Superfund Records Center
SITE: Fort Devens
BREAK: 5.04
OTHER: 200668

SDMS DocID 200668

CONTRACT NO. DAAA15-94-D-0012
Task Order 2

FINAL RECORD OF DECISION FOR THE DEFENSE REUTILIZATION AND MARKETING OFFICE YARD (AOC 32) AND PETROLEUM, OIL, AND LUBRICANTS STORAGE AREA (AOC 43A) DEVENS, MASSACHUSETTS

February 1998

Prepared for:

U.S. ARMY ENVIRONMENTAL CENTER
Restoration, Program Management, & Oversight Division
Aberdeen Proving Ground, Maryland 21010-5401

Prepared by:

Horne Engineering Services, Inc.
2750 Prosperity Avenue, Suite 450
Fairfax, Virginia 22031-4312

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Area of Contamination (AOCs) 32, the Defense Reutilization and Marketing Office (DRMO) Yard and AOC 43A, the Petroleum, Oil, and Lubricants (POL) Storage Area Devens, Massachusetts

STATEMENT OF PURPOSE AND BASIS

This decision document presents the U.S. Army's (Army's) selected remedial actions for AOCs 32 DRMO Yard, including Underground Storage Tank (UST) #13), and 43A (the POL Storage Area) at Devens, MA. It was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended, 42 United States Code (U.S.C.) §9601 *et seq.*, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as amended, 40 Code of Federal Regulations (CFR) Part 300, to the extent practicable. The Devens Base Realignment and Closure (BRAC) Environmental Coordinator; the Installation Commander; and the Director of the Waste Management Division, U.S. Environmental Protection Agency (USEPA) New England have been delegated the authority to approve this Record of Decision (ROD).

This ROD is based on the Administrative Record that has been developed in accordance with Section 113(k) of CERCLA. The Administrative Record is available for public review at the Devens BRAC Environmental Office, Building P-12, Devens, MA, and the Ayer Town Hall, Main Street, Ayer, MA. The Administrative Record Index (appendix A of this ROD) identifies each of the items considered during the selection of the remedial actions.

ASSESSMENT OF THE SITE

Actual or potential releases of hazardous substances from AOCs 32 and 43A, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health and welfare or to the environment.

DESCRIPTION OF THE SELECTED REMEDIES

These remedial actions address long-term site worker exposure to contaminated soil at AOC 32 and potential consumption of groundwater at AOCs 32 (including UST #13) and 43A.

The selected soil remedial alternative for AOC 32 is excavation and off-site disposal. This alternative will remove soils identified as contaminated and reduce the potential risk of future site worker exposure to contaminated soils. The major components of the selected remedy include the following:

- Excavating contaminated soil (1,300 cubic yards) (confirmatory sampling will be conducted prior to backfilling)

- Immediately transporting soils to an off-site, nonhazardous landfill for disposal
- Backfilling the excavated area with clean material and revegetating the area
- Monitoring groundwater on an annual basis and reviewing the site every 5 years for 30 years or until contamination is reduced to acceptable concentrations

The selected groundwater remedial alternative for AOCs 32 and 43A includes institutional controls, intrinsic remediation, groundwater flow and contaminant transport modeling, and long-term groundwater monitoring to evaluate the effectiveness of the alternative at mitigating groundwater contamination and site risk. This ROD will use the more descriptive name "monitored natural attenuation" in place of "intrinsic remediation." This usage is consistent with current USEPA guidance. The remedy will mitigate existing groundwater contamination through use of restrictions, natural attenuation, and bioremediation, thereby reducing the potential risk that future site workers will be exposed to contaminated groundwater. Monitored natural attenuation is the combination of physical, chemical, and biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater in a reasonable time frame. These insitu processes include biodegradation, dispersion, dilution, adsorption, volatilization, and biological and chemical stabilization or destruction of contaminants. The major components of the selected remedy include the following:

- Establishing institutional controls
- Installing additional groundwater monitoring wells
- Providing for monitored natural attenuation
- Collecting data on monitored natural attenuation, assessing the data, and performing groundwater modeling
- Performing long-term groundwater monitoring on an annual basis
- Reviewing the site every 5 years for 30 years or until contamination is reduced to acceptable concentrations
- Providing annual data reports to USEPA and the Massachusetts Department of Environmental Protection (MADEP)

If the monitored natural attenuation assessment results at AOC 32 and 43A indicate that the groundwater contaminant plume can not be remediated within 30 years, an additional clean-up action will be evaluated and implemented as appropriate for each AOC. If at any time during the monitored natural attenuation there is an indication that the contaminants are migrating into the currently established Zone II boundary or an area located sufficiently inside the boundary in which compliance will be determined, according to clean-up criteria stated in the Record of Decision, that a minimum will meet drinking water standards; then the Army will implement an additional remedial action which will be protective of human health and the environment.

STATE CONCURRENCE

The Commonwealth of Massachusetts has concurred with the selected remedy. Appendix B of this ROD contains a copy of the declaration of concurrence.

DECLARATION

The selected remedies are consistent with CERCLA, and to the extent practicable, the NCP; protective of human health and of the environment; in compliance with Federal and Commonwealth requirements that are legally applicable or relevant and appropriate to the remedial action; and cost-effective. The remedies use permanent solutions and alternative treatment technologies to the maximum extent practicable for both AOCs 32 and 43A.

Because the selected remedies for both AOCs 32 and 43A may result in hazardous substances remaining on-site in soil and groundwater above certain health-based exposure levels, a review will be conducted within 5 years of commencing the remedial action to ensure that the remedy at each AOC continues to provide adequate protection of human health and the environment.

The foregoing represents the selection of a remedial action by the U.S. Department of the Army and the U.S. Environmental Protection Agency, with the concurrence of the Commonwealth of Massachusetts Department of Environmental Protection.

Concur and recommend for immediate implementation:

U.S. DEPARTMENT OF THE ARMY

James C Chambers

JAMES C. CHAMBERS
Environmental Coordinator
Devens Reserve Forces Training Area

28 JAN 98
Date

This page intentionally left blank.

The foregoing represents the selection of a remedial action by the U.S. Department of the Army and the U.S. Environmental Protection Agency, with the concurrence of the Commonwealth of Massachusetts Department of Environmental Protection.

Concur and recommend for immediate implementation:

U.S. DEPARTMENT OF THE ARMY

Edward R. Murdough
Lieutenant Colonel, U.S. Army
Installation Commander

28 Jan 98
Date

This page intentionally left blank.

The foregoing represents the selection of a remedial action by the U.S. Department of the Army and the U.S. Environmental Protection Agency, with the concurrence of the Commonwealth of Massachusetts Department of Environmental Protection.

Concur and recommend for immediate implementation:

U.S. ENVIRONMENTAL PROTECTION AGENCY

Frank Cianciulli — 2-18-98

for Harley F. Laing
Director, Office of Site Remediation and restoration
U.S. Environmental Protection Agency, New England

Date

This page intentionally left blank.

TABLE OF CONTENTS

DECLARATION FOR THE RECORD OF DECISION I
TABLE OF CONTENTS ix
LIST OF ACRONYMS AND ABBREVIATIONS xiv
UNITS OF MEASURE xv
DECISION SUMMARY 1
I. SITE NAME, LOCATION, AND DESCRIPTION 1
II. SITE HISTORY AND ENFORCEMENT ACTIVITIES 1
A. Land Use and Response History 1
1. DRMO Yard (Area of Contamination 32) 1
2. POL Storage Area (Area of Contamination 43A) 2
B. Enforcement History 2
III. COMMUNITY PARTICIPATION 3
IV. SCOPE AND ROLE OF THE RESPONSE ACTION 4
V. SUMMARY OF SITE CHARACTERISTICS 5
A. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and UST #13 5
B. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Area 6
1. Soils 7
a. Area of Contamination 32 — Defense Reutilization and Marketing Office Yard and UST #13 7
b. Area of Contamination 43A — Petroleum, Oils, and Lubricants Storage Area 8
2. Groundwater 9
a. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and UST #13 9
b. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Areal 1
3. Asphalt (Area of Contamination 32 only) 12
4. Surface Water (Area of Contamination 32 only) 13
5. Sediment 13
a. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard 13
b. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Areal 3
6. Air (Area of Contamination 32 only) 14
VI. SUMMARY OF SITE RISKS 14
A. Human Health Risk Assessment 14
1. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and UST #13 15
a. Surface Soil and Asphalt 15
b. Groundwater 16
2. Area of Contamination 43A — Petroleum, Oils, and Lubricants Storage Area 17
a. Surface Soil 17
b. Groundwater 17

B. Ecological Risk Assessment 18
1. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard 19
2. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Area . 19
VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES 19
A. Statutory Requirements/Response Objectives 19
B. Technology and Alternative Development and Screening 20
1. Area of Contamination 32 — Defense Reutilization and Marketing Office Yard Soils Operable Unit 21
2. Area of Contamination 32 — UST #13 Groundwater Operable Unit 22
3. Area of Contamination 32 and 43A — The Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit 22
VIII. DESCRIPTION OF ALTERNATIVES 22
A. Defense Reutilization and Marketing Office Yard Soils Operable Unit (Area of Contamination 32) 22
1. Alternative A1: No Further Action 22
2. Alternative A2: Institutional Action 23
3. Alternative A3: Containment via Capping 23
4. Alternative A4: Excavation, Solidification, and On-Site Disposal 24
5. Alternative A6: Excavation and Off-Site Disposal 25
B. UST #13 Groundwater Operable Unit (Area of Contamination 32) 25
1. Alternative B1: No Further Action 25
2. Alternative B2: Institutional Actions 26
3. Alternative B3: Monitored natural attenuation 26
C. Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit (Area of Contamination 32 and 43A) 27
1. Alternative C1: No Further Action 27
2. Alternative C2: Institutional Action 27
3. Alternative C3: Monitored natural attenuation 28
IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES 28
A. Defense Reutilization and Marketing Office Yard Soils Operable Unit (Area of Contamination 32) 30
1. Overall Protection of Human Health and the Environment 30
2. Compliance with Applicable or Relevant and Appropriate Requirements 30
3. Long-Term Effectiveness and Permanence 30
4. Reduction of Toxicity, Mobility, and Volume through Treatment 31
5. Short-Term Effectiveness 31
6. Implementability 31
7. Cost 32
8. State Acceptance 32
9. Community Acceptance 32
B. UST #13 Groundwater Operable Unit (Area of Contamination 32) 32
1. Overall Protection of Human Health and the Environment 32

2. Compliance with Applicable or Relevant and Appropriate Requirements 33
3. Long-Term Effectiveness and Permanence 33
4. Reduction of Toxicity, Mobility, and Volume through Treatment 33
5. Short-Term Effectiveness 34
6. Implementability 34
7. Cost 34
8. State Acceptance 34
9. Community Acceptance 34
C. Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit (Area of Contamination 32 and 43A) 35
1. Overall Protection of Human Health and the Environment 35
2. Compliance with Applicable or Relevant and Appropriate Requirements 35
3. Long-Term Effectiveness and Permanence 35
4. Reduction of Toxicity, Mobility, and Volume through Treatment 36
5. Short-Term Effectiveness 36
6. Implementability 36
7. Cost 36
8. State Acceptance 37
9. Community Acceptance 37
X. THE SELECTED REMEDY 37
A. Surface Soil Cleanup Levels (Defense Reutilization and Marketing Office Soils Operable Unit — Area of Contamination 32) 37
B. Groundwater Cleanup Levels 38
1. UST #13 Groundwater Operable Unit (Area of Contamination 32) 38
2. Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit (Area of Contamination 32 and 43A) 39
C. Description of Remedial Components 39
1. Defense Reutilization and Marketing Office Yard Soils Operable Unit (Area of Contamination 32) 39
2. UST #13 Groundwater Operable Unit (Area of Contamination 32) 41
3. Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit (Area of Contamination 32 and 43A) 44
XI. STATUTORY DETERMINATIONS 46
A. The Selected Remedy is Protective of Human Health and the Environment 46
B. The Selected Remedy Attains Applicable or Relevant and Appropriate Requirements .. 47
C. The Selected Remedy is Cost-Effective 47
D. The Selected Remedy Uses Permanent Solutions and Alternative Treatment and Resource Recovery Technologies to the Maximum Extent Practical 48
1. Defense Reutilization and Marketing Office Yard Soils Operable Unit (Area of Contamination 32) 48
2. UST #13 Groundwater Operable Unit (Area of Contamination 32) 49
3. Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit (Area of Contamination 32 and 43A) 49

XII. Documentation of No Significant Changes 49
XIII. STATE ROLE 50

Appendix A — Administrative Record Index
Appendix B — Declaration of State Concurrence
Appendix C — Figures
Appendix D — Responsiveness Summary
Appendix E — Tables

FIGURES

Figure 1 — Location of Devens in Massachusetts
Figure 2 — Location of Functional Area II Sites
Figure 3 — Approximate Boundaries of AOC 32 and AOC 43A
Figure 4 — Contamination in Surface Soils and Asphalt at AOC 32
Figure 5 — Location of Surface Soil Sampled at AOC 43A
Figure 6 — Distribution of TPHC Concentrations in Soil by Depth in Boreholes as Derived from Field Screening at AOC 43A
Figure 7 — DRMO Yard Soils Operable Unit
Figure 8 — DRMO Yard and POL Storage Area Groundwater Operable Units

TABLES

Table 1 — Chemical Summary Report for Surficial Soil, AOC 32
Table 2 — Chemical Summary Report for Subsurface Soil, AOC 32
Table 3 — Chemical Summary Report for Subsurface Soils, AOC 32 (Waste Oil Tank Area)
Table 4 — Chemical Summary Report Surficial Soils, AOC 43A
Table 5 — Chemical Summary Report Subsurface Soils, AOC 43A
Table 6 — Chemical Summary Report for Organics and Water Quality Parameters in Groundwater, AOC 32
Table 7 — Chemical Summary Report for Metals in Groundwater, AOC 32
Table 8 — Chemical Summary Report for Organics and Water Quality Parameters in Groundwater, AOC 43A
Table 9 — Chemical Summary Report for Metals in Groundwater, AOC 43A
Table 10 — Chemical Summary Report for Asphalt Cores, AOC 32
Table 11 — Chemical Summary Report for Surface Water, AOC 32
Table 12 — Chemical Summary Report for Sediments, AOC 32
Table 13 — Chemical Summary Report for Air Sampling Results for Metals and PM_{10}, AOC 32
Table 14 — Chemical Summary Report for Air Sampling Results for PCBs/Pesticides, AOC 32
Table 15 — Summary of Estimated Excess Cancer Risks Associated with AOC 32
Table 16 — Summary of Estimated Hazard Indices for Noncarcinogenic Effects Associated with AOC 32
Table 17 — Summary of Estimated Excess Cancer Risks Associated with AOC 43A
Table 18 — Summary of Estimated Hazard Indices for Noncarcinogenic Effects Associated with AOC 43A
Table 19 — Chemical of Potential Concern, AOC 32 — DRMO Yard
Table 20 — Chemicals of Potential Concern, AOC 43A — POL Storage Area
Table 21 — Main Post Soil Cleanup Goal Determination
Table 22 — Main Post Groundwater Cleanup Goal Determination
Table 23 — Natural Attenuation Assessment Sampling Parameters, AOCs 32 and 43A
Table 24 — Synopsis of Federal and State ARARs for Monitored Natural Attenuation
Table 25 — Synopsis of Federal and State ARARs for Excavation and Off-site Disposal

LIST OF ACRONYMS AND ABBREVIATIONS

α-BHC	alpha-Benzene hexachloride (alpha-lindane)
AOC	Area of Contamination
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
BGS	below ground surface
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	chemical of potential concern
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DNB	dinitrobenzene
DRMO	Defense Reutilization and Marketing Office
EBS	Environmental Baseline Survey
E&E	Ecology and Environment, Inc.
EPH	extractable petroleum hydrocarbons
FS	feasibility study
HA	health advisory
HI	hazard index
IAG	Interagency Agreement
IRP	Installation Restoration Program
MADEP	Massachusetts Department of Environmental Protection
MCL	maximum contaminant level
MMCL	Massachusetts maximum contaminant level
MEP	Master Environmental Plan
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NPL	National Priorities List
O&M	operation and maintenance
ORSG	Office of Research and Standards Guidance
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PM_{10}	particulate matter less than 10 microns (μ) in size
POL	petroleum, oil, and lubricants
PPE	personal protection equipment
PRE	preliminary risk evaluation
QA/QC	quality assurance/quality control
RAB	Restoration Advisory Board

RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SA	study area
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SF	slope factor
SI	site investigation
TAL	target analyte list
TBC	to be considered
TCE	trichloroethene
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
TNB	trinitrobenzene
TPHC	total petroleum hydrocarbons
TRC	Technical Review Committee
TSCA	Toxic Substances Control Act
USAEC	United States Army Environmental Center
U.S.C.	U.S. Code
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons

UNITS OF MEASURE

μ	microns
μg/g	microgram(s)/gram
μg/L	microgram(s)/liter
mg/kg	milligram(s)/kilogram
ppm	part(s) per million

This page intentionally left blank.

DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

Devens is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, National Priorities List (NPL) site located in the towns of Ayer and Shirley (Middlesex County) and Harvard and Lancaster (Worcester County), approximately 35 miles northwest of Boston, MA (figure 1, appendix C). Prior to closure, the Fort Devens installation occupied approximately 9,600 acres and was divided into the North Post, Main Post, and South Post.

This Record of Decision (ROD) addresses soil contamination in Area of Contamination (AOC) 32 (the Defense Reutilization and Marketing Office (DRMO) Yard) and groundwater contamination in AOC 32 and 43A (the Petroleum, Oil, and Lubricants (POL) Storage Area). AOC 32 is located in Functional Area II, which is in the northeast corner of the Main Post at Fort Devens. AOC 43A is located just to the south of AOC 32, across Market Street (figure 2, appendix C).

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Land Use and Response History

Devens was established in 1917 as Camp Devens, a temporary training camp for soldiers from the New England area. In 1931 the camp became a permanent installation and was redesignated as Fort Devens. Throughout its history, Fort Devens served as a training and induction center for military personnel and as a unit mobilization and demobilization site. Some or all of these functions were conducted during World Wars I and II, the Korean and Vietnam conflicts, and Operations Desert Shield and Desert Storm. During World War II, more than 614,000 inductees were processed, and Fort Devens reached a peak population of 65,000.

The primary mission of Fort Devens was to command, train, and provide logistical support for nondivisional troop units. Fort Devens was selected for cessation of operations and closure under the Defense Base Realignment and Closure (BRAC) Act of 1990 (Public Law 101-510). The installation was officially closed in 1996, and the site was renamed Devens, MA. Devens presently supports the Army Readiness Region and National Guard units in the New England area.

1. Defense Reutilization and Marketing Office Yard (Area of Contamination 32)

AOC 32, the DRMO Yard, consists of three fenced areas (figure 3, appendix C). The DRMO Yard on the west side of Cook Street (West Yard) contained used equipment, including lead-acid batteries, telecommunications equipment, and administrative equipment. The yard on the east side of Cook Street (East Yard) was used for disassembling vehicles for reusable parts and previously contained scrap metal, tires, stored items ready for sale, and used photographic

solutions. The only unpaved, fenced area is located just north of the East Yard and was used to store and recycle tires.

A former underground storage tank (UST) site (UST #13) has been incorporated into AOC 32. This UST was used to store waste oil and was located just northeast of Building T-204. UST #13 and the remainder of AOC 32 are in separate groundwater regimes.

2. Petroleum, Oils, and Lubricants Storage Area (Area of Contamination 43A)

The POL Storage Area is located across Market Street from AOC 32 and served as the central distribution point for all gasoline and other fuels at Fort Devens from the 1940s to the present. AOC 43A consists of a fenced lot located within a developed industrial area (figure 3, appendix C).

A more complete description of AOCs 32 and 43A can be found in the *Remedial Investigation (RI) Reports for Functional Area II,* prepared by Ecology and Environment, Inc. (E&E) (August 1994), section 1.2, and the feasibility study (FS) report (January 1997), subsection 1.2.

B. Enforcement History

In conjunction with the Army's Installation Restoration Program (IRP), Fort Devens and the U.S. Army Environmental Center (USAEC) initiated a Master Environmental Plan (MEP) in 1988. The MEP assessed the environmental status of study areas (SAs), discussed necessary investigations, and recommended potential responses to environmental contamination. Priorities for environmental restoration at Fort Devens were also assigned. The MEP identified 18 historic gas station sites (SA 43B through 43S) and the then-active POL storage area (SA 43A) as some of the potential sources of groundwater contamination and recommended that each SA be investigated to determine the distribution of contamination.

On December 21, 1989, Fort Devens was placed on the NPL under CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA). The Army and U.S. Environmental Protection Agency (USEPA) New England developed and signed a Federal Facilities Agreement (Interagency Agreement (IAG)) on May 13, 1991. It was finalized on November 15, 1991. The IAG provides the framework for implementing the CERCLA/SARA process at Devens.

In 1991, the Army, through the USAEC, initiated site investigations (SIs) at AOC 32. The final SI report was issued in December 1992. The SI reported contamination exceeding screening levels for soil, water, and sediment in the storm drains and in the groundwater at AOC 32.

An SI was conducted in 1992 on the POL and the historic gas station SAs at Fort Devens. The results are presented in the 1993 SI report. Field screening followed by confirmation sampling

showed a low level of xylene and elevated petroleum hydrocarbons in subsurface soils at AOC 43A.

The objectives of the RI were to determine the nature and distribution of contamination at the AOCs, assess the risk to human health, and provide a basis for conducting feasibility studies. The final RI report was issued in 1994.

The FS report that evaluated remedial action alternatives for cleanup at AOCs 32 and 43A was issued in January 1997. The FS report identified and screened seven remedial alternatives at AOC 32 Soils Operable Unit, six remedial alternatives for AOC 32 (UST #13) Groundwater Operable Unit, and three remedial alternatives at POL Storage Area/DRMO Yard Groundwater Operable Unit (AOC 43A and 32). The FS also provided a detailed analysis of each of these remedial alternatives to allow decision makers to select a remedy for soil cleanup at AOC 32 and groundwater cleanup at POL Storage Area/DRMO Yard and UST #13.

The proposed plan detailing the Army's preferred remedial alternative was issued on July 18, 1997, for public comment. Technical comments presented during the public comment period are included in the Administrative Record. Appendix D, the Responsiveness Summary, contains a summary of these comments and the Army's responses and describes how these comments affected the remedy selection.

III. COMMUNITY PARTICIPATION

The Army has held regular and frequent informational meetings, issued a proposed plan and press releases, and held public meetings to keep the community and other interested parties informed of activities at AOCs 32 and 43A.

In February 1992, following public review, the Army released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities at Devens. As part of this plan, the Army established a Technical Review Committee (TRC) in early 1992. The TRC, as required by SARA section 211 and Army Regulation 200-1, included representatives from USEPA, USAEC, Devens, Massachusetts Department of Environmental Protection (MADEP), local officials, and the community. Until January 1994, when it was replaced by the Restoration Advisory Board (RAB), the TRC generally met quarterly to review and provide technical comment on schedules, work plans, work products, and proposed activities for the SAs/AOCs at Devens. The SI, RI, and FS reports; proposed plan; and other related support documents were all submitted to the TRC or RAB for their review and comment.

When an installation closure involves transfering property to the community, the Army, as part of its commitment to involve the affected communities, forms a RAB. The Devens RAB was formed in February 1994. The RAB consists of 28 members (15 original TRC members plus 13

new members) who are representatives from the Army, USEPA New England, MADEP, local governments, and citizens of the local communities. The RAB meets monthly and provides advice to the installation and regulatory agencies on Devens cleanup programs. Specific responsibilities include addressing cleanup issues such as land use and cleanup goals, reviewing plans and documents, identifying proposed requirements and priorities, and conducting regular meetings that are open to the public.

On June 18, 1997, the Army issued the proposed plan to citizens and organizations to provide the public with a brief explanation of the Army's preferred remedy for cleanup at both AOC 32 and 43A. The proposed plan also described the opportunities for public participation and provided details on the upcoming public comment period and public meetings.

A public notice announcing the public meeting was published the week of June 18, 1997, in the *Times Free Press/Public Spirit*, the *Lowell Sun*, *Fitchburg-Leominster Centennial and Enterprise*, and the *Worcester Telegram*. The Army also made the proposed plan available to the public at the information repositories at the town libraries in Ayer, Shirley, Lancaster, and Harvard and in the Devens BRAC Environmental Office.

From June 18, 1997, to July 18, 1997, the Army held a 30-day public comment period to accept public comments on the alternatives presented in the FS and the proposed plan, as well as other documents released to the public. On July 17, 1997, the Army held a public meeting at Devens to present the Army's proposed plan to the public, accept verbal or written comments from the public, and discuss the cleanup alternatives evaluated in the FS. This meeting also provided the opportunity for open discussion concerning the proposed cleanup. A transcript of this meeting, public comments, and the Army's response to comments are included in the attached Responsiveness Summary (appendix D).

All supporting documentation for the decision regarding AOCs 32 and 43A is contained in the Administrative Record. The Administrative Record is a collection of all the documents the Army considered in choosing the remedy for both AOCs 32 and 43A. The Army has made the Administrative Record available for public review at the Devens BRAC Environmental Office and at the Ayer Town Hall, Ayer, MA. An index to the Administrative Record is available at the USEPA Records Center, 90 Canal Street, Boston, MA and is provided as appendix A.

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

The Army developed the selected remedies by combining components of different source control and migration management alternatives. The selected remedies for AOCs 32 and 43A will remove contaminated soil and control the migration of contaminants in groundwater, reduce contaminant concentrations, and control potential groundwater use. The selected remedies will also provide environmental monitoring of groundwater for a period of up to 30 years.

Implementing the selected alternatives will not adversely affect any future response actions at AOCs 32 and 43A, should they be required.

These remedial actions will address the principal threats to human health at AOCs 32 and 43A posed by long-term site worker exposure to contaminated soils and groundwater.

V. SUMMARY OF SITE CHARACTERISTICS

A. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and Underground Storage Tank #13

AOC 32, the DRMO Yard, is located in the northeast corner of the Main Post at Devens (figure 2, appendix C). This site is bordered on the north by the recently capped Shepley's Hill Landfill. To the south across Market Street is the POL Storage Area (AOC 43A) and the remainder of the Main Post, which consists of buildings, roads, and mowed grass lots. The DRMO was used as a materials storage facility. Operational records indicate that the facility was active from at least 1964 to 1995. The nature of materials that were processed and the activities conducted in this yard varied significantly.

AOC 32 consists of three fenced areas incorporating approximately 280,000 square feet (figure 3, appendix C). The DRMO yard on the west side of Cook Street (West Yard) contained used equipment, including lead-acid batteries, telecommunications equipment, and administrative equipment. The yard on the east side of Cook Street (East Yard) was used for disassembling vehicles for reusable parts and previously contained scrap metal, tires, stored items ready for sale, and used photographic solutions. The only unpaved fenced area is located just north of the East Yard and was used to store and recycle tires. The enclosure for the two paved sections of the DRMO Yard and the tire storage area consists of a 6-foot tall chain-link fence, topped with barbed wire.

Because vehicle scrap was found in the East Yard, a radiation survey was performed. Twelve "hot spots" were found. All were located in the north end of the East Yard and all were remediated in 1996 by removing radium-contaminated soil or radium dials.

A pit is located in the East Yard that was reported to be part of the remediation of a polychlorinated biphenyl (PCB)-contaminated rectifier oil spill in 1990. Approximately 600 gallons of liquid from the remaining electrical units and 40 cubic yards of potentially contaminated asphalt and soil were removed from the site. The oil was analyzed and found to not contain PCBs (minimum detection level of 21 parts per million (ppm)). The removed material was, therefore, handled as oil-contaminated waste.

A former UST site (UST #13) was incorporated into AOC 32. This UST, which was removed in 1992, was used to store waste oil and was located just northeast of Building T-204. Three

trenches were excavated around the former UST site during the RI in an attempt to characterize any hydrocarbon plume that may have migrated from the former tank. Two of the three trenches were found to be clean based on field screening for organic vapors. The third trench was extended to a drainfield, where approximately 2 cubic yards of petroleum-contaminated soil were encountered. The source of the contamination was found to be waste debris that included oil filters. UST #13 is located in a separate groundwater regime from the DRMO Yard.

B. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Area

AOC 43A, the POL Storage Area, is located across Market Street from AOC 32 and is bounded on the south, west, and north by Antietam Street, Cook Street, and Market Street. It is located in the northeast corner of the Main Post, adjacent to Shepley's Hill Landfill.

The POL Storage Area served as the central distribution point for all gasoline stations at Fort Devens during the 1940s and 1950s. It was subsequently used to store fuels for various purposes. The distribution facility formerly consisted of a main gasoline station building (T-401) (figure 3, appendix C), a pump house, four 12,000-gallon USTs, one 10,000-gallon UST, two 12,000-gallon aboveground storage tanks (ASTs), and two 8,000-gallon ASTs. Gasoline was delivered to the facility by rail car and transferred to the tanks.

Between 1965 and 1972, four ASTs located in a pit behind T-401 were removed. In 1989 and 1990, five USTs located near the pump house were excavated at the site. All five tanks were listed as storage tanks for fuel oil. In 1989 and 1990, three USTs and 800 cubic yards of soil beneath the pump house were excavated. The excavated soil was analyzed for total petroleum hydrocarbons (TPHCs). The highest TPHC concentration was 237 milligrams per kilogram (mg/Kg). In 1991, five new USTs were installed in the POL Storage Area and were used to store fuel for military vehicles.

The POL Storage Area consists of a fenced lot located within a developed industrial area of buildings, roads, and grass lots, with the exception of the east side of the site, which is bounded by a wooded area on a rock outcrop. A set of railroad tracks, formerly used to transport fuels to the site, forms the site's northern boundary. The UST area is fenced. An asphalt driveway leads into the POL Storage Area from Antietam Street. The driveway is bermed to contain any spills. A pump station is located in the center of the fenced area and the new USTs are located on the eastern side.

Section 1 of the AOCs 32 and 43A FS report contains an overview of the RI completed for each AOC. A complete discussion of site characteristics can be found in sections 5, 6, and 7 of the RI report (E&E 1994). Significant findings of the RI are summarized in the following subsections of this ROD.

1. Soils

a. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and Underground Storage Tank #13

Twenty surface soil samples were collected from AOC 32 and the surrounding area. Surface soil sampling locations are shown in figure 4, appendix C. The samples were analyzed for target analyte list (TAL) metals, target compound list (TCL) pesticides/PCBs, and TPHC. Petroleum hydrocarbons, heavy metals, PCBs, and pesticides were detected in soils surrounding AOC 32. The RI report identified cadmium, lead, and beryllium as exceeding various standards. Except for two samples showing dichlorodiphenyltrichloroethane (DDT), the pesticide levels were below screening values. Since DDT was detected mainly in areas near roads and buildings, its presence may or may not be site related. The elevated TPHC, metals, and PCBs were primarily located around the East Yard and the Tire Recycling Yard. PCBs were detected in site soils at concentrations in excess of State standards. These locations were all possible drainage points for the asphalt-covered East Yard. Results of the chemical analysis are summarized in table 1, appendix E. It appears that the contaminated soil is caused by site drainage, perhaps from oil laden with heavy metals and PCBs. The northeast portion of the East Yard is also the area where suspected PCB oils were spilled from stored rectifiers.

Fifteen boreholes were advanced in October 1992. The boreholes were located in the West Yard, Tire Storage Area, and East Yard (figure 4, appendix C). The boreholes were generally sampled at depths of 1, 5, and 10 feet, except for one sample that was collected at the surface because the location was unpaved. The subsoil samples were analyzed for TAL metals, TCL pesticides/PCBs, and TPHC. The analytical results are summarized in table 2, appendix E. Lead concentrations exceeded the screening value for subsurface soil at the 1-foot depth in two boreholes. Arsenic exceeded the screening value at the 5-foot depth in one borehole and at the 10-foot depth in another borehole. No organic compounds exceeded screening values for subsurface soils in the DRMO Yard.

In general, no significant contamination appeared in the subsurface soils at the DRMO Yard, with the exception of one borehole. That borehole had elevated metals, pesticides, and TPHC concentrations at the 1-foot depth. Elevated levels of PCBs could be due to the boring's location, adjacent to the area where it is suspected that PCB-laden oil was spilled onto the soil. The TPHC and metals concentrations are probably the cumulative result of very localized incidents at the DRMO Yard.

On October 29, 1992, three test trenches were excavated around the former UST #13 excavation. The trenches were located on the east (T-shaped), north, and south sides (T-shaped) of the former UST location. The samples were analyzed for TAL metals, TCL pesticides/PCBs, TCL volatile organic compounds (VOCs), and TPHC. The analytical results are summarized in table 3, appendix E. The east trench showed elevated TPHC and lead concentrations that could be associated with debris (e.g., oil filters, cans, glass bottles) and a former leachfield encountered

during the excavation and was not apparently associated with the former UST. During the RI, three test pits were sampled around the former UST site. Arsenic exceeded its screening value in one pit. Lead exceeded its screening value in a second pit, which also exhibited TPHC.

b. Area of Contamination 43A — The Petroleum, Oil, and Lubricants Storage Area

Ten surface soil samples were collected from the POL storage area and analyzed for TAL metals, polynuclear aromatic hydrocarbons (PAHs), pesticides/PCBs, and TPHC. Sampling locations are shown in figure 5, appendix C. Several metals concentrations in surface soils exceeded background: arsenic, calcium, cobalt, copper, lead, nickel, sodium, and zinc. Arsenic exceeded the screening level in one sample. Organic compounds detected in surface soils included DDT, dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyldichloroethane (DDD), alpha-benzene hexachloride (α-BHC), nine PAH compounds, and heptadecane. Five PAH compounds exceeded screening values in one sample. The levels of TPHC are very low considering their location within a POL storage area. Results of the chemical analysis are summarized in table 4, appendix E.

One hundred eighty-three subsurface soil samples were collected from boreholes during field activities at the POL Storage Area. The samples were collected at intervals of 5 feet above the water table, at the water table, and 5 feet below the water table. Fifteen of the subsurface samples were collected and analyzed for TCL VOCs, TCL PAHs, TCL pesticide/PCBs, TAL metals, and TPHC. Most of the samples underwent field screening analysis for benzene, toluene, ethylbenzene, and xylene (BTEX) and TPHC.

None of the 18 samples collected from six additional confirmation boreholes had metal concentrations above screening values. Three of the 18 samples contained arsenic concentrations slightly above the screening value for soils. Subsurface soils showed relatively high TPHC concentrations in two boreholes. One sample (21,000 micrograms per gram (μg/g)) exceeded the screening value. No organics or pesticides exceeded screening values for subsurface soil. The results of the chemical analysis are summarized in table 5, appendix E.

Two onsite hydrocarbon plumes and one small offsite plume were detected in the subsurface soils by field screening. The easternmost plume, which is approximately 120 feet long and 100 feet wide, originates close to the site of the removed USTs, inside the fenced area. A second plume (120 feet long by 90 feet wide), defined from field screening, originates on the western side of the POL Storage Area, close to the former ASTs site . The third plume originates north of Building T-247, which is across Antietam Street from AOC 43A. All three plumes are presented in figure 6, appendix C.

The highest TPHC concentrations (30,000 mg/kg at 25 to 27 feet below ground surface (BGS)) in subsurface soils were measured in the easternmost plume. No BTEX compounds were detected during the soil screening within the boundaries of the easternmost plume. The elevated

TPHC concentrations were verified by two confirmation borehole samples. Apparently the contaminants migrated vertically through the vadose zone before reaching the top of bedrock or the silty material just above the bedrock, then spread laterally to the southeast and northwest. The source of the plume appears to be subsurface related.

Concentrations of TPHC were much lower in the westernmost plume. BTEX compounds were detected in three boreholes. Apparently the product migrated vertically through the vadose zone before dissolving in groundwater and spreading laterally to the southwest without leaving any residual contamination in the soil, suggesting that the material forming the plume was more mobile, volatile, and biodegradable. The source of the plume appears to be surface related.

The third plume is north of the lawnmower maintenance building across Antietam Street from AOC 43A. Screening concentrations of TPHC were very low in the third plume, but BTEX compounds were detected as high as 4,700 mg/kg. This plume may have been identified due to a high "background." Since the occurrence of high background levels cannot be definitely asserted, the data were reported. Confirmation samples from two additional soil borings had relatively low TPHC concentrations and did not contain detectable BTEX compounds.

TPHC were also detected in several boreholes unrelated to the aforementioned plumes. A TPHC concentration of 100 μg/g was found in 43SA93-44S, which was located in front of Building 213. Three soil borings in the parking lot across Antietam Street from AOC 43A had TPHC levels ranging from 56 μg/g to 180 μg/g. Since TPHC levels were not detected in the two confirmation boreholes between these borings, the results suggest variability in the screening analysis or in the distribution of the contaminant.

2. Groundwater

a. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and Underground Storage Tank #13

Groundwater samples were collected in November 1992 and March and June 1993. The first two rounds of samples were analyzed for TCL organics, TAL metals, TPHC, and hardness. A few samples were also analyzed for dissolved TAL metals. The results of the chemical analysis are summarized in tables 6 and 7, appendix E. The third round of samples was analyzed for total and dissolved TAL metals, explosives, and hardness. Due to the silt and clay content of the groundwater from all wells, the metals concentrations in the unfiltered samples exceeded screening values. To distinguish between total and dissolved metals in the groundwater, additional samples were collected and filtered through 0.45-micron (μ) glass filters. Toxic heavy metals concentrations of arsenic, cadmium, chromium, and copper often correlated with aluminum and iron concentrations, suggesting that the heavy metals could be present in suspended material or could be sorbed onto aluminum or iron oxides.

The unfiltered metals results exceeded screening values for aluminum, iron, and manganese, indicating that concentrations of other metals associated with particulates would also be elevated. Other unfiltered metals that exceeded USEPA maximum contaminant levels (MCLs) were arsenic, beryllium, chromium, lead, sodium, and nickel. Filtered samples exceeded the MCLs for aluminum, manganese, sodium, and iron. Elevated sodium is attributed to the proximity of the well to an area that carries runoff containing road salt. Manganese concentrations were as high or higher in filtered samples as they were in unfiltered samples from the same well. High levels of soluble manganese appear to occur naturally in the groundwater at this site. Apart from an elevated dissolved manganese concentration, which appears to be a natural condition, there is no convincing evidence that AOC 32 has any dissolved metals concentrations above screening values attributable to DRMO activities.

The upgradient well contained several organic compounds. Bis(2-ethlhexyl)phthalate exceeded the screening value in only one round of analysis. The other down-gradient wells contained one or more of eight detected organic compounds, including 6-aminohexanoic acid lactum, dodecanoic acid, di-n-butylphthalate, 1,2-dichloroethane, acetone, toluene, chloroform, and trichloroethene (TCE). TCE was the only chemical that exceeded its screening value. It exceeded its screening value in only one well, POL-3, which is immediately downgradient of the DRMO Yard. Wells further downgradient of the site in the POL Storage Area do not have detectable levels of TCE.

The groundwater quality and flow in the area of the former UST (UST #13) were defined by three wells adjacent to the excavation area and two additional wells. These five wells are located east of the groundwater divide in a separate groundwater flow system from the other DRMO Yard wells. Inorganics in the groundwater showed the same characteristics as those in the DRMO Yard wells. Unfiltered samples were typically high in aluminum, iron, and manganese and exceeded MCL values for lead and arsenic. Only one well exceeded screening values (arsenic and manganese) in filtered samples. It appears that both arsenic and manganese could reflect residual impacts from the former UST, but these impacts do not appear to extend off-site.

The two wells closest to the UST excavation greatly exceeded screening values for TPHC. They also showed a wide range of organics (13 in one well and 10 in the second well), dominated by dichlorobenzenes, that exceeded screening values. TCE exceeded screening values in 32M-92-06X. A significant decline in organic concentrations was noted during subsequent groundwater analyses, except for TPHC concentrations, which were consistent. Based on existing data, only the two wells closest to the excavation exceeded MCLs. Both wells have multiple exceedences. The groundwater regime in the area is complex and difficult to predict. The detailed directions of groundwater flow and the possible contamination migration routes cannot be identified with any certainty. Oil that contained chlorinated aromatics was apparently spilled on the surface. Analytical results from the UST and oil-soaked overburden removals and excavation trench confirm that no contaminant source associated with the UST activity remains at the former UST site except within fractures in the bedrock. The existing information strongly implies that groundwater contamination is not migrating from the spill location.

b. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Area

Five rounds of groundwater samples were collected and analyzed for both total and dissolved TAL metals, TCL VOCs, pesticides/PCBs, PAHs, explosives, and TPHC. The results of the chemical analyses are summarized in tables 8 and 9, appendix E. The initial screening of the borings demonstrated no exceedances of the BTEX screening levels. TPHC screening values were exceeded in the eastern plume only at 43MA-93-04X.

Filtered and unfiltered metals analyses were conducted on all water samples collected from the newly installed monitoring wells. Silt and clay particles in the samples often resulted in metals levels in unfiltered samples that exceeded MCLs. To determine the level of dissolved metals, the samples were filtered. Low solubility metals (aluminum and iron) were reduced, while the soluble metals (sodium and calcium) were not significantly affected.

All of the wells exceeded screening values for aluminum, iron, manganese, and sodium in unfiltered samples. The wells with the highest aluminum and iron concentrations also had the highest concentrations of other metals, indicating a relationship between the presence of particulates and the content of metals in groundwater.

Filtered samples from these wells had lower levels of inorganics, indicating that the majority of the metals were in the suspended solids. Aluminum levels exceeded background in a few wells, which may be attributable to weathering of aluminosilicate bedrock minerals. Manganese levels were also above background in several wells. With the exception of manganese and aluminum, which occur naturally at the site, the data collected do not indicate the widespread presence of dissolved metals above background concentrations. The background level of dissolved iron was exceeded in one monitoring well, but this appeared to be localized, as samples from two nearby downgradient wells did not exceed background.

Groundwater samples from the boreholes following soil sample collection were screened in the field by analyzing for BTEX and TPHC. Two contaminant plumes (eastern and western) were defined by the field screening at AOC 43A. The contaminant distribution is similar to the general patterns noted during soil analyses. The lack of confirmation of these results by monitoring well samples implies that much of the BTEX and TPHC found during screening was sorbed on the particulates in the turbid samples collected from the bottom of the boreholes. Thus the BTEX and TPHC concentrations in the groundwater may be much lower than levels reported during the field screening.

Samples collected from monitoring wells were analyzed for TAL metals, VOCs, PAHs, explosives, and TPHC. Results of the groundwater analyses for BTEX and TPHC were significantly lower than the screening results, indicating a poor correlation. The groundwater screening samples were determined not to be representative of the groundwater conditions. Only a few VOCs were detected in groundwater. TCE was detected in three wells and exceeded its screening value once, but was not found in any wells downgradient of AOC 43A. The TCE

source is attributed to the DRMO Yard. In two monitoring wells 2-Methylnaphthalene was detected at levels exceeding screening values. This contaminant was not detected in a sample collected from one of the wells 3 months later. TPHC concentrations exceed screening values in two wells. The maximum measured concentration was 7,820 micrograms per liter (µg/L).

Explosive compounds were detected in three wells at or near the POL Storage Area. According to available information, the POL Storage Area has never treated, stored, or disposed of explosive compounds; therefore, the origin of these compounds is unknown. The detection of explosives in the groundwater correlates directly with high levels of TPHC and may not be related to explosive contamination. The rationale for this conclusion follows: At one well, intended to be down gradient of POL/DRMO Yards, the groundwater was clearly derived from local sources since it was heavily contaminated with road salt (up to 420 mg/kg of sodium), which is more than an order of magnitude greater than the average level in POL/DRMO Yards groundwater. This well showed traces of explosive-related compounds, 1,3-nitrobenze, 2-nitrotoluene, 3-nitrotoluene, 2,6-dinitrotoluene, and an estimated low level of cyclonite (less than 2 µg/L). Well 43MA93-10x, at the POL area, also showed a trace of cyclonite (0.673 µg/L). There is no site history to link the location of these wells to explosive use or storage. Both wells show high levels of TPHC and the chemists reviewing the data could not eliminate these compounds on quality assurance/quality control (QA/QC) grounds, but stated in the RI that the reported results "could be artifacts of the analytical method related to the presence of petroleum products" in these wells.

PAHs were detected in two wells. Because PAHs have high retardation factors, they move very slowly in groundwater and are readily sorbed on soils or aquifer materials. Because of their tendency to sorb, they would not be expected to move with the groundwater, except at a slow rate and in low concentrations

A complete presentation of the groundwater results can be found in section 7 of the AOC 43A final RI report.

3. Asphalt (Area of Contamination 32 only)

Fifteen asphalt samples were collected at AOC 32. Sample locations are shown in figure 4, appendix C. The samples were analyzed for pesticides and PCBs. The results of the chemical analysis are summarized in table 10, appendix E. No pesticides were detected above soil screening values. PCBs were detected in 12 samples taken in the east DRMO Yard. PCB-1248 exceeded screening values in four samples. Based on the samples with detectable PCB concentrations, the soil contamination at the DRMO Yard, and the history of site usage, there are site-related PCB contamination in the asphalt. Some of the samples with PCBs were collected in the area of the known rectifier oil spill.

4. Surface Water (Area of Contamination 32 only)

No naturally occurring surface waters are found within AOC 32. One surface water sample was collected in a catch basin, north of the East Yard. This storm drain discharges to a drainage ditch that would flow to the Plow Shop Pond. The sample was analyzed for TAL metals, TCL pesticides/PCBs, and water quality parameters. The analytical results are summarized in table 11, appendix E. Copper and lead were found to be above the screening values for chronic effects on aquatic life. Other metals were found to be elevated above background concentrations including antimony, cadmium, and zinc. Under normal runoff conditions, any discharges to the storm sewer system would percolate into the sandy soil before reaching a permanent surface water body.

5. Sediment

a. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard

Four sediment samples were collected from the storm drain system (catchment basins north of the East Yard and the storm drain outlet to the drainage ditch). Two samples were collected from further down the drainage ditch south of Shepley's Hill Landfill into which the storm drain discharges. The samples were analyzed for TCL pesticides/PCBs, TAL metals, TPHC, and total organic carbon (TOC). The analytical results are summarized in table 12, appendix E.

Both storm drain system samples exceeded background levels for metals, TOC, and TPHC. Metals of particular concern in the catchment basin were cadmium and lead. The metal concentrations were higher in storm drain discharge to the drainage ditch than in the catchment basin, probably due to sorption on organic carbon in the sediment.

The metals concentrations in the drainage ditch samples were in the same range or higher than those noted in the storm drain system. Runoff from the DRMO storm drain contributed metals to the sediment along the drainage ditch and to the groundwater recharge area. Much of the runoff percolates into the soil and recharges groundwater. The pesticide/PCB results showed DDD, DDT, and PCB-1254 in the storm drain sediments. The ditch sediments contained lindane and DDD. The PCBs may have migrated from the DRMO Yard. The low levels of pesticide may reflect historic pest control activities.

b. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Area

Several storm drain catch basins exist at the junction of Cook Street and Antietam Street. One catch basin is located on the southwest corner of the POL Storage Area. A storm drainage ditch originates within the Coal Pile area across Cook Street (west) from AOC 43A. Seven sediment samples were collected and analyzed for organics along Willow Brook and the associated storm

drains. All of these sediments contained moderate to high levels of organic carbon and TPHC above background. Three groups of organics were detected: PAHs, pesticides, and phthalates. Several individual compounds, such as toluene and dibenzofuran, were also detected.

There is no evidence of any specific impact from AOCs 32 or 43A on Willow Brook either via stormwater runoff or groundwater discharge. No pattern of contamination is attributable to a single source, nor are there correlations between levels of contaminants within a sample. No metals concentrations in sediments from the storm drains or Willow Brook were found to be above background levels.

6. Air (Area of Contamination 32 only)

Air samples were collected at three locations: (1) the field next to Fort Devens Elementary School, (2) near the southwest corner of the DRMO, and (3) at center of the East DRMO Yard. A collocated sample was taken at the latter location. Nine samples were collected: three VOCs, three particulate matter less than 10μ (PM_{10})/metals, and three pesticide/PCBs. The first location was considered to be background.

The results of the sample analysis are summarized in table 13 and 14, appendix E. This analysis showed no detectable concentrations or concentrations above background, with exceptions discussed as follows.

The second and third locations showed levels of PM_{10} above background, but within the range of normal ambient conditions. Unless further investigation reveals high concentrations of metals in the surface soils, no further action is warranted.

The collocated samples had measurable concentrations of the pesticide α-BHC and PCB-1248. The results, based on samples collected under less than optimum conditions, indicate that emissions of PCBs and pesticides from the DRMO are of concern if the site is left unremediated.

VI. SUMMARY OF SITE RISKS

A. Human Health Risk Assessment

A human health risk assessment was conducted to evaluate potential health risks to individuals under current or foreseeable future site conditions at AOC 32 and 43A. The risk assessment is consistent with relevant guidance and standards developed by the USEPA and incorporates data from the scientific literature used in conjunction with professional judgment.

The human health risk assessments for AOC 32 and 43A consist of the following components:

- Selecting chemicals of potential concern (COPCs)
- Assessing exposure
- Assessing toxicity
- Characterizing risk
- Evaluating uncertainty
- Developing a summary and conclusions

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively or qualitatively by developing several hypothetical exposure pathways. These hypothetical pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the site.

1. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard and Underground Storage Tank #13

The exposure pathways evaluated for the human health risk at AOC 32 are listed below:

- Direct contact (dermal contact and incidental ingestion) with contaminants in asphalt, surface soil, or sediment (sediments were not quantitatively evaluated)
- Inhalation of contaminant vapor emissions from the asphalt and soil by site workers and visitors
- Direct contact with contaminants in subsurface soils near underground utility lines by utility workers (not quantitatively evaluated)
- Inhalation of airborne soil particles by utility workers (not quantitatively evaluated)
- Inhalation of vapors that have diffused via the soil gas to indoor air of a new building (UST #13)
- Ingestion of contaminants in drinking water

a. Surface Soil and Asphalt

The cancer risks associated with AOC 32 are listed in table 15, appendix E. The maximum estimated potential cancer risk under the case of reasonable maximum exposure (RME) to contaminants at the DRMO Yard for a site worker exposed to asphalt paving and surface soil under current conditions is 9.2×10^{-5}, which is within the acceptable range (10^{-4} to 10^{-6}). The maximum estimated potential cancer risk associated with soil and asphalt under the case of RME under future conditions, when the higher contaminated subsoil could be exposed during construction, is 1.3×10^{-4}. The cancer risks are associated with PCBs, arsenic, and beryllium.

The hazard indices for noncarcinogenic COPCs at the DRMO Yard are listed in table 16, appendix E. The only hazard index (HI) exceeding 1.0 under current site conditions is associated with the RME case of worker soil exposure. The HI for dermal absorption and ingestion is 4.4 for PCBs and 0.9 for lead.

Under future conditions associated with soils, HIs exceed 1.0 for construction workers (RME value) and site workers (RME and average values). These exceedances are primarily due to PCBs and lead and, to a lesser degree, arsenic, mercury, and chromium (assuming that 10% of the chromium in soils is hexavalent chromium).

b. Groundwater

At the DRMO Yard, the estimated cancer risk from consuming unfiltered groundwater for the RME case is 6.0×10^{-3}, which exceeds the acceptable range. Almost all of the risk is associated with ingesting arsenic and beryllium, which are found in groundwater with high suspended sediments. When metals data from filtered groundwater samples are used, the estimated cancer risk for the RME case is reduced to 5.7×10^{-5}, which is within the acceptable range.

Future consumption of filtered and unfiltered groundwater at the DRMO Yard yields HIs above 1.0. The contaminants associated with the unfiltered groundwater scenario are arsenic, manganese, and lead. The HI for filtered groundwater is solely due to manganese. However, any future use of area groundwater as a drinking water source is unlikely because of the existing public water supply system and the aquifer's low yield.

In the former UST #13 area, the estimated cancer risk from consuming unfiltered groundwater for the RME case is 5.2×10^{-3}, which exceeds the acceptable range. Almost all of the risk is associated with ingesting arsenic, with additional risk from PCBs and 1,4-dichlorobenzene. When metals data from filtered groundwater samples are used, the estimated cancer risk for the RME case is reduced to 6.2×10^{-4}.

Future consumption of filtered and unfiltered groundwater at the former UST #13 site yields HIs above 1.0. The contaminants associated with both groundwater scenarios are arsenic, PCBs, and manganese. The HI for filtered groundwater is solely due to manganese. However, any future use of area groundwater as a drinking water source is highly unlikely because of the existing public water supply system and the aquifer's very low yield.

2. Area of Contamination 43A — Petroleum, Oils, and Lubricants Storage Area

The exposure pathways evaluated for the human health risk at AOC 43A are listed below:

- Direct contact (dermal contact and incidental ingestion) with contaminants in surface soil
- Direct contact with contaminants in subsurface soils near underground utility lines by utility workers (not quantitatively evaluated)
- Inhalation of airborne soil particles by utility workers (not quantitatively evaluated)
- Ingestion of contaminants in drinking water

a. Surface Soil

The cancer risks associated with AOC 43A are listed in table 17, appendix E. The maximum estimated potential cancer risk under the case of RME to contaminants at the AOC 43A is 2.1 X 10^{-5} for a site worker under current conditions, which is within the acceptable range. For AOC 43A, most of the estimated cancer risk is due to ingestion and dermal absorption of arsenic (85%) and ingestion of carcinogenic PAHs (15%). As shown in table 18, appendix E, the noncarcinogenic HIs are less than 1.0 for the exposure scenarios under the current site conditions.

For future construction workers exposed to surface soil contaminants, estimated cancer risks are 2.2 X 10^{-5} for RME cases and 3.0 X 10^{-6} for the average case, which also fall within the acceptable range. The majority of this risk (85%) is due to arsenic. Approximately 17% of the total cancer risk is due to carcinogenic PAHs, which was considered for ingestion and inhalation pathways only. Noncancer HIs total 4.7 for the RME case and 0.75 for the average exposure case. Most of the RME total is due to ingestion and dermal absorption of arsenic, with a total HI of 4.1. Arsenic was the only COPC with an HI greater than 1.0.

b. Groundwater

At AOC 43A, estimated potential cancer risks from consuming groundwater based on data from unfiltered groundwater samples are 1.9 X 10^{-4} for the RME case (above the USEPA acceptable range), and 4.1 X 10^{-5} for the average exposure case. More than 99% of the risk is associated with ingesting beryllium. The highest concentrations of beryllium detected in unfiltered groundwater are associated with high levels of suspended sediments, levels that would not be present in groundwater actually used as drinking water.

It should be noted that the cancer slope factor (SF) for beryllium was derived from the laboratory using soluble salts; however, beryllium at the POL Storage Area is mostly in an insoluble and inactive form. Therefore, these risk estimates are probably unrealistic.

Total HIs for noncarcinogenic effects from consuming groundwater at the POL Storage Area, based on data from unfiltered groundwater samples, are 21 for the RME case and 3.9 for the average exposure case. The HI for the RME case is due to manganese (HI = 16) and lead (HI = 3.0). The measured concentration of many metals in groundwater is due to high levels of suspended sediments. Using metals from filtered groundwater, total HIs drop to 2.7 for the RME and 0.8 for the average exposure cases. Manganese was the only COPC in filtered groundwater with an HI greater than 1.0.

The highest estimated soil risks are for workers in the future, and the highest estimated groundwater risks are for unfiltered groundwater. The RME risk is mostly from ingesting groundwater. Any future use of area groundwater as a drinking water source is unlikely because of the existing public water supply system and the low yield of the aquifer. Therefore, the most realistic risks in the future are those for the site worker from potential exposure to soil contaminants alone.

B. Ecological Risk Assessment

The ecological risk assessment followed a four-step process:

- *Problem Formulation* — This section is based on information collected during the site-specific ecological characterization and hydrogeological studies, as well as the chemical data provided from the RI sampling effort. This phase of the ecological risk assessment is presented in four parts: (1) ecosystems of concern; (2) potential stressors, exposure pathways, (3) ecological affects; ecological endpoints; and (4) the conceptual model.
- *Exposure Assessment* — This section includes only site-specific information pertinent to assessing potential ecological exposures to contaminants at AOC 32. This phase of the ecological risk assessment is presented in three parts: (1) exposure point concentrations, (2) exposure scenarios and pathway, and (3) exposure estimates.
- *Ecological Effects Assessment* — This section includes site-specific information pertinent to assessing potential ecological effects of contaminants at AOC 32. This phase of the ecological risk assessment is presented in two parts: (1) toxicity reference values and (2) field studies/summary of findings.
- *Risk Characterization* — This section, which integrates the three earlier steps, summarizes the potential and actual risks posed by hazardous substances at the site. This phase of the ecological risk assessment is presented in three parts: (1) hazard quotients, (2) summary of risks and uncertainties, and (3) ecological significance.

A summary discussion of the ecological risk assessment approach is presented in volume I, section 6 of the RI report, while more detailed discussions are presented in section 9 of volumes II (DRMO Yard) and III (POL Storage Area) of the RI.

COPCs were established for the DRMO Yard (table 19, appendix E) and the POL Storage Area (table 20, appendix E).

1. Area of Contamination 32 — The Defense Reutilization and Marketing Office Yard

The only COPCs selected in the media potentially affected by activities in the DRMO Yard were cadmium and nickel in sediments of the drainage ditch. The DRMO Yard site lacks vegetation because of human activities. The site consists of paved areas that are surrounded or bordered by grass strips and a gravel parking lot. The drainage ditch is the only area of the site that is not directly affected by human activity. The ecological assessment addressed incidental contact and ingestion, as well as uptake of these contaminants in the food chain for the drainage ditch and adjacent habitats. Levels of cadmium and nickel exceed reference values for invertebrates, but these exceedances are not likely to be ecologically significant, due to the limited extent of contamination. Potential risks of contaminants to wildlife species, such as small mammals and carnivores, are minimal. Therefore, no action to further investigate or to mitigate ecological risks of sediment contamination at the site is considered to be necessary at the DRMO Yard.

2. Area of Contamination 43A — The Petroleum, Oils, and Lubricants Storage Area

A few metals and organic chemicals were detected in soils and groundwater at the POL Storage Area at levels exceeding background and ecological criteria. However, none of these contaminants are considered to be COPCs for ecological receptors due to the minimal chance of exposure. No ecologically significant receptors or pathways are present at the POL Storage Area and, therefore, no risks from site contamination were identified for this site.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Under its legal authorities, the Army's primary responsibility at NPL sites is to undertake remedial actions that protect human health and the environment. In addition, § 121 of CERCLA (42 USC 9621) establishes several other statutory requirements and preferences:

- The remedial action, when complete, must comply with all Federal and any more stringent State environmental standards, requirements, criteria, or limitations, unless a waiver is invoked.
- The remedial action must be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

- A preference must be given to those remedies in which treatment permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element.

Response alternatives were developed to be consistent with these mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives (RAOs) were developed to aid in developing and screening alternatives. These RAOs were developed to mitigate existing and future potential threats to human health and the environment.

The RAOs for site-related surface and subsurface soils are as follows:

- Prevent direct and indirect contact, ingestion, and inhalation of the soil contaminated with COPCs by human and ecological receptors at levels that could pose risks.
- Prevent erosion and migration of soil contaminated with COPCs to storm sewers and surface water bodies.
- Prevent COPC migration to the groundwater at levels that could adversely affect human health and the environment.

The RAOs for site-related groundwater include the following:

- Prevent off-site migration of COPCs at levels that could adversely affect flora and fauna.
- Prevent lateral and vertical migration of COPCs at levels that could adversely affect potential and existing drinking water supply aquifers.
- Prevent seepage of groundwater from the site that could result in surface water concentrations in excess of ambient water quality standards.

RAOs were not developed for surface water because it is impracticable to remediate this medium directly. Rather, surface water contamination is addressed by proactive RAOs in other media. RAOs were not developed for sediments because of minimal site effects.

B. Technology and Alternative Development and Screening

CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establish the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for AOCs 32 and 43A. The NCP reaffirms CERCLA's preference for permanent solutions that use treatment technologies to reduce the toxicity, mobility, and volume of hazardous substances to the maximum extent practicable.

With respect to soil within AOC 32, the FS developed several remedial alternatives that attain site-specific cleanup levels using different technologies, as well as institutional control and no further action alternatives. All alternatives included extended monitoring programs.

The residual soil contamination detected at UST #13 (AOC 32) was sporadic in nature, and excavation was conducted to remove all soil above screening values. Development of soil remedial alternatives was therefore deemed not to be warranted. As the soil contamination noted at AOC 43A was isolated or only marginally above cleanup goals, no remedial action program was developed.

Surface water within the DRMO Yard (AOC 32) consists of drainage runoff from the yard. Addressing contamination of the AOC 32 soils would improve the quality of the surface water. The surface water was, therefore, not considered for direct remediation.

With respect to groundwater (UST #13 and POL/DRMO), the FS developed one remedial alternative that eventually attains site-specific cleanup goals using intrinsic remediation, as well as institutional controls and no further action alternatives. This ROD will use the more descriptive name "monitored natural attenuation" in place of "intrinsic remediation." This usage is consistent with current USEPA guidance. Monitored natural attenuation is the combination of physical, chemical, and biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants in soil or groundwater in a reasonable time frame. These insitu processes include biodegredation, dispersion, dilution, adsorption, volatilization, and biological and chemical stabilization or destruction of contaminants. The alternatives in the FS used monitored natural attenuation as the primary remedial action. All the alternatives included extended environmental monitoring programs.

Section 3 of the FS identified, assessed, and screened technologies and process options based on Implementability, effectiveness, and cost. In section 4 of the FS, these technologies and process options were combined into the candidate alternatives listed below for each operable unit.

1. Area of Contamination 32 — Defense Reutilization and Marketing Office Yard Soils Operable Unit

- Alternative A1: No Further Action
- Alternative A2: Institutional Actions
- Alternative A3: Containment via Capping
- Alternative A4: Excavation, Solidification, and On-site Disposal
- Alternative A6: Excavation and Off-site Disposal

2. Area of Contamination 32 — Underground Storage Tank #13 Groundwater Operable Unit

- Alternative B1: No Further Action
- Alternative B2: Institutional Actions
- Alternative B3: Monitored Natural Attenuation (with Long-Term Monitoring)

3. Area of Contamination 32 and 43A — Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit

- Alternative C1: No Further Action
- Alternative C2: Institutional Actions
- Alternative C3: Monitored natural attenuation (with Long-Term Monitoring)

The alternatives were then evaluated and screened in section 4 of the FS based on Implementability, effectiveness, and cost, as described in section 300.430(e)(4) of the NCP. From this screening process, each remedial alternative was retained for detailed analysis.

VIII. DESCRIPTION OF ALTERNATIVES

Based on preliminary information relating to the types of contaminants, environmental media of concern, and potential exposure pathways at Fort Devens, remedial alternatives for three operable units are discussed in the following sections. These operable units are soil contamination in and around the DRMO Yard (AOC 32), groundwater contamination in the area of the removed UST #13 (AOC 32), and the groundwater in the POL Storage Area/DRMO Yard (AOC 43A and 32).

This section provides a narrative summary of each alternative evaluated in detail in the FS completed for AOC 32 and AOC 43A. A detailed assessment of each alternative can be found in sections 4 and 5 of the FS report.

A. Defense Reutilization and Marketing Office Yard Soils Operable Unit (Area of Contamination 32)

Five alternatives for remediation of the DRMO soils were retained from the initial screening.

1. Alternative A1: No Further Action

This alternative does not involve remedial actions. No treatment or containment will be performed. This alternative would leave contaminated soil in place. No action would be taken to

eliminate the exposure pathways of these contaminants. Groundwater monitoring of the existing wells would be performed annually for 5 years, at which time the program would be reviewed. As required by CERCLA, Alternative A1 was developed to provide a basis of comparison for the remaining alternatives.

Total Direct and Indirect Costs:	$0
Present Worth of Operation and Maintenance (O&M) costs:	$80,380 (over 5 years)
Total Present Worth:	$80,380

2. Alternative A2: Institutional Actions

- Limit land use to restricted development through deed restrictions.
- Install approximately 60 feet of new fencing and move 840 feet of existing fencing to isolate contaminated soils in drainage ditches.
- Review site conditions every 5 years for a period of 30 years, including groundwater monitoring.

No remediation would occur under this alternative; activity would be limited to minimal measures intended to reduce exposure to the contaminants of concern. Deed restrictions would limit land use and development. The existing fencing on the east and west side of the East Yard would be modified to isolate contaminated soils in drainage ditches along the perimeter. Groundwater monitoring would be conducted once every 5 years for a period of 30 years, in conjunction with the site condition reviews. Exposure scenarios would be revisited based on site use at the time of each review. If warranted, additional action will be considered at these times.

Total Direct and Indirect Costs:	$17,950
Present Worth of O&M costs:	$64,880 (over 30 years)
Total Present Worth:	$103,690

3. Alternative A3: Containment via Capping

- Excavate and consolidate contaminated soils.
- Backfill excavated areas with clean material.
- Install a new drainage swale.
- Install a multilayered cap.
- Maintain cap and monitor groundwater annually for 30 years.
- Impose future site restrictions.

Under this alternative, direct contact with the contaminated soils and asphalt around the East Yard would be eliminated by installing an impermeable cap. The cap would minimize the

generation of contaminated groundwater. Contaminated soil is found in four areas: the southern portion of the tire storage area (north of the East Yard), the center of the East Yard, and two drainage swales along the eastern and western edges of the East Yard. The excavated soil from the swales would be placed on and between the other two contaminated areas. The multilayered clay cap would be vegetated and fenced. Annual O&M activities would be conducted for 30 years and includes repairing holes, revegetation, and groundwater monitoring.

Total Direct and Indirect Costs:	$470,320
Present Worth of O&M costs:	$366,200 (over 30 years)
Total Present Worth:	$836,520

4. Alternative A4: Excavation, Solidification, and On-Site Disposal

- Excavate the contaminated waste (1,300 cubic yards).
- Transport the waste to a temporary storage area.
- Mix the waste with a binder.
- Cure the waste for approximately 30 days.
- Transport the waste to a final disposal location.
- Sample groundwater annually for 30 years.
- Impose future site restrictions.

This alternative includes the excavation, on-site treatment via solidification, and on-site disposal of contaminated soils. Contaminated soils and asphalt (center portion of the East Yard) would be excavated using earth-moving equipment such as bulldozers, transported to the southern portion of the East DRMO Yard to await treatment, and mixed with a solidification agent (portland cement and water). The waste/binder mixture would be placed in forms and allowed to cure for up to 30 days to achieve full strength. Finally, the monoliths would be disposed of on-site. The probable location for disposal would be the northern DRMO Yard and southern tire recycling area, the areas from where the soils would be excavated. The disposal site would be covered with top soil and vegetated.

Groundwater monitoring wells would be sampled on an annual basis for a period of 30 years to evaluate potential contaminant migration. Under this alternative, the contaminants would be treated and contained but not removed from the site. Solidification is intended to address inorganic contaminants such as lead and cadmium in the soil. Physically binding large organics, such as PCBs and pesticides, would reduce the risk of exposure. Groundwater monitoring would also aid in protecting human health and the environment in because it would detect and evaluate potential contaminant migration.

Total Direct and Indirect Costs:	$490,870
Present Worth of O&M costs:	$287,270 (over 30 years)
Total Present Worth:	$778,140

5. Alternative A6: Excavation and Off-site Disposal

- Excavate the contaminated waste (1,300 cubic yards). Perform confirmatory sampling prior to backfilling.
- Transport the waste immediately to a final off-site disposal location (nonhazardous landfill).
- Backfill the area with clean material and revegetate.
- Monitor groundwater after 5 years.

Under this alternative, all soil identified as being contaminated would be excavated and disposed of off-site. Figure 7, appendix C shows the soil to be excavated. A total of 1,300 cubic yards of contaminated soil would be excavated and transferred immediately to a final off-site disposal area: a nonhazardous landfill. The excavated areas would then be regraded or backfilled to grade with clean soils and revegetated for stabilization. The southern portion of the East DRMO Yard could be used as a decontamination pad for the excavation equipment. Because the source of contamination would be removed from the site, no long-term monitoring would be required. However, a review of site conditions, including groundwater monitoring, would be conducted in 5 years to ensure that no contaminants migrate from any unidentified sources. This alternative would not treat or destroy the contaminants, but would completely remove them from the site. All three RAOs would be achieved permanently. Therefore, this alternative would provide complete protection of human health and the environment.

Total Direct and Indirect Costs:	$543,696
Present Worth of O&M costs:	$19,850
Total Present Worth:	$563,550

B. Underground Storage Tank #13 Groundwater Operable Unit (Area of Contamination 32)

Three alternatives for remediation of UST #13 groundwater were retained from the initial screening.

1. Alternative B1: No Further Action

The no further action alternative would neither contain, treat, nor destroy the contaminants in the groundwater near UST #13. Under this alternative, no remedial action of any type would be undertaken. It is assumed that the contamination would remain in its present state and pose the same risks as currently exist. Monitoring, however, would be performed to detect contaminant migration. Groundwater monitoring would be performed annually for 5 years, at which time the continuation of the program would be reviewed. This alternative would not meet the RAOs.

Total Direct and Indirect Costs:	$0
Present Worth of O&M costs:	$75,820 (over 5 years)
Total Present Worth:	$75,820

2. Alternative B2: Institutional Actions

Institutional actions would not treat or destroy any of the contaminants. No remediation would occur under this alternative. Figure 8, appendix C shows the lateral extent of this groundwater operable unit. Activity would be limited to minimal measures intended to reduce exposure to contaminated media. Deed restrictions would limit land use and development. Groundwater monitoring would be conducted once every 5 years for a period of 30 years, in conjunction with the site condition reviews. Exposure scenarios would be revisited based on site use at the time of each review. If warranted, additional action would be considered at these times. This alternative would not meet the RAOs.

Total Direct and Indirect Costs:	$0
Present Worth of O&M costs:	$58,140 (over 30 years)
Total Present Worth:	$58,140

3. Alternative B3: Monitored Natural Attenuation

The monitored natural attenuation alternative will not directly treat, contain, destroy, or reduce the mobility of contaminants. The principal components of this alternative are the assumed natural attenuation and bioremediation taking place at the site.

The key components of this alternative are as follows:

- Establish institutional controls to prevent intrusion into or installation of wells into the known area of contamination in the bedrock.
- Allow for monitored natural attenuation by naturally occurring microorganisms in the groundwater.
- Install additional groundwater monitoring wells.
- Collect and incorporate additional field data into groundwater flow and contaminant transport models.
- Perform long-term monitoring and report annually on groundwater quality.
- Review field data, modeling predictions, and compliance with applicable or relevant and appropriate requirements (ARARs) at 5-year intervals.
- Review the need for continued monitoring and additional action at 5-year intervals.

Total Direct and Indirect Costs:	$0
Present Worth of O&M costs:	$170,910 (over 30 years)
Total Present Worth:	$170,910

C. Petroleum, Oils, and Lubricants Storage Area/Defense Reutilization and Marketing Office Yard Groundwater Operable Unit (Area of Contamination 32 and 43A)

Three alternatives for remediating AOC 32 and 43A groundwater were retained from the initial screening.

1. Alternative C1: No Further Action

The no further action alternative would neither contain, treat, nor destroy the contaminants in the groundwater within the AOC 32 and 43A areas. Under this alternative, no remedial action of any type would be undertaken. It is assumed that the contamination would remain in its present state and pose the same risks as currently exist. Monitoring, however, would be performed to detect contaminant migration. Groundwater monitoring would be performed annually for 5 years, at which time the continuation of the program would be reviewed. This alternative would not meet the RAOs.

Total Direct and Indirect Costs:	$0
Present Worth of O&M costs:	$84,840 (over 5 years)
Total Present Worth:	$84,840

2. Alternative C2: Institutional Actions

Institutional actions would not treat or destroy any of the contaminants. No remediation would occur under this alternative. Activity would be limited to minimal measures intended to reduce exposure to contaminated media. Deed restrictions would limit land use and development. Groundwater monitoring would be conducted once every 5 years for a period of 30 years, in conjunction with the site condition reviews. Exposure scenarios would be revisited based on-site use at the time of each review. If warranted, additional action would be considered at these times. This alternative would not meet the RAOs.

Total Direct and Indirect Costs:	$0
Present Worth of O&M costs:	$69,460 (over 30 years)
Total Present Worth:	$69,460

3. Alternative C3: Monitored Natural Attenuation

The monitored natural attenuation alternative would not directly treat, contain, destroy, or reduce the mobility of contaminants. Figure 8, appendix C shows the lateral extent of this groundwater operable unit. The principal components of this alternative are the assumed natural attenuation and bioremediation taking place at the site. The institutional restrictions, if properly executed, prevent exposure to contaminants and reduce potential risks to human health to within acceptable levels.

The key components of this alternative are as follows:

- Establish institutional controls to prevent intrusion into or installation of wells into the known area of contamination in the bedrock.
- Allow for monitored natural attenuation by naturally occurring microorganisms in the groundwater.
- Install additional groundwater monitoring wells.
- Collect and incorporate additional field data into groundwater flow and contaminant transport models.
- Perform long-term monitoring and report annually on groundwater quality
- Review field data, modeling predictions, and compliance with ARARs at 5-year intervals
- Review the need for continued monitoring and additional action at 5-year intervals

Total Direct and Indirect Costs:	$0
Present Worth of O&M costs:	$258,870 (over 30 years)
Total Present Worth:	$258,870

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

§ 121(b)(1) of CERCLA (42 USC 9621) presents several factors that, at a minimum, the Army is required to consider in assessing alternatives. Building upon these specific statutory mandates, the NCP describes nine evaluation criteria to be used in assessing the individual remedial alternatives. The nine criteria are used to select a remedy that meets the goals of protecting human health and the environment, maintains protection over time, and minimizes untreated waste.

A detailed analysis was performed on the alternatives using the nine evaluation criteria to select a site remedy. Specific discussion regarding this analysis is provided in section 5 of each FS report. Definitions of the nine criteria are provided as follows:

Threshold Criteria

The two threshold criteria described below must be met for an alternative to be eligible for selection in accordance with the NCP:

1. *Overall Protection of Human Health and the Environment* — This criterion assesses how well an alternative, as a whole, achieves and maintains protection of human health and the environment.
2. *Compliance with ARARs* — This criterion assesses how the alternative complies with location-, chemical-, and action-specific ARARs and whether a waiver is required or justified.

Primary Balancing Criteria

The following five criteria are used to compare and evaluate the elements of alternatives that meet the threshold criteria:

3. *Long-Term Effectiveness and Permanence* — This criterion evaluates the effectiveness of the alternative in protecting human health and the environment after response objectives have been met. It considers the magnitude of residual risks and the adequacy and reliability of controls.
4. *Reduction of Toxicity, Mobility, and Volume Through Treatment* — This criterion evaluates the effectiveness of treatment processes used to reduce the toxicity, mobility, and volume of hazardous substances. It considers the degree to which treatment is irreversible and the type and quantity of residuals remaining after treatment.
5. *Short-Term Effectiveness* — This criterion examines the effectiveness of the alternative in protecting human health and the environment during the construction and implementation of a remedy until response objectives have been met. It considers the protection of the community, workers, and the environment during implementation of remedial actions.
6. *Implementability* — This criterion assesses the technical and administrative feasibility of an alternative, as well as the availability of required goods and services. Technical feasibility considers the ability to construct and operate a technology, its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. Administrative feasibility considers the ability to obtain approvals from other parties or agencies and the extent of required coordination with other parties or agencies.
7. *Cost* — This criterion evaluates the capital and O&M costs of each alternative.

Modifying Criteria

The following modifying criteria are used on the final evaluation of remedial alternatives, generally after the Army has received public comments on the FS and proposed plan:

8. *State Acceptance* — This criterion considers the State's preferences or concerns about the alternatives, including comments on ARARs or the proposed use of waivers.
9. *Community Acceptance* — This criterion considers the community's preferences or concerns about the alternatives.

Following the detailed analysis of each alternative, the Army conducted a comparative analysis focusing on the relative performance of each alternative against the nine criteria. The comparative analysis of the alternatives for each AOC are summarized in the following sections.

A. Defense Reutilization and Marketing Office Yard Soils Operable Unit (Area of Contamination 32)

1. Overall Protection of Human Health and the Environment

This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy. Alternative A1 would not provide any additional protection above that which already exists in the current zoning, fencing, and land-use plans for the site. Alternatives A2, A3, and A4 would minimize the exposure routes to human and environmental receptors, thus reducing risks to acceptable levels. Alternative A6 would remove contaminated soils to an offsite landfill, eliminating contamination at the site. All alternatives would involve some duration of groundwater monitoring to detect potential contaminant migration.

2. Compliance with Applicable or Relevant and Appropriate Requirement

CERCLA requires that the selected alternative also meet a second threshold criterion of compliance with ARARs or obtain a waiver if the criterion cannot be met. The PCB ARAR would be exceeded in all alternatives except Alternatives A6 and possibly A4. However, minimizing the exposure routes via Alternatives A2 and A3 would minimize risks for the Toxic Substances Control Act (TSCA) ARAR for PCBs, the Resource Conservation and Recovery Act (RCRA) action levels for pesticides and cadmium, and the human health risk assessment calculated cleanup goals for lead. Also, Alternatives A1, A2, and A3 would eliminate the possibility that the RCRA action-specific ARAR would apply.

3. Long-Term Effectiveness and Permanence

This criterion evaluates the magnitude of residual risk and the reliability of controls after response objectives have been met. Alternatives A1, A2, A3, and A4 require continued institutional controls. Alternatives A1 and A2 require continued control of access to the DRMO Yard, and thus are not considered to be effective in the long term. Alternative A3 requires maintaining the fence and the integrity of the cap, and Alternative A4 requires protecting the

buried monoliths. Of these alternatives, A4 would be more effective in the long term. In Alternative A6, the burden of responsibility shifts to the offsite landfill operator to ensure that the landfill integrity is upheld. However, the site risks would be eliminated in the long term. All alternatives would require monitoring well sampling to ensure that no continued contaminant migration occurs.

4. Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion evaluates whether the alternatives meet the statutory preference for treatment under CERCLA. The criterion evaluates the reduction of toxicity, mobility, or volume of contaminants and the type and quantity of treatment residuals. Alternatives A1 and A2 do not involve treatment and would not reduce toxicity, mobility, or volume of contamination. Alternatives A3 and A6 would not provide a reduction in toxicity or volume, but they would reduce the mobility of contamination. Of these two, Alternative A6 would be more effective in this reduction. Neither alternative satisfies the preference for on-site treatment. A4 would reduce the toxicity of lead and cadmium contamination, but not that of PCBs or pesticides. It would drastically reduce the mobility of these contaminants, but would likely increase the volume. Alternative A4 is the only option that would satisfy the regulatory preference for on-site treatment. Monitoring under all alternatives would serve to verify reduction in contaminant migration.

5. Short-Term Effectiveness

CERCLA requires that potential adverse short-term effects to workers, the surrounding community, and the environment be considered during selection of a remedial action. Alternative A1 would cause no disturbance of surface soil that might endanger human health. Alternative A2 would cause a brief disturbance to surface soils while fencing was installed. Alternatives A3, A4, and A6 would involve extensive short-term earth moving and remedial activities, which would require Level C personal protection equipment (PPE) to prevent worker exposure, as well as dust and runoff control activities to prevent community exposure. In addition, these three alternatives would require air monitoring during excavation activities. Under all alternatives, groundwater sampling would be performed in dermal and respiratory protection to minimize exposure risks.

6. Implementability

This criterion evaluates each alternative's ease of construction and operation and availability of services, equipment, and materials to construct and operate the alternative. Also evaluated is the ease of undertaking additional remedial actions and administrative feasibility. None of the alternatives face any technical obstacles to implementation. However, Alternatives A1, A2, and A3 would require waivers for the PCB ARAR. On the other hand, Alternatives A4 and A6 would possibly require RCRA action-specific ARARs for lead and cadmium. Alternative A4 would

require the longest time to implement, approximately 4 to 5 months. All of the alternatives except A6 would require future site-use restrictions.

7. Cost

Alternative A1 requires annual monitoring costs, of approximately $80,380 over 5 years. Alternative A2 requires minimal work and an estimated $103,690 to implement. Alternative A3 would require consolidation and capping of the soil, which could be implemented relatively easily at an estimated cost of $836,520. Alternative A4 would require slightly more time for solidification and burial, at an estimated cost of $778,140. Alternative A6 could be implemented easily and quickly for an estimated cost of $563,550.

8. State Acceptance

This criterion addresses whether, based on its review of the RI/FS and proposed plan, the State concurs with, opposes, or has no comment on the alternative the Army is proposing as the remedy for the DRMO soils operable unit (AOC 32). The Commonwealth of Massachusetts has reviewed the RI/FS, proposed plan, and this ROD and concurs with the selected remedy (see section X).

9. Community Acceptance

This criterion addresses whether the public concurs with the Army's proposed plan. No comments were received from the community during the public comment period. The Army believes this shows community acceptance of the proposed plan and selected remedy.

B. Underground Storage Tank #13 Groundwater Operable Unit (Area of Contamination 32)

1. Overall Protection of Human Health and the Environment

This criterion, according to CERCLA, must be met for a remedial alternative to be chosen as a final site remedy. Alternatives B1, B2, and B3 will not directly treat, contain, destroy, or reduce the mobility of contaminants in the UST #13 groundwater area. Alternative B1 would not provide any additional protection above that which already exists in the current zoning, fencing, and land-use plans for the site. Alternative B2 would minimize the exposure routes to human and environmental receptors by isolating the AOC by development restrictions, thus reducing risks to acceptable levels. Alternative B3, in conjunction with institutional controls, will provide good data on contaminant migration and the potential for human health risks outside the controlled

area. All alternatives would involve some duration of groundwater monitoring to detect potential contaminant migration.

2. Compliance with Applicable or Relevant and Appropriate Requirements

CERCLA requires that the selected alternative also meet a second threshold criterion of compliance with ARARs or obtain a waiver if the criterion cannot be met. The chlorobenzene ARAR would be exceeded in all alternatives except Alternative B3, where the groundwater would eventually comply with the ARAR. Minimizing the exposure routes via Alternatives B2 and B3 would minimize risks for the Safe Drinking Water Act (SDWA) ARAR for chlorobenzene.

3. Long-Term Effectiveness and Permanence

This criterion evaluates the magnitude of residual risk and the reliability of controls after response objectives have been met. Under Alternatives B1 and B2, the potential for human and ecological exposure to contaminants in groundwater endure. These alternatives do not satisfy the preference for treatment and permanence. Alternatives B2 and B3 require continued institutional controls. In Alternative B3 (the microbial degradation process of monitored natural attenuation), the organic COPCs would ultimately be converted to inert compounds such as carbon dioxide, methane, and water. Inorganic COPCs would persist after completion of organic degradation but may be naturally occuring. Because of the actual degradation/destruction of organic contaminants that occurs in this process, intrinsic bioremediation provides permanent treatment effectiveness without secondary waste disposal. Alternative B3, if successful, would provide a permanent and effective long-term remediation of the site. All alternatives would require monitoring well inspection.

4. Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion evaluates whether the alternatives meet the statutory preference for treatment under CERCLA. The criterion evaluates the reduction of toxicity, mobility, or volume of contaminants and the type and quantity of treatment residuals. Alternatives B1 and B2 do not involve treatment and would not reduce toxicity, mobility, or volume of contamination. Alternative B3 meets the statutory preference for treatment under CERCLA because monitored natural attenuation is a naturally occurring treatment. Monitoring under all alternatives would serve to verify reduction in contaminant migration. Alternative B3 proposes more intensive monitoring to determine whether the expected results are or are not attained.

5. Short-Term Effectiveness

CERCLA requires that potential adverse short-term effects to workers, the surrounding community, and the environment be considered during selection of a remedial action. No alternative will have any significant impact on existing site conditions. Under all alternatives, groundwater sampling would be performed in dermal and respiratory protection to minimize exposure risks.

6. Implementability

This criterion evaluates each alternative's ease of construction and operation, as well as availability of services, equipment, and materials to construct and operate the alternative. None of the alternatives face any technical obstacles to implementation. However, Alternatives B1 and B2 would require waivers for the chlorobenzene ARAR. Alternative B3 has the ultimate objective of meeting ARARs and poses no apparent administrative obstacles.

7. Cost

Capital, O&M, and present worth costs were estimated for Alternatives B1 through B3. Cost estimates for these alternatives included similar expenses for long-term groundwater monitoring. As would be expected, Alternatives B1 and B3 are the least and most expensive alternatives, respectively. The only alternative with capital costs is B3. These expenditures are designated for installing additional monitoring wells and creating and calibrating a site-specific flow and contaminant transport model. The O&M costs associated with Alternative B3 include the potential adjustment of the site-specific model.

8. State Acceptance

This criterion addresses whether, based on its review of the RI/FS, and proposed plan, the State concurs with, opposes, or has no comment on the alternative the Army is proposing as the remedy for the UST #13 Groundwater Operable Unit (AOC 32). The Commonwealth of Massachusetts has reviewed the RI/FS, proposed plan, and this ROD and concurs with the selected remedy (see section XIII).

9. Community Acceptance

This criterion addresses whether the public concurs with the Army's proposed plan. No comments were received from the community during the public comment period. The Army believes this shows community acceptance of the proposed plan and selected remedy.