities that have been conducted.

IMPORTANT DATES

PUBLIC COMMENT PERIOD

October 27 – November 25, 2008

- DLA will accept written, electronic and verbal comments on this Revised Proposed Plan during the public comment period.

PUBLIC MEETING

November 13, 2008

- DLA will conduct a presentation and public meeting to explain the Revised Proposed Plan and the changes from the selected alternatives presented in the Dunn Field Record of Decision. Verbal and written comments will also be accepted at the meeting, which will be held at:

Ruth Tate Senior Citizens Center
1620 Marjorie St., Memphis, TN

Public Meeting begins 6:00 p.m.

Contact Persons:

Michael Dobbs (717) 770-6950
Stacy Umstead (717) 770-2880

IMPORTANT DATES (con't)

OTHER WAYS TO COMMENT

Leave comments on the Former Memphis Depot Community Information Line at (901) 774-3683 or send comments to:

Defense Distribution Center (Memphis)
BRAC Environmental Coordinator
2245 Truitt Street
Memphis, TN 38114
michael.dobbs@dla.mil

For more information, visit the Information Repository at the following location:

- Memphis Depot Business Park
  DLA Community Outreach Room
  2245 Truitt Street
  Memphis, TN (901) 774-3683
  Hours: 9 am to 5 pm

The Memphis Depot administrative record is on line at:
www.adminrec.com/DLA.asp

SITE HISTORY

The Memphis Depot consists of approximately 642 acres on two adjacent sites (see Figure 1). The Main Installation (MI) includes open storage areas, supply warehouses, military family housing, and outdoor recreational areas. Dunn Field includes former mineral storage and former waste disposal areas. Starting in the 1940s, the Memphis Depot received, warehoused, and distributed supplies common to all U.S. military services and some civil agencies. These materials included food, clothing, medical supplies, and hazardous industrial materials.

To facilitate the investigation of this site, the Memphis Depot was divided into two areas: the MI and Dunn Field. This Revised Proposed Plan addresses only Dunn Field.

Dunn Field is a 64-acre rectangular area that joins the MI on the north, across Dunn Avenue, and has been designated Operable Unit (OU) 1. Most of Dunn Field is unpaved. Specifically, about two-thirds of the area is grassed, and the remaining area is covered with crushed rock or pavement. Dunn Field was used for aboveground bulk mineral ore storage (bauxite and fluorspar) and underground waste disposal. Based on information obtained from Depot records and interviews with former Depot personnel, Dunn Field was used intermittently for burial of waste. Disposal records and interviews with facility personnel identified specific instances when some of the burial occurred. The earliest records of burial date back to 1946.

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

- On **October 14, 1992,** the site was placed on the National Priorities List (NPL).
- On **March 6, 1995**, a Federal Facilities Agreement (FFA) was reached by EPA, TDEC and DLA 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). The FFA outlined the terms by which the investigation and cleanup would be conducted.

The Memphis Depot has conducted public participation activities throughout the CERCLA site cleanup process prior to this Revised Proposed Plan. This includes Restoration Advisory Board (RAB) meetings since 1994, Community Information Sessions and public meetings, a regular newsletter, and the establishment of information repositories, including a Community Outreach Room.

SITE CHARACTERISTICS

From 1998 through 2002, the Memphis Depot conducted an RI/FS with oversight by EPA, TDEC, and DLA. The RI/FS identified the types, quantities, and locations of substances detected in the environment and studied the feasibility of potential cleanup solutions. Dunn Field was divided into three geographic areas to facilitate the investigation (see the description below and Figure 2).

DUNN FIELD AREA DEFINITIONS AND ACTIVITIES

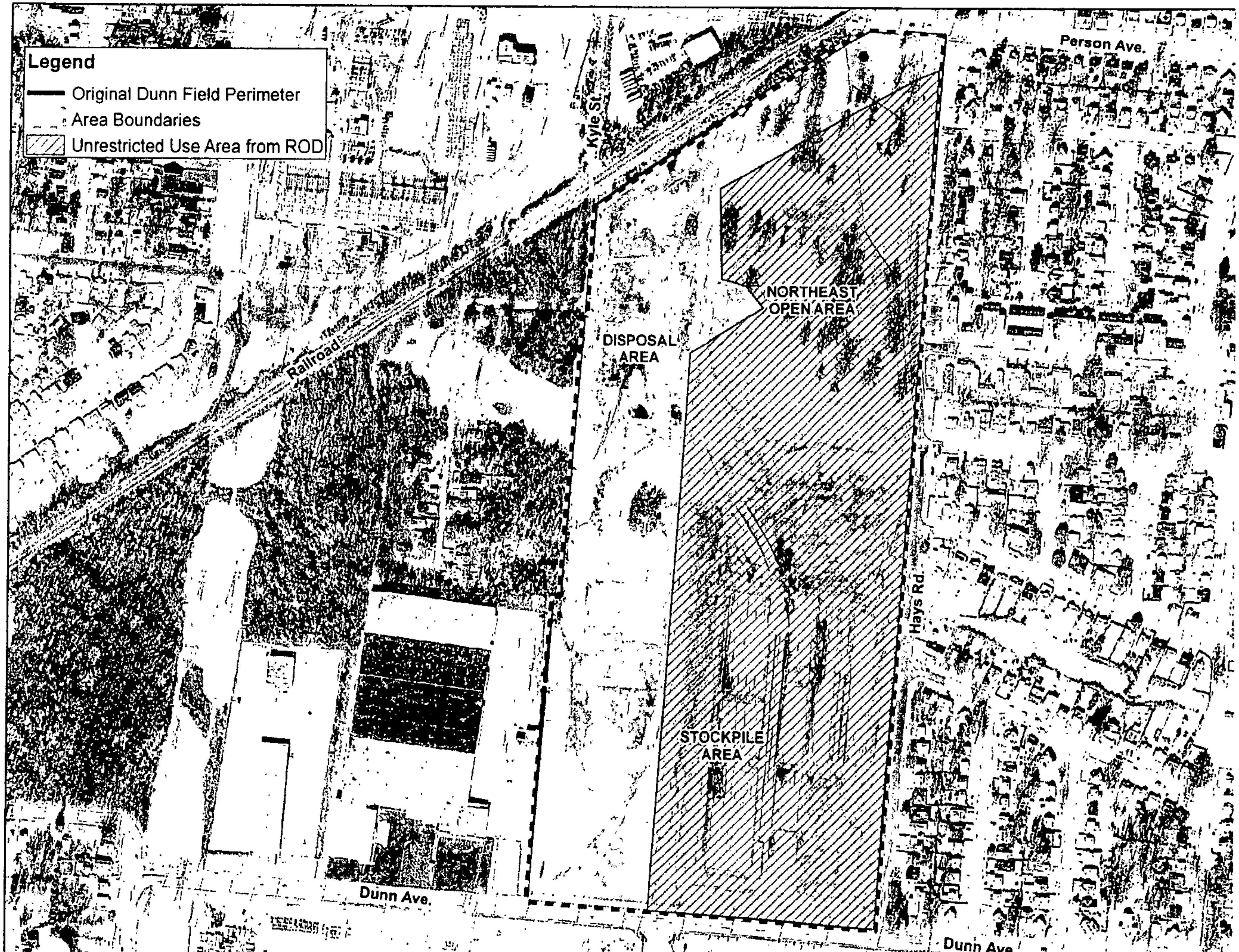
Northeast Open Area – Approximately 20 acres of land located in the northeast quadrant of Dunn Field. This area is mostly grass covered with some lightly wooded areas.

Disposal Area – Approximately 14 acres of open land located in the northwest quadrant of Dunn Field, where disposal sites are located. Historical information concerning the location of the disposal sites are included in the Dunn Field RI Report (July 2002)

Stockpile Area - Approximately 30 acres of open land located in the southeastern and southwestern portions of Dunn Field. This area includes the former bauxite and fluorspar stockpiles (removed in 1999) and burial areas in the eastern and southwestern portions of Dunn Field.


Legend
Original Dunn Field Perimeter
Main Installation Perimeter
Person Ave
Railroad
Dunn Field
Railroad
Hays Rd
Dunn Ave
Airways Blvd
Main Installation
Ball Rd

956 3


Legend
Original Dunn Field Perimeter
Area Boundaries
Unrestricted Use Area from ROD
Person Ave.
Kyle St.
Railroad
DISPOSAL AREA
NORTHEAST OPEN AREA
STOCKPILE AREA
Hays Rd.
Dunn Ave.
Dunn Ave.

956 4

Approximately 41 acres on the east side of Dunn Field, including the majority of the Northeast Open Area and the Stockpile Area was identified in the ROD as available for unrestricted use (Figure 2). The selected remedy in the ROD addresses surface soil, material within disposal sites and associated soil, and chlorinated volatile organic compounds (CVOCs) in subsurface soil and groundwater. The recommended changes in this Revised Proposed Plan are for components of the remedy in subsurface soil and groundwater in the Disposal Area and in the groundwater plume west (downgradient) of the Disposal Area. The key findings from the Dunn Field RI relevant to the recommended changes to the selected remedy are provided below.

Disposal Area – Subsurface Soils

- The following CVOCs were detected at elevated concentrations in subsurface soils in the Disposal Area:

  - **Tetrachloroethene (PCE)**
  - **Trichloroethene (TCE)**
  - **1,2 Dichloroethene (1,2-DCE)**
  - **Vinyl Chloride**
  - **1,1,2,2 Tetrachloroethane (1,1,2,2-PCA)**
  - **1,1,2 Trichloroethane (1,1,2-TCA)**
  - **Carbon Tetrachloride (CCl_4)**
  - **Chloroform**

- CVOCs detected in soils via laboratory analysis of soil samples correlate well with the extent of CVOCs detected during the passive soil gas survey. The apparent clustering of the higher CVOC concentrations correlates with the historical information indicating that the disposal pits and trenches were relatively small and separate. CVOCs have migrated from near the base of the disposal trenches (8 to 10 feet below ground surface [bgs]) to the fluvial aquifer (up to 83 feet bgs).
- Based on comparison of soil sample analytical results to environmental conditions in groundwater beneath Dunn Field, there is a complete migration pathway for CVOCs from disposal area to subsurface soil and then to shallow groundwater (fluvial aquifer). This release has not impacted the deeper Memphis Aquifer, source of the municipal drinking water supply.

Groundwater

- The groundwater in the fluvial aquifer is not a drinking water source for area residents.
- The nature and extent of contamination in the fluvial aquifer underlying Dunn Field and areas to the west were assessed in the RI/FS based on groundwater samples collected from January 1996 through February 2001. Groundwater samples were analyzed for the presence of explosives, herbicides, metals (total), pesticides, polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). Groundwater samples were also analyzed for chemical warfare material (CWM) breakdown products, including Thiodiglycol, 1,4-Oxathiane, and 1,4-Dithiane. Based on these analyses, VOCs, dieldrin, arsenic, iron, and manganese were identified as constituents of concern (COCs) in groundwater during the RI. However, the metals and dieldrin were not detected at significant levels or did not have a high frequency of detection in additional groundwater samples collected prior to the ROD. Based on the analytical data and the low solubility of the metals and dieldrin, only CVOCs were selected as constituents of concern (COCs) in groundwater.
- The investigation identified three major CVOC plumes in the shallow groundwater under Dunn Field: a northern plume, a central plume, and a southern plume. There is some mixing of the plumes from the active groundwater extraction system, natural groundwater flow, and degradation processes. Nine primary CVOCs have been detected in groundwater during sampling events:

  - **Tetrachloroethene (PCE)**
  - **Trichloroethene (TCE)**
  - **(Cis & Trans)1,2 Dichloroethene (1,2-DCE)**
  - **1,1 Dichloroethene (1,1-DCE)**
  - **1,1,2,2 Tetrachloroethane (1,1,2,2-PCA)**
  - **1,1,2 Trichloroethane (1,1,2-TCA)**
  - **Carbon Tetrachloride (CCl_4)**
  - **Chloroform**

- The northern plume is considered to have both on-site and off-site sources. PCE, TCE and 1,1-DCE have been detected in off-site monitoring wells, which are upgradient to the northeast of Dunn Field. PCE and TCE have been frequently detected in soil samples on Dunn Field, but 1,1-DCE has not. The CVOCs in the on-site wells are TCE, 1,1,2,2-PCA, 1,2-DCE, chloroform, PCE and 1,1-DCE. Additional sampling and analysis are being performed by EPA and TDEC to identify the off-site source area(s).

WHAT ARE THE "CONSTITUENTS OF CONCERN"?

DLA, EPA and TDEC have identified the following substances in the subsurface soil or groundwater that, if exposure occurs, may pose unacceptable risks to human health at this site based on the anticipated future land use. (Under the current conditions at Dunn Field, these substances are contained in soil beneath the ground surface or in the shallow aquifer, thereby minimizing the potential for direct exposure.)

Tetrachloroethene (PCE): A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 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 to 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): A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. TCE is a halogenated organic compound that has been 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.

1,1,2,2-Tetrachloroethane (1,1,2,2-PCA): A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 1,1,2,2-PCA is a manufactured chemical historically used to make other chemicals, as a solvent, to clean and degrease metals, and in paints and pesticides. Commercial production for these uses has stopped in the U.S. and it is currently only used as an intermediate in the production of other chemicals. 1,1,2,2-PCA can be found at low levels in indoor and outdoor air. In closed environments, inhalation of high levels of 1,1,2,2-PCA can cause fatigue, vomiting, dizziness, and possible unconsciousness. Exposure to large amounts over long periods can cause liver damage, stomachaches, or dizziness. The health effects from long-term exposure to low levels are unknown. Based on animal studies, 1,1,2,2-PCA is a possible human carcinogen.

1,1,2-Trichloroethane (1,1,2-TCA): A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 1,1,2-TCA is an insoluble, colorless, liquid used as a solvent and as an intermediate in the production of 1,1-DCA, or found as an impurity in other chemicals. Most 1,1,2-TCA in the environment is released into the air. Exposure to 1,1,2-TCA may cause the skin to sting and burn. Based on animal studies, inhalation of 1,1,2-TCA at high levels affected the liver, kidneys, and nervous system and ingestion of 1,1,2-DCE affected the stomach, blood, liver, kidneys, and nervous system. There is no information as to whether 1,1,2-TCA is a carcinogen.

1,1-Dichloroethene (1,1-DCE): A COC in the groundwater of the fluvial aquifer. 1,1-DCE is a colorless liquid used to make plastics, packaging materials, flame retardant coatings for fiber and carpet backings and coating for steel pipes, and in adhesive applications Occupational exposures may occur to workers in industries who make or use 1,1-DCE. Long-term inhalation of 1,1-DCE may damage the human nervous system, liver, and lungs. Short-term exposure to high levels may damage the central nervous system. Contact of 1,1-DCE on skin or in the eyes causes irritation. Based on animal studies, 1,1-DCE is listed as a possible carcinogen .

1,2-Dichloroethene (1,2-DCE): A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 1,2-DCE is a highly flammable, colorless, liquid that is present in two forms: cis-1,2-DCE and trans-1,2-DCE. It is commonly used to produce solvents and chemical mixtures. In the environment, it may break down into vinyl chloride. Short-term inhalation of 1,2-DCE at high levels can cause drowsiness, nausea, and fatigue. Inhalation of very high levels may cause death. Exposure to lower doses of cis-1,2-DCE can cause a decrease in red blood cells and affect the liver. Long term human health effects after exposure to low levels of 1,2-DCE are unknown. Cis-1,2-DCE is not classifiable as a human carcinogen and trans-1,2-DCE is not classified.

Carbon Tetrachloride (CCl_4): A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. CCl_4 is most often found as a colorless gas and was historically used in the production of refrigeration fluid and propellants for aerosols, and as a pesticide, cleaning fluid and degreasing agent. These uses are now banned, but CCl_4 still has some industrial applications. Exposure to high levels through inhalation, ingestion, and possibly skin contact, can cause liver, kidney, and central nervous system damage. In severe cases, coma and death can occur. CCl_4 may reasonably be anticipated to be a carcinogen, however the data are inconclusive.

Chloroform: A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. Chloroform is a colorless liquid that is presently used to make other chemicals and may be formed in small amounts when chlorine is added to water. Short-term inhalation of 900 ppm of chloroform in air can cause dizziness, fatigue, and headache. Long-term exposure to high levels through breathing or ingestion may damage the liver and kidneys. Exposure of large amounts to the skin may cause sores. Chloroform may be reasonably anticipated to be a carcinogen.

Vinyl Chloride: Vinyl chloride is a colorless, flammable, gas used to make polyvinyl chloride (PVC), which is used in plastics and furniture and automobile upholstery. Vinyl chloride also results from the breakdown of other substances, including the COCs TCE and PCE. Short-term inhalation of high levels of vinyl chloride can cause dizziness or sleepiness; inhalation of extremely high levels can cause unconsciousness or death. Long-term inhalation can cause changes to the structure of the liver. Exposure to skin may cause numbness, redness, and blisters. Workers have developed nerve damage and immune reactions, problems with blood flow in the hands, and destruction of bones in the tips of fingers. Vinyl chloride is a known carcinogen.

- The central plume is principally composed of 1,1,2,2-PCA and TCE but contains PCE, 1,2-DCE and 1,1,2-TCA. Off-site portions of this plume flow to the west and northwest. The southern plume is principally composed of 1,1,2,2-PCA, TCE, and chloroform, but contains PCE, CCl_4, 1,1,2-TCA, and 1,2-DCE. The suspected sources of the central and southern plumes appear to be located within the Disposal Area of Dunn Field.

SCOPE AND ROLE OF THE RESPONSE ACTION

The overall strategy for remediating Dunn Field is to select the most effective response action to address soil and groundwater contamination that will allow transfer of the property for its intended land use. This intended land use for Dunn Field is industrial. Recreational land use was initially planned for the Northeast Open Area and that portion of the area identified as available for unrestricted use was offered to the City of Memphis for a public park. The City of Memphis declined the property transfer and the parcel was sold through a public sale. The current zoning for Dunn Field is Light Industrial (I-L). The zoning ordinance does not allow residential use in I-L zoned areas.

Several remedial actions have been performed to date at Dunn Field:

- In 1996, an Interim Remedial Action (IRA) ROD was submitted for a groundwater removal action at Dunn Field. The selected IRA was for hydraulic control of the contaminant plume in groundwater beneath Dunn Field via groundwater extraction and discharge to the municipal sanitary sewer. The seven-well extraction system was constructed in 1998 on the northwest boundary of Dunn Field. Four additional recovery wells were added to the system in early 2000.
- A non-time critical removal action was conducted to reduce or eliminate the potential risk posed by CWM wastes at Sites 1, 24-A, and 24-B. The removal action was completed in March 2001 and documented in the Final Chemical Warfare Materiel Investigation/Removal Action Report (2001). Approximately 914 cubic yards (CY) of soil contaminated with mustard degradation by-products and 19 CY of mustard-contaminated soil were excavated, transported, and disposed of off-site. Twenty-nine bomb casings were recovered from Site 24-A.
- A non-time critical removal action to address lead -contaminated surface soil at Site 60, a former pistol range in the Northeast Open Area, was completed in March 2003. Approximately 930 CY of lead-contaminated surface soil was excavated, transported, and disposed of off-site at an approved, permitted landfill.
- The Dunn Field RI and FS have been conducted and the final reports are part of the Administrative Record (July 2002 and May 2003, respectively). The Dunn Field Proposed Plan (May 2003) was presented to the public in May 2003. The Dunn Field Record of Decision (March 2004) was completed and signed by DLA in March 2004, and by TDEC and EPA in April 2004.
- The Dunn Field Disposal Sites Remedial Design (April 2004) was approved by EPA and TDEC. Based on the Disposal Sites Pre-Design Investigation of 17 medium and high priority sites, 5 disposal sites (3, 4.1, 10, 13 and 31) were selected for excavation and off-site disposal of soil and debris. The Disposal Sites Remedial Action Work Plan (RAWP) (October 2004) was approved by EPA and TDEC. The excavation and off-site disposal was performed in March to May 2005 and February to March 2006. Approximately 2,700 CY of non-hazardous soil and debris were excavated and transported to the BFI South Shelby County Landfill for disposal. Approximately 234 CY of hazardous materials were transported to the Clean Harbors Lambton Secure Landfill in Canada for disposal. Soil confirmation samples demonstrated that the remedial goals had been met and the Remedial Action Completion Report (July 2006) was approved by EPA in August 2006.
- An Early Implementation of Selected Remedy (EISR) using zero-valent iron (ZVI) injection was performed in 2004 at the leading edge of the high -concentration (>500 µg/L) portion of the central plume in the fluvial aquifer. The EISR was performed in the Off Depot groundwater plume approximately 1,000 feet west of Dunn Field based on CVOC concentrations significantly higher than observed at this distance from Dunn Field during the RI. The rationale and scope of the action were approved by DLA, EPA and TDEC in October 2004. The objective of the EISR was to reduce contaminant mass downgradient of the planned PRB location in order to ensure that the portion of the plume slated for MNA in the ROD

was not unduly extensive or high in concentration. The EISR Work Plan (November 2004) was approved by EPA and TDEC in November 2004. ZVI injections were made November 2004 to January 2005. Injections were made in 14 borings at 2-foot intervals over the fluvial aquifer thickness, which averaged 21 feet; the injection borings were spaced approximately 60 to 80 feet apart. The depth of injection ranged from approximately 70 to 100 feet bgs. The total mass of ZVI injected was approximately 192,500 pounds. The injections did not achieve the goal of 90 percent or greater reduction of TCE and 1,1,2,2-PCA. The report recommended decreased spacing between injection locations in future remedial actions to achieve increased reduction in CVOCs. The EISR Interim Remedial Action Completion Report (September 2005) was approved by EPA in September 2005.

- The Source Areas Final Remedial Design (April 2007) was approved by EPA and TDEC. The Fluvial SVE component of the Source Areas remedy was expedited to limit further impacts to groundwater from CVOCs in the subsurface soil. The Dunn Field Fluvial Soil Vapor Extraction Remedial Action Work Plan, Rev.1 (May 2007) was approved by EPA . Fluvial SVE system construction was completed in July 2007 and system operations began 25 July 2007. As of 2 May 2008, approximately 2360 pounds of CVOCs have been removed by the fluvial SVE system and CVOC concentrations in groundwater on Dunn Field have decreased.
- The remaining components of the Source Areas remedy (ZVI injection in groundwater and thermal-enhanced SVE and ET&D in the loess) were included in the Dunn Field Source Areas Loess/Groundwater RAWP, Rev.1 (August 2007) which received partial approval from EPA. The RAWP was approved with regard to RA construction and operation but demonstration of attainment of the clean-up levels for subsurface soils was not approved. This allowed construction to start while details regarding confirmation sampling were settled by DLA, EPA and TDEC. Further revisions to the Loess/Groundwater RAWP were prepared to document the final revisions with regard to the attainment of clean-up levels, the use of non-detect results in evaluation of confirmation sample results, a flow chart for the thermal-enhanced SVE component, and addition of ET&D for shallow soil in Treatment Area 3. The Loess/Groundwater RAWP received final approval from EPA on 5 June 2008 and from TDEC on 7 July 2008.

SUMMARY OF SITE RISKS

A baseline risk assessment (BRA), including an ecological risk assessment and human health risk assessment (HHRA), was conducted for each of the three geographical areas of Dunn Field (Figure 2) and the underlying groundwater. 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.

The HHRA compared site- and contaminant -specific risk estimates with the acceptable health risks and hazard index (HI) levels. For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent a cancer risk of between 10^{-4} and 10^{-6}, 1 in 10,000 to 1 in 1 million, respectively. The 10^{-6} risk level is used as the point of departure for determining remediation goals when standards are either not available or sufficiently protective because of multiple contaminants or pathways of exposure. For non-carcinogenic site-related chemicals, the acceptable HI level is 1.0 or lower.

Details of the BRA are presented in the Dunn Field RI Report and the BRA is summarized in the Dunn Field ROD. The current consensus is that the Selected Remedy is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. <u>No changes to the BRA are included in this Revised Proposed Plan</u>.

REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) describe the goals that the remedial actions identified in the ROD are expected to accomplish. <u>No changes to the RAOs are included in this Revised Proposed Plan, which addresses the following RAOs:</u>

<u>Subsurface Soil</u>

- Prevent direct inhalation of indoor air vapors from subsurface soils in excess of industrial worker criteria.
- Reduce or eliminate further impacts to the shallow fluvial aquifer from the CVOCs in the subsurface soil.

Because there are no federal or state cleanup standards for soil contamination, target levels were established 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. The subsurface soils, primarily within the Disposal Area of Dunn Field, have residual CVOC levels that exceed the soil-to-groundwater migration-based screening levels and have potential for vapor intrusion to indoor air under possible future land use conditions. Site-specific target values were calculated for the loess and fluvial deposits and are summarized below (values are expresses in mg/kg or parts per million [ppm]):

	Loess	Fluvial
PCE	0.180	0.092
TCE	0.182	0.093
Cis 1,2-DCE	0.755	0.404
Trans 1,2-DCE	1.520	0.790
Vinyl Chloride	0.024	0.015
1,1,2,2-PCA	0.011	0.006
1,1,2-TCA	0.062	0.035
CCl_4	0.215	0.108
Chloroform	0.917	0.486

Groundwater

- Prevent human exposure to contaminated groundwater in excess of protective target levels from potential future on-site wells.
- Prevent further off-site migration of CVOCs in groundwater in excess of protective target levels.
- Remediate fluvial aquifer groundwater to drinking water quality to be protective of the deeper Memphis aquifer.

The findings of the HHRA for the CVOCs detected in groundwater in the fluvial aquifer indicate that concentrations are high enough to make the water unsuitable for drinking. The chemicals responsible for this predicted excess risk are CVOCs.

Currently there is no exposure to the contaminated groundwater in the fluvial aquifer at Dunn Field. Thus the focus of the remedial action is to protect human health from potential future exposures as well as to restore groundwater in order to allow maximum beneficial use of groundwater.

COCs in groundwater and their respective target concentration levels are shown below (in microgram per liter [ug/L] or parts per billion [ppb]. These individual groundwater target goals will change with the number and concentrations of chemicals present in a plume during remediation; however, the target risk level (e.g. 1×10^{-4}) will remain fixed.

	Groundwater Target Goal
PCE	2.5
TCE	5
Cis 1,2-DCE	35
Trans 1,2-DCE	50
1,1 DCE	7/340*
1,1,2,2-PCA	2.2
1,1,2-TCA	1.9
CCl_4	12
Chloroform	3

* EPA reclassified 1,1-DCE as a non-carcinogen, however, the existing MCL is based on previous assumption that it is a carcinogen. EPA may revise this MCL.

CRITERIA FOR EVALUATING REMEDIAL ALTERNATIVES

The remedy selection for the soil and groundwater at the Memphis Depot Dunn Field, as described in the May 2003 Proposed Plan, was the result of a comprehensive screening and evaluation process. The FS identified and analyzed appropriate alternatives for addressing the contamination at Dunn Field. The FS and other documents described the alternatives considered, as well as the process and criteria used to narrow the list of the potential remedial alternatives. 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 Applicable or Relevant and Appropriate Requirements (ARARs) - Addresses whether or not a remedy is expected to meet any identified 'applicable' or 'relevant and appropriate' federal or more stringent state environmental law or regulations (i.e., ARARs). Alternatively, addresses whether a waiver of an ARAR can be invoked under CERCLA Section 121(d)(4).

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 expressed as net present worth costs.

Modifying Criteria

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

9. Community Acceptance - Summarizes the general response to the recommended changes described in the Revised Proposed Plan based 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 Amendment following a review of the public comments received on the Revised Proposed Plan.

SELECTED REMEDY

As described in the Dunn Field ROD, the selected remedy included the remediation of disposal sites and associated subsurface soil, and groundwater contamination as well as CVOC contamination within subsurface soil that is outside of the disposal sites. The major components of the selected remedy for Dunn Field are:

- Excavation, transport, and disposal of soil and material contained within disposal sites located in the western half of Dunn Field based upon results from a pre-design investigation into these sites.
- Use of soil vapor extraction (SVE) to reduce CVOC concentrations in subsurface soils to levels that are protective of the intended land use and groundwater.
- Injection of zero-valent iron (ZVI) within Dunn Field to treat chlorinated CVOCs in the most contaminated part of the groundwater plume, and installation of a permeable reactive barrier (PRB) to remediate CVOCs within the offsite areas of the groundwater plume.
- Monitored natural attenuation (MNA) and long-term groundwater monitoring (LTM) to document changes in plume concentrations, to detect potential plume migration to offsite areas or into deeper aquifers, and to track progress toward remediation goals.
- Implementation of land use controls, which consist of the following institutional controls: deed and/or lease restrictions; Notice of Land Use Restrictions; City of Memphis/Shelby County zoning restrictions and the Memphis and Shelby County Health Department groundwater well restrictions.

NEW INFORMATION SUPPORTING CHANGES IN SELECTED REMEDY

Information gathered since completion of the Dunn Field ROD resulted in a reassessment of components of the selected remedy. Three studies were performed on Dunn Field as part of the Source Areas RD: a field treatability study was conducted to evaluate the effectiveness of ZVI injection for subsurface remediation of CVOCs; an SVE pilot study was performed to collect site-specific data for both the loess and the unsaturated fluvial deposits; and a remedial design investigation (RDI) was performed to delineate CVOC concentrations in the loess and to collect additional groundwater samples.

Additional studies were performed in the groundwater plume west of Dunn Field to aid the Off Depot Groundwater RD. An Off-site Design-Related Investigation (DRI) was performed to evaluate site hydrogeology and CVOC concentrations in groundwater, with monitoring wells installed and sampled in a phased approach. The Off-site DRI showed that the high concentration portion of the plume (<500 μg/L) extended further downgradient from Dunn Field than previously known. These findings led to the EISR described above. A Field ZVI PRB Implementation Study was also performed west of Dunn Field; a pilot-scale ZVI PRB was installed using the jet grouting technique to evaluate its implementability and cost-effectiveness for a full-scale PRB.

Groundwater flow modeling was performed to provide a quantitative description of hydrogeologic conceptual site model and allow evaluation of the effects of different treatment scenarios. The model simulates the entire potential flow path between the Off-Depot plume and the Allen well field with assumptions on the connectivity of the fluvial, intermediate, and Memphis aquifers and is useful for estimating potential contaminant migration from the fluvial aquifer to the underlying aquifers.

A laboratory study was performed to evaluate 1,1,2,2-PCA and TCE biodegradation rates using three carbon substrates, site sediments, and groundwater, and commercially-available bacteria. The study was conducted to evaluate whether target compounds could be biodegraded efficiently under existing conditions, and to assess whether site amendments might increase degradation rates . The reports of these studies are included in the Administrative Record for this Revised Proposed Plan.

These studies have led to seven recommended changes to components of the selected remedy.

As stated in the introduction, one of the changes is considered fundamental and has led to this Revised Proposed Plan:

- Use of air sparging with soil vapor extraction (AS/SVE) for the Off Depot groundwater plume instead of a ZVI PRB.

The other six changes to the subsurface soil and groundwater remedies on Dunn Field are presented for public information. Five of the changes are considered significant:

- Revision to criteria for extent of the AS/SVE system and clarification of the treatment objective for AS/SVE.
- Reduction in the areal extent of the soil vapor extraction (SVE) treatment in subsurface soils;
- Use of thermal-enhanced SVE in the shallow subsurface soils (loess) instead of conventional SVE;
- Reduction in the areal extent of zero-valent iron (ZVI) injections in groundwater based on identified source areas with total CVOC concentrations above 1,000 ug/L; and
- Use of excavation, transportation and off-site disposal (ET&D) in two areas with shallow impacts (a small area of CVOC-impacted subsurface soils and an area of buried crushed drums not identified in the Source Areas RD).

The final change is considered minor:

- The sequencing of remedial action components will be revised so that ZVI injections in groundwater on Dunn Field, if necessary, will occur after implementation of the subsurface soil remedies.

The table on the following page lists the selected remedy components for Dunn Field and the status and/or recommended changes.

In addition, this Revised Proposed Plan addresses a revision to the original Dunn Field ROD, dated March 2004. Although the revision does not result in a change to any component of the selected remedy, it is included in the Revised Proposed Plan for completeness. The revision is the deletion from the Dunn Field ROD page 2-55 of the following statement, "A contingency plan may be implemented to further address remediation of the off-site VOC ground water plume entering the northeast portion of Dunn Field in the event the Parties determine the on-site remedy is inadequate and poses unacceptable risk to human health and the environment." This sentence is being stricken because it may convey the notion that the remedy described in the ROD, or in an amended ROD, is not a final remedy for Dunn Field. Striking this statement is not meant to imply that the remedy is now unchangeable; the FFA parties can change a remedial action where warranted by the site conditions whether or not this statement is included.

Status of Selected Remedy Components

Area	Selected Remedy	Status/Changes
Disposal Sites	Excavation, transportation and disposal (ET&D)	Completed per ROD in March 2006.
Subsurface Soil	Soil vapor extraction (SVE)	Remedy was changed to include thermal enhancement and ET&D of two shallow areas. Conventional SVE in fluvial sands began in July 2007; thermal-enhanced SVE in loess began in May 2008; initial ET&D completed in January 2008; additional ET&D planned.
Groundwater		
Source Areas	Zero valent iron (ZVI) injection in most contaminated part of groundwater plume	ZVI injections to be made in areas with total CVOCs exceeding 1,000 ug/L, following completion of thermal-enhanced SVE.
Off Depot	Installation of a permeable reactive barrier (PRB)	PRB to be replaced by air sparging (AS) and SVE following ROD Amendment. AS/SVE to be implemented in 2009 as part of the Off Depot remedial action
Site-wide	Monitored natural attenuation and long-term groundwater monitoring	To be implemented in 2009 as part of the Off Depot remedial action.
Site-wide Land Use	Implementation of land use controls	To be implemented in 2009 as part of the Off Depot remedial action.

NEW ALTERNATIVE TO SELECTED REMEDY—FUNDAMENTAL CHANGE

Changes to the PRB component for Off Depot groundwater are recommended based on information from the EISR, the Field PRB Implementation Study, the microcosm study and the results of the Fluvial SVE implementation.

Additional monitoring wells installed for the EISR provided new information on groundwater flow gradient, saturated thickness, and contaminant concentrations around the ROD-proposed location of the ZVI PRB. The relatively low groundwater gradient in that area would make it difficult to ensure consistent flow through a ZVI PRB, while the thicker saturated zone would increase the construction cost. In addition, CVOC concentrations downgradient of the ROD-proposed location exceed 5,000 parts per billion (ppb), which is an order-of-magnitude higher than those presented in the ROD. These concentrations are higher than considered appropriate for MNA and would require active treatment downgradient of the ZVI PRB.

To comply with the ROD and account for the new hydrogeologic information, a new ZVI PRB alignment near the midpoint of the Off Depot plume was considered. This location, which was selected because of a thinner saturated zone and a narrowing of the CVOC plume, would have been a more cost-effective alignment for the PRB. The Field PRB Implementation Study was performed in this area. The results of the PRB study indicate that formation of a uniform PRB was not achieved and that several technical issues would need to be solved for installation of an effective full-scale PRB. Key findings that could adversely impact the expected effectiveness and cost of a full-scale ZVI PRB include:

- **Highly variable clay surface.** The top of the clay surface is highly variable, which could result in iron/sand columns that are either above or below the top of clay. Consequences of the variable clay surface include the potential for the CVOC plume to pass over or under the full-scale ZVI PRB or that iron installed below the top of clay is essentially wasted.

- **High groundwater velocities.** Aquifer testing conducted as part of the study indicated much higher groundwater velocities than previously understood (up to 6 feet per day [ft/d] versus the previous estimate of 1 ft/d). The higher groundwater velocities would require a much thicker (6-foot versus 1-foot) ZVI PRB in order to achieve remedial goals.

- **Construction challenges.** The jetting technique used for the pilot-scale ZVI PRB requires modification to address incomplete removal of formation material during the jetting process and impacts of sidewall sloughing and variable column diameter on overall system effectiveness. The percentage of ZVI in the columns was highly variable and the consistency would need to be improved.

- **Supplemental technologies would be required.** Multiple injection wells for enhanced bioremediation were proposed in the Intermediate Off Depot Groundwater RD (June 2006) to address elevated CVOC concentrations downgradient of the full-scale ZVI PRB location.

Based on the challenges to successful installation of a full-scale ZVI PRB, enhanced bioremediation through injection of a carbon substrate and a consortia of bacteria was considered as an alternative for the Off-Depot groundwater plume. The initial results of microcosm testing suggested enhanced bioremediation could be effectively used to address site CVOCs, and enhanced bioremediation was proposed for the Off-Depot plume in the Off-Depot Groundwater Pre-final RD (July 2007).

However, the uncertainty of enhanced bioremediation effectiveness and an updated cost estimate for implementation prompted review of other technologies. The factors creating the uncertainty in the effectiveness of enhanced bioremediation include:

- **Lack of field verification.** Although the commercially-available microbial consortia (WBC-2) and carbon sources used during the microcosm study resulted in complete 1,1,2,2-PCA and TCE dechlorination in the laboratory, it has not been applied in the field.

- **Aquifer conditions.** WBC-2 viability and overall enhanced bioremediation effectiveness is highly contingent on the ability to sustain strongly reducing conditions, which may be challenging in the Fluvial aquifer, which is strongly aerobic. In addition, buffering would be required to sustain neutral pH levels to optimize WBC-2 effectiveness and maximum CVOC degradation rates.

- **Substrate delivery.** Development of horizontally and vertically continuous enhanced bioremediation zones is contingent on uniform delivery of carbon substrate in the aquifer. Given the variability seen in ZVI delivery during the EISR and in vapor extraction in the Fluvial SVE operations, uniform distribution of the carbon substrate may not be possible.

- **Additional studies required.** Additional field testing would be essential to optimize the enhanced bioremediation system prior to full-scale implementation. Critical parameters to be determined prior to implementation include: the achievable radius of injection during substrate injection, the actual subsurface distribution of WBC-2 following injections, and the need for and magnitude of pH adjustments to sustain microbial activity.

- **Field labor and access.** Injection of carbon substrate to sustain enhanced bioremediation would require significant field labor (several man-years) and regular access to off-site properties.

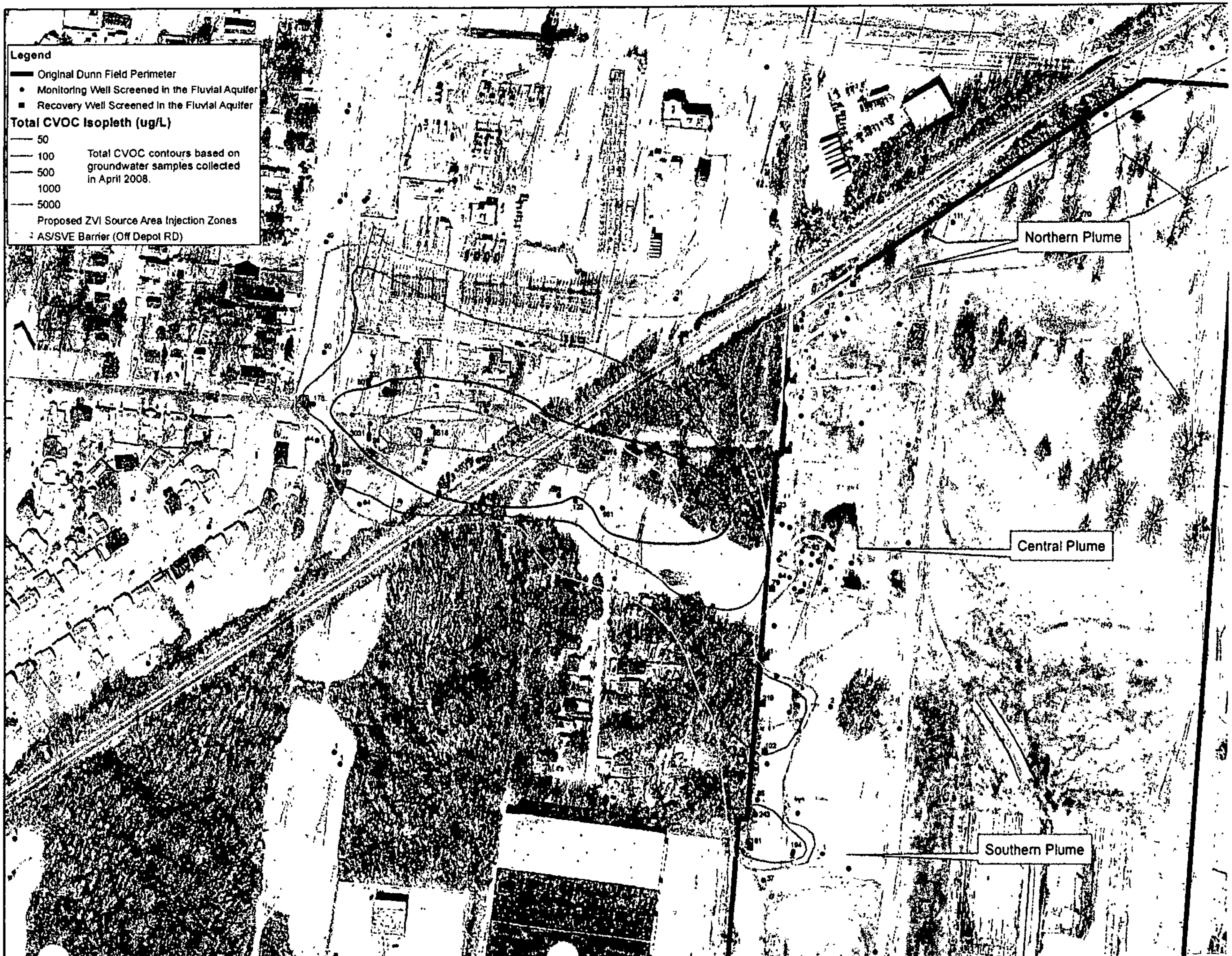
AS/SVE was evaluated as an alternative to enhanced bioremediation for the Off Depot remedy. AS/SVE had been considered in the Dunn Field ROD for remediation of groundwater beneath the source areas. Although it was not selected because ZVI injection offered rapid reduction of CVOC concentrations without continuing operations and maintenance and was slightly less expensive, AS/SVE was considered a viable treatment technology. A conceptual layout of the AS/SVE treatment system in the Off Depot area is shown on Figure 3.

The use of AS/SVE to treat the Off-Depot plume is similar to the use of the ZVI PRB in the Dunn Field ROD. The following similarities are noted:

- Both technologies rely on physical and/or chemical, rather than biological, processes.

- Both would treat a large portion of the Off Depot Plume, with only a small portion to be treated by MNA.

- Operations and maintenance activities are limited relative to the injection activities required for enhanced bioremediation.



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Off Depot Groundwater Remedial Alternatives

Evaluation Criteria	Selected Remedy PRB and MNA with Institutional Controls	Revised Proposed Plan AS/SVE and MNA with Institutional Controls
Protective of Human Health and Environment	High	High
Complies with ARARs	Yes	Yes
Effective and Permanent	Low	High
Reduces Toxicity, Mobility, or Volume through Treatment	Yes	Yes
Short-term Effectiveness	Medium	High
Implementability	Low	High
Capital Cost Operating Cost Total Cost	\$2,686,946 \$1,067,400 \$3,754,346	\$2,549,069 \$2,369,658 \$4,918,727
State Acceptance	Yes	Yes
Community Acceptance	Yes	Will be determined after comment period

The other elements that resulted in selection of AS/SVE are summarized below.

- **Proven technology.** AS/SVE has been implemented to remove CVOCs from groundwater at numerous sites, completed or in-process. The Fluvial SVE system is operating successfully on Dunn Field.
- **Straight-forward implementation.** Construction of AS and SVE wells is relatively rapid using conventional drilling methods. Air compressor and blower equipment are easily procured.
- **Rapid evaluation.** AS/SVE effectiveness can be assessed in a relatively short time period, unlike enhanced bioremediation, which requires many months to implement and reliably assess.

The nine criteria described previously were used to evaluate the selected Off Depot Remedy in the ROD based on the data available at that time. Studies performed since the ROD was signed brought the selected remedy into question. The table above compares the selected remedy and the proposed revised remedy against the nine criteria using the current data. The costs listed in the table for the selected remedy are from the ROD, while the costs for the recommended changes are from the Off Depot Groundwater RD.

EXPLANATION OF OTHER CHANGES TO SELECTED REMEDY

Off Depot Groundwater

Changes to the extent and the treatment objective of the AS/SVE system were made based on information from groundwater monitoring results, groundwater modeling and the effect of Fluvial SVE operations on CVOC concentrations in groundwater.

The ROD stated that the length of the PRB would be based on the furthest northeast and southwest 50 ug/L isoconcentration contour for any COC. The extent of the recommended active remedy (AS/SVE), shown on Figure 3, crosses the core of the plume near the downgradient end. The MLGW substation prevents shifting the AS/SVE system further north to capture more of the plume. The criteria for the length of active treatment presented in the ROD were conservative to address the level of uncertainty on groundwater flow and contaminant transport. Studies completed since completion of the ROD have greatly reduced the uncertainty, and the planned extent of the AS/SVE system in combination with natural attenuation is considered sufficient to achieve groundwater RAOs.

Thirty-one new monitoring wells were installed in 2004 in the Off Depot area to determine the extent of the groundwater plume. Groundwater monitoring results since 2005 (Figure 4) demonstrate that the overall plume extent has been stable since that time. Groundwater modeling conducted for the Off Depot RD suggests that while the AS/SVE system will reduce CVOC concentrations in the fluvial aquifer, the system is not needed to protect the Memphis Sand aquifer. Estimated CVOC concentrations in the Memphis Sand aquifer are well below maximum contaminant levels with or without the AS/SVE system. Based on the April 2008 groundwater monitoring results shown on Figure 4, operation of the Fluvial SVE system on Dunn Field has greatly reduced groundwater concentrations upgradient of the AS/SVE system location.

The ROD stated that the PRB would treat the COCs to non-toxic end products and achieve a 95% CVOC degradation rate. The recommended active remedy will reduce the CVOC concentrations to 50 ug/L or less. Groundwater modeling results indicate that the AS/SVE system in combination with natural attenuation processes will reduce groundwater concentrations to MCLs in accordance with the RAOs within a reasonable period of time.

Subsurface Soil

Changes to the SVE component for subsurface soil were made based on information from the SVE pilot study and the RDI.

SVE was selected as the presumptive remedy for CVOCs in subsurface soil (the vadose zone) at Dunn Field and was expected to meet the RAOs in less than 5 years.

The impacted vadose zone at Dunn Field consists of two distinct geological units: (1) a shallow, relatively low-permeability loess composed of silt, silty clay and silty fine sand, and (2) a deep, relatively high-permeability alluvium composed of sand and gravel with discontinuous layers of silt and clay, designated the fluvial deposits. The loess extends from the ground surface to a depth of about 30 feet, bgs. Underlying the loess are several feet of a sandy clay transition layer, followed by 30 to 75 ft of fluvial sands, silt, and gravel.

The SVE pilot study was conducted in four phases to collect site-specific data for design of a full-scale system. The study findings supported use of SVE in the fluvial deposits and indicated the RAOs could be met within 5 years in that unit. However, the study demonstrated limited vapor extraction rates and high applied vacuum requirements for the loess. The estimated times required to meet RAOs for the two primary CVOCs in the loess were up to 235 years for 1,1,2,2-PCA and up to 14 years for TCE.

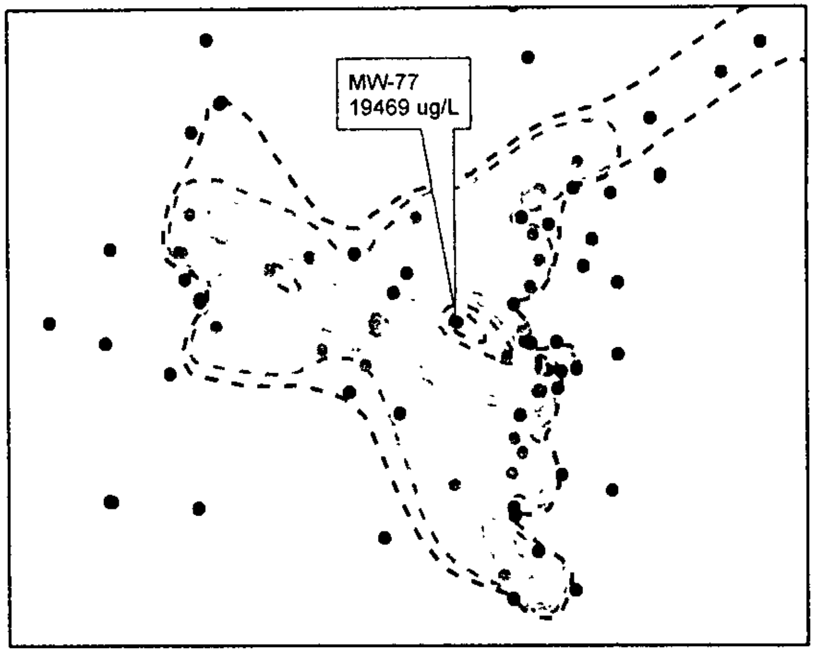
The RDI included a membrane interface probe (MIP) investigation and soil sample analyses to characterize the magnitude and extent of elevated CVOCs in the loess on a 40-foot by 40-foot grid throughout the treatment areas identified in the ROD. The study resulted in better delineation of the loess deposits requiring SVE treatment. The total area within the four treatment areas was reduced from 5.5 acres as shown in the ROD to 1.25 acres. The RDI determined that CVOC concentrations in the upper 5 feet of soil in the treatment areas were generally below RGs. Therefore, the treatment interval in the loess will extend from a depth of 5 feet to the sandy clay transition layer within the fluvial deposits, at a depth of 30 to 35 feet.

The May 2003 Proposed Plan stated that the SVE remedy may be implemented with enhancements to improve permeability or vapor transport. The reduced area requiring SVE treatment allows implementation of thermal enhancements to the SVE system for the loess. In situ thermal desorption (ISTD) is the thermal technology selected for implementation at Dunn Field.

The ISTD technology heats subsurface soils via radiation and conductive heat transfer. The heating converts subsurface moisture to steam, which mobilizes and volatizes contaminants. The heated vapor is removed from the subsurface via SVE. Temperature monitoring points will be installed throughout the treatment areas to measure the subsurface temperature throughout the remediation process.

The extracted soil vapor will be treated before release to the atmosphere. Site controls will be in place to limit access during implementation. Further, process controls will be implemented to minimize fugitive emissions and releases of CVOCs above acceptable levels. Thermal-enhanced SVE is expected to meet the RAOs in the loess in less than one year of operation.

Soil sampling and MIP results indicated one CVOC (chloroform) was present slightly above the remedial goal (RG) at depths of 8.5 to 13 feet in one RDI boring. None of the surrounding borings had CVOCs above the RGs. Based on the limited extent



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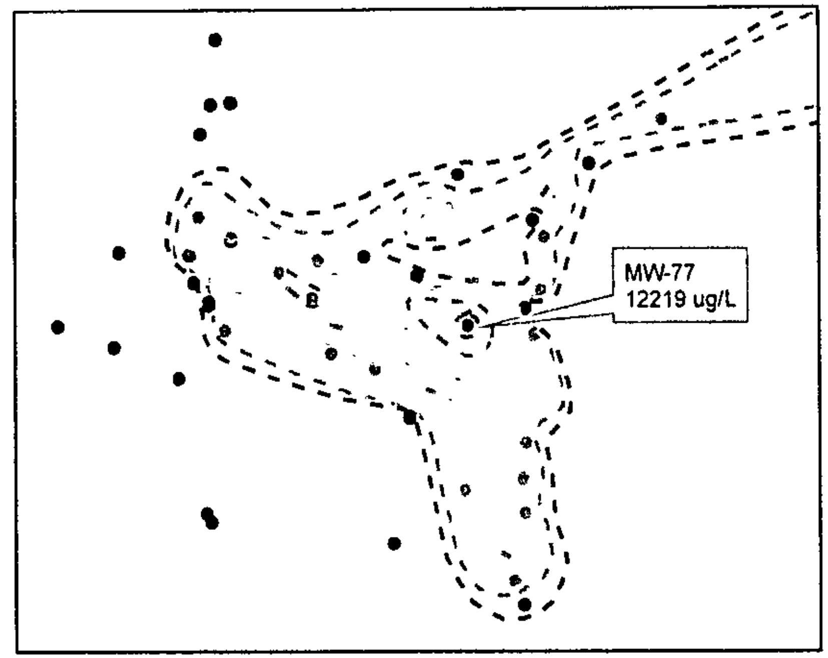

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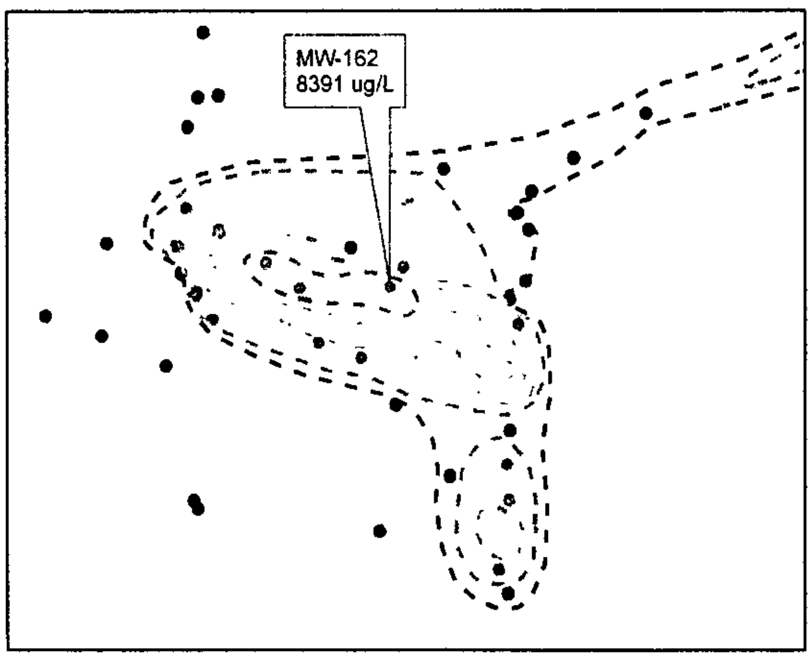

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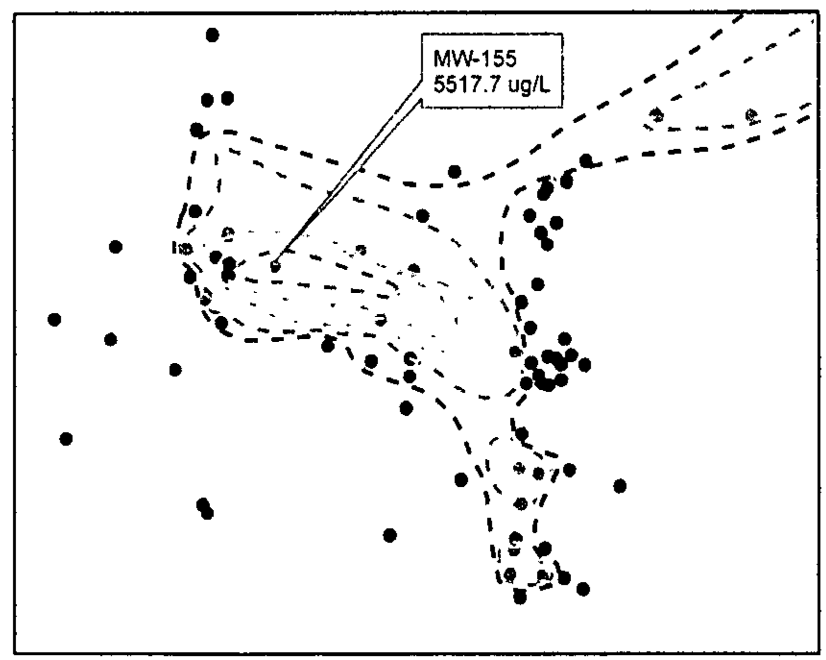

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0 200 400 600 800 1,000
Feet

and depth, this area was excavated rather than treated by thermal-enhanced SVE.

A second area of shallow soil contamination was identified during construction of the Fluvial SVE system in June 2007. Crushed metal drums were found at a depth of 2.5 feet bgs during hand-auguring prior to installation of Fluvial SVE vapor monitoring points in TA-3. Residual material in the drums was determined to be primarily diesel range and heavier hydrocarbons. The extent of the buried, crushed drums was estimated by a surface geophysical survey and test pit excavations to cover approximately 10,500 square feet with a volume of approximately 1,950 cubic yards. Excavation was also selected as the most effective remedy for this area. The revised loess treatment areas and the excavation areas are shown on Figure 5.

Groundwater on Dunn Field

Changes to the ZVI component for groundwater on Dunn Field were made based on information from the ZVI field treatability study, the EISR, the RDI, and recent groundwater monitoring results.

The ZVI component uses pressurized pneumatic injection of ZVI powder into the saturated zone (fluvial aquifer). Pneumatic fracturing is conducted as a first step to maximize ZVI dispersal in the treatment zone. The Dunn Field ROD estimated that ZVI injections would be made at 53 injection borings with a spacing of 60 to 80 feet.

In the treatability study, ZVI injections were made in four borings spaced 25 to 30 feet apart; approximately 25,000 pounds of ZVI was injected at 1 to 2-foot intervals spanning the approximately 13-foot saturated thickness of the fluvial aquifer at that location. An 84 to 99 percent reduction of CVOCs was observed in groundwater samples from the ZVI treatment zone during post-injection groundwater monitoring over six months. Later groundwater samples indicated CVOC rebounding at some wells possibly as the result of contaminant leaching from overlying soils; desorption of CVOCs not directly treated by iron emplacement; overall iron distribution and longevity; and/or transport of dissolved-phase CVOCs into treated areas.

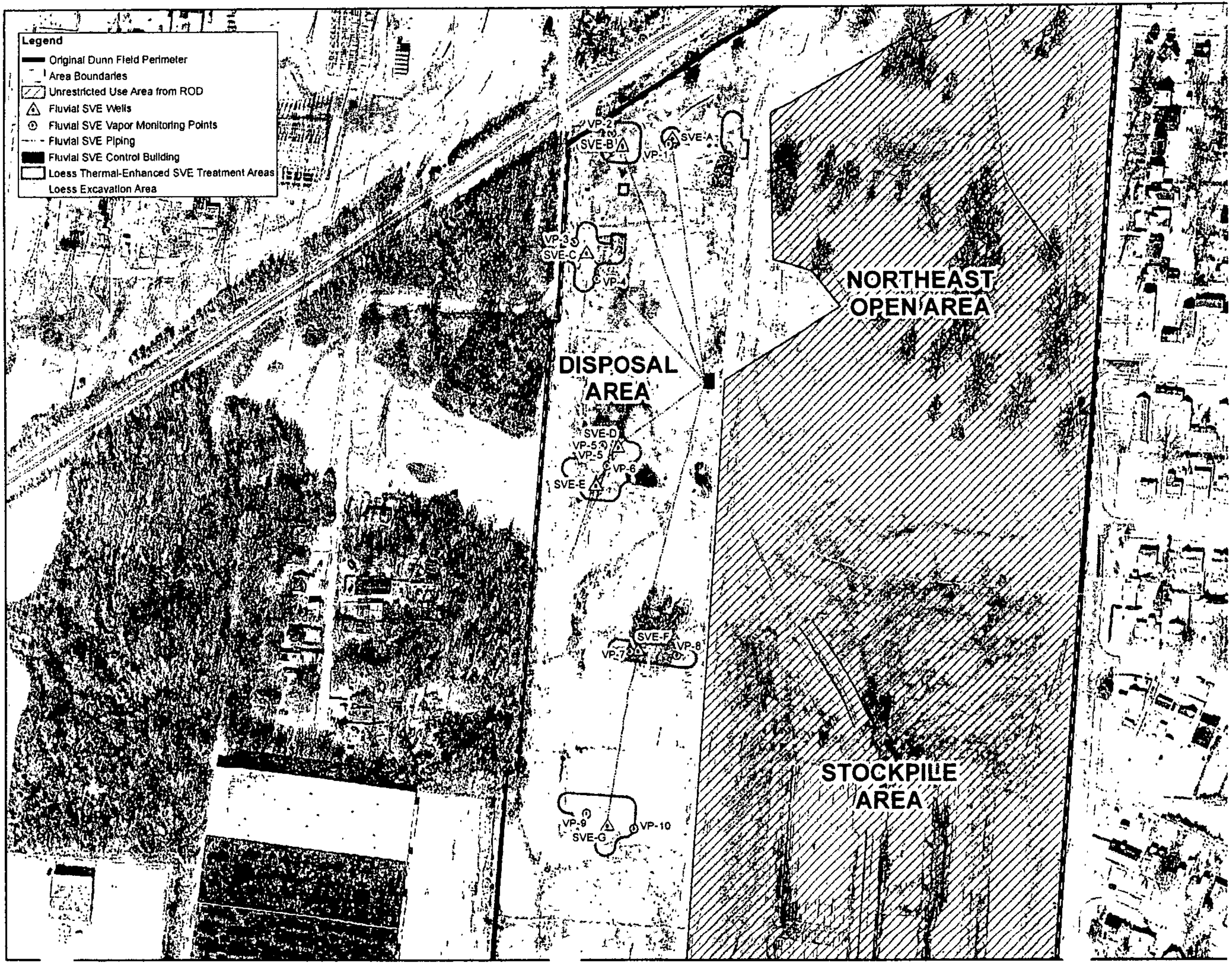
In the EISR, ZVI injections were made in 14 borings at 2-foot intervals over the fluvial aquifer thickness, which averaged 21 feet; the injection borings were spaced 60 to 80 feet apart. The total mass of ZVI injected was approximately 192,500 pounds. In the central injection area, TCE concentrations were reduced approximately 46 percent and 1,1,2,2-PCA concentrations were reduced approximately 65 percent. The report recommended decreased spacing between injection locations in future remedial actions to achieve increased reduction in CVOCs.

The RDI included installation of 12 new monitoring wells on Dunn Field and groundwater sampling from the new and existing wells. The groundwater data provided greater delineation of the CVOC concentrations underlying the source areas in the loess.

Based on this additional information, ZVI injections will be made within areas of the fluvial aquifer on Dunn Field identified by the 1,000 ug/L total CVOC contour. This criterion was selected to clarify the language in the Dunn Field ROD which called for injection of zero-valent iron (ZVI) in the most contaminated part of the groundwater plume. The CVOC plume outside the ZVI injection area will be treated by the Off Depot groundwater remedy.

The sequencing of the ZVI injections relative to the other Source Areas RA remedies was also changed. The groundwater remedy will be implemented after installation and start-up of the fluvial SVE system and after completion of thermal-enhanced SVE in the loess. This change was made to minimize potential rebounding of CVOC concentrations in groundwater after injection due to leaching from the overlying source areas.

The groundwater sample results shown on Figure 4 indicate that CVOC concentrations have decreased significantly since operation of the Fluvial SVE system began. The decline in total CVOC concentrations in groundwater indicates there is not a continuing source of contamination in the fluvial aquifer. Total CVOC concentrations on Dunn Field are currently below 1,000 ug/L and ZVI injections may not be required.


Legend
Original Dunn Field Perimeter
Area Boundaries
Unrestricted Use Area from ROD
Fluvial SVE Wells
Fluvial SVE Vapor Monitoring Points
Fluvial SVE Piping
Fluvial SVE Control Building
Loess Thermal-Enhanced SVE Treatment Areas
Loess Excavation Area
NORTHEAST OPEN AREA
DISPOSAL AREA
STOCKPILE AREA
VP-2
SVE-B
VP-1
SVE-A
VP-3
SVE-C
VP-4
SVE-D
VP-5
VP-6
SVE-E
SVE-F
VP-7
VP-8
VP-9
SVE-G
VP-10

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SUMMARY

Based on the information available at this time, DLA, EPA and TDEC believe the recommended change to the selected remedy for the Off Depot groundwater plume 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 recommended change can be modified in response to public comment or new information, such as a detected change in groundwater conditions that would require an additional remedy.

COMMUNITY PARTICIPATION

DLA, EPA and TDEC provide information regarding the cleanup of the Memphis Depot to the public through Restoration Advisory Board (RAB) meetings, public information sessions, the EnviroNews community newsletter, the Administrative Record file for the site that can be found in the Information Repository, and announcements published in *The Commercial Appeal, Tri-State Defender, Memphis Flyer* and *Silver Star News*. DLA, EPA and TDEC encourage the public to gain a more comprehensive understanding of the site and the remedial investigations and remedial actions that have been conducted to date.

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

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ACRONYMS

AR	Administrative record
ARAR	Applicable or relevant and appropriate requirement
AS	Air Sparging
BCT	BRAC Cleanup Team
BRA	Baseline risk assessment
BRAC	Base Realignment and Closure
CCl_4	Carbon Tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of concern
CVOC	Chlorinated volatile organic compound
DDC	Defense Distribution Center
DCA	Dichloroethane
DCE	Dichloroethene
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
GW	Groundwater
HI	Hazard index
IR	Information repository
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
PCA	Tetrachloroethane
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
POTW	Publicly owned treatment works
Ppb	Parts per billion
ppm	Parts per million
PRB	Permeable reactive barrier
PRG	Preliminary remediation goal
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SS	Surface soil
SVE	Soil vapor extraction
TAC	Tennessee Code Annotated
TCA	Trichloroethane
TCE	Trichloroethene
TDEC	Tennessee Department of Environment and Conservation
VOC	Volatile organic compound
ZVI	Zero-valent iron

GLOSSARY OF TERMS

Terms used in this Revised 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 treat and/or clean up environmental impacts at a CERCLA site. This file is held in the information repository for public review.

Air Sparging: Air sparging involves the injection of air or oxygen through a contaminated aquifer. Injected air removes volatile and semivolatile organic contaminants by volatilization. The injected air helps to flush the contaminants into the unsaturated zone.

Applicable or relevant and appropriate requirements (ARARs): The federal and state environmental laws that a selected remedy must 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 may be present or occurring naturally at similar levels in other areas near the site, and 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 substances 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/domestic wells.

Information Repository: A resource area containing accurate up-to-date information, technical reports, reference documents, and other materials pertinent to the site. The IR 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 environmental conditions over time.

Monitoring: Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action.

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

Organic compounds: Carbon compounds, such as solvents, oils, and pesticides. Most are not readily dissolved in water.

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.

Soil vapor extraction: Soil vapor extraction is used to remediate unsaturated (vadose) zone soil through a vacuum applied to the soil. The vacuum induces a controlled flow of air which removes volatile and some semivolatile organic contaminants.

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 Revised Proposed Plan for the Dunn Field portion of 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 to:

Defense Distribution Center (Memphis)
BRAC Environmental Coordinator
2245 Truitt Street
Memphis, TN 38114

Comments must be postmarked by November 25, 2008.

If you have any questions about the comment period, please contact Stacy Umstead at (717) 770-2880.
Those with electronic communications capabilities may submit their comments via Internet to either of the following e-mail addresses:

michael.dobbs@dla.mil or stacy.umstead@dla.mil.

Name: ______________________________

Address: ______________________________

City: ______________________________

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