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2001

EPA Superfund
Record of Decision:

NATICK LABORATORY ARMY RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER
EPA ID: MA1210020631
OU 01
NATICK, MA
09/19/2001

Record of Decision

T-25 Area Ground Water (Operable Unit 1)
U.S. Army Soldier Systems Center
Natick, Massachusetts

Submitted to

U.S. Army Soldier Systems Center
Natick, Massachusetts

April 2001

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List of Acronyms and Abbreviations

ARAR	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chemical of Concern
CSF	Cancer Slope Factors
DCE	Dichloroethene
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
FFS	Focused Feasibility Study
GAC	Granular Activated Carbon
gpm	Gallons Per Minute
GW-1	Ground Water 1
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
MADEM	Massachusetts Department of Environmental Management
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MCP	Massachusetts Contingency Plan
MNA	Monitored Natural Attenuation
msl	Mean Sea Level
NCP	National Contingency Plan
NPV	Net Present Value
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Perchloroethene or Tetrachloroethene
POC	Point of Compliance
POL	Petroleum, Oil, and Lubricant
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation

List of Acronyms and Abbreviations (cont.)

ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act
SSC	United States Army Soldier Systems Center
SVOC	Semivolatile Organic Compound
TAG	Technical Assistance Grant
TCE	Trichloroethene
TS	Treatability Study
UCL	Upper Confidence Limit
UV	Ultraviolet
VOC	Volatile Organic Compound

PART 1: DECLARATION FOR THE RECORD OF DECISION April 2001

1.1 Site Name and Location

Operable Unit 1 - T-25 Area Ground Water
Natick Laboratory Army Research, Development, and Engineering Center National Priorities List Site
U.S. Army Soldier Systems Center (SSC)
Natick, Massachusetts
CERCLIS FD No. MA121002063

1.2 Statement of Basis and Purpose

This decision document presents the U.S. Army's Selected Remedy for Operable Unit 1 (OU-1), the T-25 Area ground water at the Natick Laboratory Army Research, Development, and Engineering Center National Priorities List Site, at the U.S. Army Soldier Systems Center (SSC) in Natick, Massachusetts (Site). It was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended; as well as in accordance with the Department of the Army policy. The Assistant Chief of Staff for Installation Management or the Deputy Assistant Secretary of Army for Environmental, Safety and Occupational Health, and the Director of the U.S. Environmental Protection Agency (EPA) New England Region have been delegated the authority to approve this Record of Decision (ROD). This decision 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 SSC Environmental, Safety and Health Office, Building 4, Soldier Systems Center, Natick, Massachusetts. Information repositories are at the Natick Board of Health (Town Hall, 13 Central Street, Natick, MA 01760), the Massachusetts Department of Environmental Protection (MADEP) (Bureau of Waste Site Cleanup, Federal Facilities, 1 Winter Street, 7th Floor, Boston, MA 02108), and the Morse Institute (Reference Section, 14 East Central Street, Natick, MA 01760). The Administrative Record Index (Appendix A of this ROD) identifies each of the items considered during the selection of the remedial action.

The Commonwealth of Massachusetts concurs with the selected remedy.

1.3 Assessment of the Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of Selected Remedy

The selected remedial action addresses potential future exposure to contaminated ground water, the principal known threat at Operable Unit 1 the T-25 Area ground water. Several remedies were considered for this remedial action. The remedy selected consists of ground water extraction to contain the primary area of ground water contamination, followed by treatment using air stripping and carbon adsorption, with discharge of treated ground water to Lake Cochituate or other alternative uses approved by EPA and MADEP; institutional controls; monitored natural attenuation (MNA), and long-term monitoring. The remedy contains and treats the T-25 Area ground water contamination, and prevents potential future exposure to ground water with contaminant concentrations in excess of federal and more stringent state drinking water standards. The ground water extraction and treatment technology is one of EPA's preferred approaches for treating dissolved volatile organic compound (VOC)-contaminated ground water. This technology was selected using the EPA's presumptive remedy guidance for streamlining remediation of CERCLA sites. The extraction and treatment portion of this alternative began operation in November 1997 as part of the Treatability Study (TS), and continues to operate.

The selected remedy includes the following major components:

- Ground water extraction and treatment
  - Extraction of ground water from extraction wells
  - Treatment of the contaminated ground water in an air stripper to transfer VOCs to an off-gas stream (vapor effluent)
  - Secondary treatment of the air stripper's aqueous effluent by granular activated carbon (GAC) adsorption to reduce organic contaminants to concentrations less than established cleanup levels
  - Treatment of the air –stripper's vapor effluent containing the stripped volatile contaminants in a vapor-phase GAC adsorbent system
  - Discharge of treated ground water to Lake Cochituate or other alternative uses approved by EPA and MADEP
- Long-term ground water monitoring including MNA parameters both on-facility and off-facility

- Implementation of on-facility and off-facility institutional controls to restrict access to the contaminated aquifer. A town of Natick Board of Health ordinance will prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in a prescribed area around the facility, while the Army's Master Plan for SSC will restrict the on-facility use of ground water. If the SSC property is transferred out of federal ownership, the United States will impose appropriate enforceable land-use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property.
- MNA
- Five-year reviews until cleanup levels are attained
- Army support of a portion of the operation and maintenance of the air stripping system at the town of Natick's Springvale Treatment Plant

The selected remedy for Operable Unit 1 addresses the ground water associated with the T-25 Area, which contains elevated concentrations of the principal threat contaminants (PCE and TCE) and other secondary contaminants. The remedy will use ground water extraction to contain and clean up the T-25 Area ground water, prevent contamination from reaching downgradient receptors, pull back some off-facility contamination, and treat (with air stripping and carbon adsorption) the extracted ground water and air streams to established cleanup levels prior to discharge. Natural attenuation processes will also be actively monitored to ensure that cleanup goals are being met for any contamination outside the influence of the treatment system, and any residual contamination within the T-25 Area remaining after the treatment system is shut down due to diminishing returns. Further, institutional controls will prohibit anyone from using both the contaminated on-facility and off-facility ground water.

To further protect the drinking water of the town of Natick, the Army will support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant. Agreements between the Army and the Town of Natick were developed through negotiations between the Town and the Army, and are presented in Appendices B and F. The agreements include several provisions including: 1) the Army will provide the Town with a one-time payment of $3.1 million, 2) agreements by the Town to continue operation of the Springvale Treatment Plant, and the Army to continue operation of source area containment of contaminated ground water at the T-25 Area site, and 3) agreement by the Town of Natick to impose institutional controls in the area for the full time of the cleanup. These agreements allow the selected remedy to avoid building redundant systems and to leverage existing systems already in place.

Other areas at SSC, in addition to Operable Unit 1, either currently under investigation or previously addressed under separate CERCLA actions include: T-25 Area Storage Area (past soil removal action), T-25 Area Storm Water Outfall Area, Former Proposed

Gymnasium Site, Boiler Plant Site, the SSC Water Supply Wells Site, and the Main Storm Water Outfall. Field investigations for many of these other study areas at SSC have already been completed, however, at this time, remedial activities have not been planned. Operable Unit 1 is the second response action for the NPL Site and addresses the ground water contamination associated with the T-25 Area. The first response action at the NPL Site addressed an isolated area of pesticide-contaminated soil from a small Storage Area within the T-25 Area, that posed an ecological risk. Approximately 1,000 cubic yards of contaminated soil was removed under a separate removal action. No current soil source area for the observed ground water contamination (PCE and TCE) associated with the T-25 Area was found during the investigations. Therefore, no action for soils is required under this ground water ROD. The remaining soils associated with the T-25 Area do not pose an unacceptable incremental human health or ecological risk. However, some small areas of soil associated with other operable units at the NPL Site are under study for a possible limited soil removal action.

1.5 Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate (ARAR) to the remedial action, and is cost effective. The remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

Because this remedy will result in hazardous substances remaining on-facility above levels that allow for unlimited use and unrestricted exposure (for a period of time estimated at about 27 years), a review will be conducted within five years after initiation of remedial action, and every five years hence until cleanup goals are attained, to ensure that the remedy continues to provide adequate protection of human health and the environment.

1.6 Record of Decision Data Certification Checklist

The following information is included in the Decision Summary section (Section 2) of this ROD.

- Chemicals of concern (COCs) and their respective concentrations
- Baseline risk presented by COCs
- Cleanup levels established for COCs and the basis for the levels

- Current and future land and ground water use assumptions used in the baseline risk assessment and ROD
- Land and ground water use that will be available at the site as a result of the Selected Remedy
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
- Decisive factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria)

Additional information can be found in the Administrative Record file for this site.

1.7 Authorizing Signatures

1.7.1 U.S. Department of the Army Authorizing Signatures

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:

Raymond J. Fatz
Deputy Assistant Secretary of Army
(Environment, Safety and Occupational Health)
OASA (I&E)

1.7.2 U.S. Environmental Protection Agency Authorizing Signatures

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:

9/19/01

Patricia L. Meaney
Director
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency New England Region

PART 2: DECISION SUMMARY

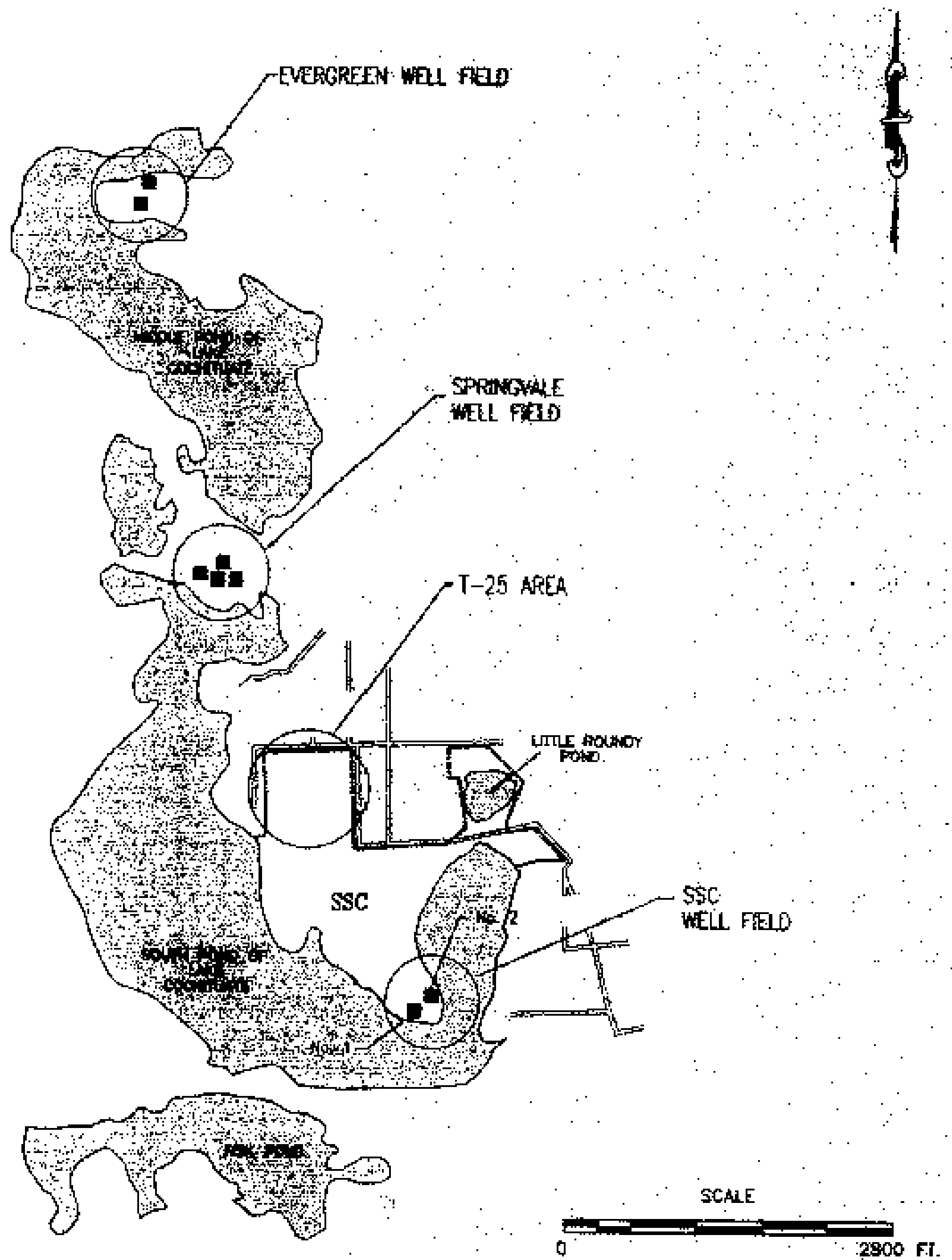
2.1 Site Name, Location, and Description

Site Name: T-25 Area Ground Water at Natick Laboratory Army Research, Development, and Engineering Center National Priorities List Site
Site Location: U.S. Army Soldier Systems Center (SSC), Natick, Massachusetts
CERCLIS ID: MA121002063
Lead Entity: U.S. Army
Site Type: Active facility

T-25 Area site is one of several sites at the Natick Laboratory Army Research, Development, and Engineering Center National Priorities List Site (Site). The T-25 Area is located approximately 17 miles west-southwest of Boston at the U.S. Army Soldier Systems Center (SSC) in Natick, Massachusetts. SSC is an active research facility, which occupies a small peninsula extending from the eastern shoreline of the South Pond of Lake Cochituate, and encompasses approximately 78 acres. Lake Cochituate is made up of three connected ponds (North, Middle, and South Ponds). The land use surrounding SSC includes residential, commercial/retail, and light industrial areas. The facility is located approximately 2,500 feet southeast of the Springvale Municipal Water Supply Well Field (Springvale Well Field). A site location map is provided in Figure 1 and the SSC facility map is provided in Figure 2.

The T-25 Area, named because Building T-25 is located there, is a 15.6-acre rectangular area in the northwestern portion of the SSC facility. Most of the T-25 Area ground surface is covered by buildings or asphalt. Many of the buildings are temporary. The area is ringed by an unpaved road on an embankment approximately 10 feet above the base of the site. The embankment rises an additional 10 feet above the dirt road and is topped by a chain-linked fence, which abuts residential properties. The only open, uncovered areas include a baseball field for employee use located in the northwest corner of the site, and the unpaved perimeter road and embankment. The T-25 Area is bounded to the west, north, and east by residential properties; it is bounded to the south by the rest of the SSC facility.

A more complete description of the facility and the T-25 Area can be found in the Phase II T-25 Area Remedial Investigation Report (Arthur D. Little, Inc., 1998) on pages 1-2 through 1-19.

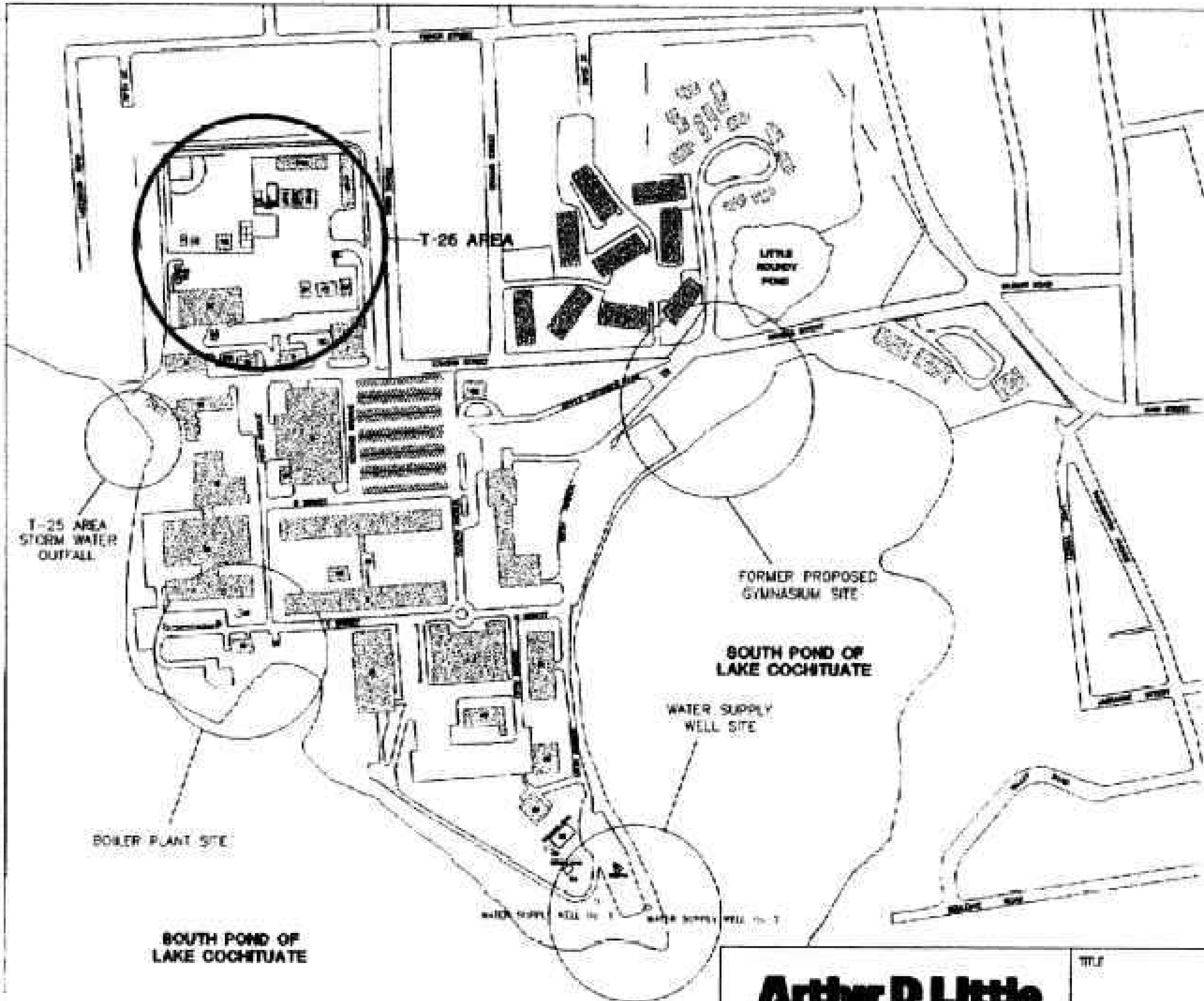


Arthur D Little

TITLE
FIGURE 1
SITE LOCATION MAP

APPROVALS		DATE
DRAWN	MSB	11/99
CHECKED	KJP	11/99
QA/CONTROL	THC	11/99
TECH REVIEW	LA	11/99
PROJ MNGR	KET	11/99

PREPARED FOR: USAEC
SCALE: 1 IN = 1400 FT.
DATE: DEC 1999
DWG NO: E7067 338
SOURCE: ARTHUR D. LITTLE, INC.
SHEET 1 OF 1



SCALE

0 1100 FT.

Arthur D Little

APPROVALS		DATE
DRAWN	MSB	12/99
CHECKED	KJP	12/99
QA/CONTROL	THC	12/99
TECH REVIEW	LA	12/99
PROJ MNGR	KET	12/99

TITLE

FIGURE 2
U.S. ARMY SOLDIER SYSTEMS CENTER FACILITY MAP

PREPARED FOR: USAEC	SCALE: 1 IN. = 550 FT.
DATE: DEC. 1999	DWG. NO.: 67067-339
SOURCE: ARTHUR D. LITTLE, INC.	SHEET 1 OF 1

2.2 Site History and Enforcement Activities

Site History

SSC has previously been called the Quartermaster Research and Engineering Command; the U.S. Army Natick Research and Development Command; the U.S. Army Natick Research, Development, and Engineering Center; and the Soldier Systems Command. SSC has been a permanent Army installation since October 1954. Its mission includes research and development activities in food engineering, food science, clothing, equipment, and materials engineering, and aero-mechanical engineering.

The SSC location was selected in 1949 for development of a research facility from 340 possible sites in 40 states by a special site-selection committee appointed by the Secretary of Defense. The town of Natick was selected because of its proximity to the nation’s capital and to one of the nation’s largest scientific and educational communities. Approval for construction of the facility was granted in October 1949 and construction was completed in October 1954. Much of the topography at the facility was modified during its construction and development.

The T-25 Area buildings are built upon a filled and regraded former gravel pit in the northern portion of SSC that was owned and operated by the town of Natick. The gravel pit was regraded prior to development. The T-25 Area is almost completely paved with the exception of the baseball field and the unpaved perimeter road and embankment. The location of the T-25 Area is illustrated in Figure 2.

Present and past operations within the T-25 Area include: quarrying; indoor and outdoor storage of bulk items, wastes, petroleum, solvents, antifreeze, pesticides, and Freon 113; warehouse operations (shipping and receiving); laboratory research activities including the testing of petroleum, oil, and lubricant (POL) pumping equipment, refrigeration units, and various types of fuel in engines; clothing and textile research; drop-testing; waste incineration; and garage operations including spray painting, vehicle maintenance, insect and rodent control, metal parts and brush cleaning, battery charging, silk screening, and rubber adhesive thinning.

Perchlorethylene (PCE) and trichloroethene (TCE) have been used in the past at the facility for metal parts washing in the garage (Building 14), for dry cleaning in the mobile dry cleaning machines in the T-25 Area, fabric treatment in Building 5 (located just to the south of the T-25 Area), and in relatively smaller amounts in the various laboratories within the facility (in Buildings 4, 7, and 8). TCE was used in the largest volumes in the climatic control chamber (Building 2) located in the south-central portion of the facility, where it was used in a cooling brine solution, and stored in three

1,000-gallon tanks. The climatic control chambers have been remodeled and TCE has been replaced with diethyl benzene (Dowtherm J). PCE and TCE have been used at the facility from the time it was constructed (1954) to the present, in volumes that have steadily decreased over time (presently less than 10 gallons per year for the entire facility). Prior to the facility's construction, the T-25 Area was a town-owned gravel pit. PCE/TCE use during this time is unknown. A more complete description of the facility and the T-25 Area can be found in the Phase II T-25 Area Remedial Investigation Report (Arthur D. Little, Inc., 1998) on pages 1-2 through 1-19.

Federal and State Investigations
A series of investigations have been conducted at SSC and the T-25 Area. A description of the investigations listed below are presented in the *Final Phase II Remedial Investigation Report: T-25 Area at the U.S. Army Soldier Systems Command (SSCOM), Natick, Massachusetts* (Arthur D. Little, Inc. 1998).

- 1980 Installation Assessment - U.S. Army Toxic and Hazardous Materials Agency. 1980. *Installation Assessment of U.S. Army Natick Research and Development Command.* Report No. 170. May.
- 1989 and 1990 Soil Gas Surveys - Northeast Research Institute, Inc. 1990. *Phase II Soil Gas Survey Conducted at the U.S. Army Research, Development, and Engineering Center in Natick, Massachusetts.* April.
- 1991 Expanded Site Investigation - Dames & Moore, Inc. 1991. *Expanded Site Inspection (ESI) of Natick Research, Development and Engineering Center.*
- 1991 Underground Storage Tank Removal Data – summarized in Argonne National Laboratory. 1993. *Master Environmental Plan for the U.S. Army Natick Research, Development and Engineering Center, Natick, Massachusetts.* January.
- 1992 Expanded Site Investigation Addendum – U.S. Army Toxic and Hazardous Materials Agency. 1992. *Addendum Expanded Site Inspection (ESI) of Natick Research, Development and Engineering Center.*
- 1993 Master Environmental Plan – Argonne National Laboratory. 1993. *Master Environmental Plan for the U.S. Army Natick Research, Development and Engineering Center, Natick, Massachusetts.* January.
- 1992 U.S. Army Environmental Center Investigation – Installation and Sampling of 16 Ground Water Monitoring Wells. Results reported in the Phase I Report below.
- 1993/1994 U.S. Army Environmental Center Phase I Remedial Investigation/Feasibility Study- Arthur D. Little, Inc. 1996b. *Final Phase I Remedial Investigation Report, T-25 Area at the U.S. Army Natick Research, Development, and Engineering Center (Natick), Natick, Massachusetts.* August.

- Storage Area Investigation – Arthur D. Little, Inc. 1996a. *Action Memorandum - Storage Area.* June.
- 1995/1996 U.S. Army Environmental Center Phase II Remedial Investigation/Feasibility Study – Arthur D. Little, Inc. 1998. *Final Phase II Remedial Investigation Report: T-25 Area at the U.S. Army Soldier Systems Command (SSCOM), Natick, Massachusetts* December.

Also, the *Final Focused Feasibility Study/Treatability Study Report: T-25 Area at the U.S. Army Soldier Systems Center (SSC), Natick, Massachusetts* was completed in September 1999.

History of CERCLA Enforcement Activities
In May 1993, SSC, then known as the Natick Laboratory Army Research, Development, and Engineering Center was proposed for inclusion on the NPL. It was officially added to the NPL in May 1994 as a result of ground water contamination found at the T-25 Area and its location relative to the town of Natick Springvale Municipal Water Supply Well Field. The Phase I T-25 Area RI was completed in August 1996 and the Phase II T-25 Area RI was completed in December 1998. A Focused Feasibility Study/Treatability Study (FFS/TS) for the T-25 Area ground water was completed in Fall of 1999. The Proposed Plan detailing the Army's preferred remedial alternative for the T-25 Area ground water was presented to the public in September of 1999.

2.3 Community Participation

Throughout the NPL Site's history, community concern and involvement has been high. The Army has kept the community and other interested parties apprised of the NPL Site activities through informational meetings, fact sheets, open houses, press releases, public meetings, Information Repositories, and phone, e-mail, letter, and personal access to Army representatives.

A community relations plan for SSC was prepared in December 1995 and updated in July 1996. The plan outlined a program to 1) educate and inform all interested parties about remedial activities, any potential impacts posed by the site, enforcement activities, and opportunities for public involvement; 2) listen to concerns of organized groups, individuals, and town officials regarding proposed work plans, schedules, remedial activities, and health and environmental concerns; and 3) address community concerns in a timely manner and incorporate public concerns, to the extent possible, in selecting, designing, and implementing the remedial actions.

The public has been involved in a number of different ways. They are kept informed through regular newsletters and open houses, and they have direct involvement as a result of a Restoration Advisory Board (RAB). A RAB was formed for SSC in 1995, with members from the public at large (including SSC neighbors and town representatives), SSC facility staff, and federal and state regulators. Since its inception there have been monthly meetings. The purpose of the RAB is not only informational, but also to actively solicit input from local stakeholders to ensure that any cleanup actions address community concerns. The RAB has allowed the community easy access to the remediation process, kept the community informed, and given them the opportunity to make recommendations that affect the community. Members of the RAB reviewed the planning and report documents, and provided valuable comments and insights on all phases of the process, from investigation through cleanup. In addition, the Army continues to provide the RAB with a list of potential response actions that could be taken at various locations at SSC, and asks for the RAB members to rank the potential actions in terms of importance. The rankings are taken into account by the Army when determining budgetary decisions for the upcoming years.

As part of the CERCLA process, a Technical Assistance Grant (TAG) was made available to a local community group, the Lakewood Association, for use in hiring an independent consultant to provide technical review/evaluation of activities at SSC. The Lakewood Association hired a consultant (Environmental Insight) in 1998, and since then, the consultant has reviewed and commented on a number of planning and report documents produced in association with the T-25 Area.

In March 1993, the Army made the administrative record available for public review. The documents in the administrative record have been available to the public since 1992. The administrative record is maintained at SSC, and at information repositories at the Morse Institute (Natick Public Library), the Natick Board of Health, and the Massachusetts Department of Environmental Protection (MADEP). The Army published a notice and brief analysis of the Proposed Plan in the *MetroWest Daily News* on August 23, 1999, September 22, 1999, and September 23, 1999, and the *Natick Tab* on August 24, 1999 and September 21, 1999, and made the plan available to the public at the information repositories. On September 9, 1999, the Army held an Informational Meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Focused Feasibility Study and to present the Army's Proposed Plan. Also during this meeting, the Army answered questions from the public. The community TAG consultant also presented their comments at the informational meeting. On September 23, 1999, the Army held a Public Hearing to discuss the Proposed Plan and to accept any oral comments. From August 23 to October 1, 1999, the Army held a 30-day public comment period to accept public comment on the alternatives presented in the Focused Feasibility Study and the Proposed Plan and on any other documents previously released to the public.

2.4 Scope and Role of Operable Unit or Response Action

As with many Superfund sites, the problems at SSC are complex. A number of investigations have been completed or are currently ongoing at SSC. This ROD is being written for Operable Unit 1, the T-25 Area ground water. Other areas of SSC either currently under investigation or previously addressed under separate actions include:

Past response actions:
- T-25 Area Storage Area (past soil removal action)

Activities proposed in this ROD:
- **Operable Unit 1: T-25 Area Ground Water**

Future response plans:
- T-25 Area Storm Water Outfall Area
- Former Proposed Gymnasium Site
- Boiler Plant Site
- SSC Water Supply Wells Site
- Main Storm Water Outfall Area

The first response action at the NPL Site addressed an isolated area of pesticide-contaminated soil from a small Storage Area within the T-25 Area, that posed an ecological risk. Approximately 1,000 cubic yards of contaminated soil was removed under a separate removal action. No current soil source area for the observed ground water contamination (PCE and TCE) associated with the T-25 Area was found during the investigations. Therefore, no action for soils is required under this ground water ROD. The remaining soils associated with the T-25 Area do not pose an unacceptable incremental human health or ecological risk. However, some small areas of soil associated with other operable units on-facility are under study for a possible limited soil removal action.

Operable Unit 1, the subject of this ROD, addresses the ground water contamination associated with the T-25 Area. The concentrations of PCE and TCE, and other secondary chemicals of concern in the T-25 Area ground water exceed federal and more stringent state drinking water criteria and acceptable risk levels for a future ingestion of ground water use scenario. This operable unit is the second response action for the NPL Site and addresses the ground water contamination at the NPL Site through the extraction and treatment of ground water.

Field investigations for the other study areas at this NPL Site have been performed, however, at this time, remedial activities have not been planned.

2.5 Site Characteristics

A summary of the site characteristics is provided below. A more detailed analysis of the site characteristics can be found in the Phase II T-25 Area Remedial Investigation Report (Arthur D. Little, Inc., 1998).

Conceptual Model

The conceptual model for the site is illustrated on Figure 3. This model provides the basis for the risk assessments and response actions taken at the site. This ROD is focused on the T-25 Area ground water. Other media in the T-25 Area, including soil, air, and surface water, do not pose risks to human health and/or the environment. Sediment near the T-25 Area outfall in Lake Cochituate is being addressed separately from the ground water.

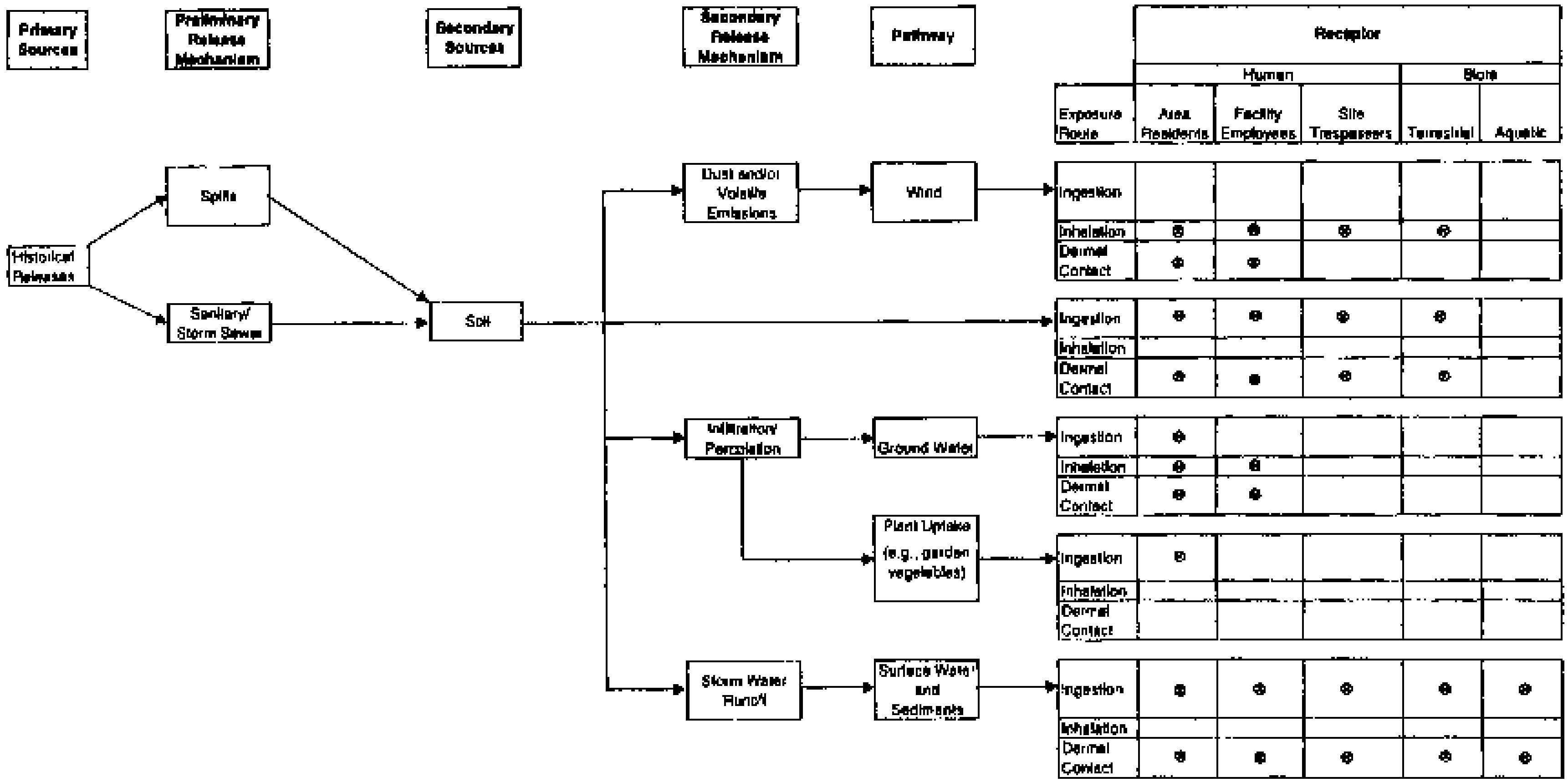
Based on the volatile organic carbon (VOC) contamination found in ground water beneath the T-25 Area, estimated noncancer and cancer risks exceeded the EPA's acceptable risk levels for future residential ground water ingestion and for dermal contact during future industrial use. These results indicate that ground water is a priority for cleanup.

Site Overview

SSC in the town of Natick, Massachusetts, is a research facility occupying a small peninsula extending from the eastern shoreline of Lake Cochituate and is about 74 acres in size. One
surface water body, Little Roundy Pond, is located within the northeastern corner of the facility. Wetlands surround Little Roundy Pond and skirt the shoreline of the Lake Cochituate.

The T-25 Area, named because Building T-25 is located there, is a 15.6-acre rectangular area located in the northwestern portion of the SSC facility. The T-25 Area is a former gravel pit, which was filled with soil and construction debris prior to the development of the overall T-25 Area in the 1950s. The current area consists of paved storage space with permanent and temporary shelters and a ball field.

Figure 3
U.S. Army SSC Conceptual Site Model for Contaminated Ground Water



Notes:

⊗ Indicates that the exposure route for the receptor is likely.
All exposure pathways (ingestion, inhalation, dermal contact) were assessed for each pahtway.

Site Geology

The region surrounding SSC is underlain by unconsolidated sediments of glacial origin dominated by ice contact, till, and glaciofluvial and glaciolucastrine deposits. The regional surficial geology is complicated and heterogeneous due to the coalescing and overlapping of lacustrine deltas from the many ice fronts of the retreating glacier. The result of this depositional history is a complex distribution of stratigraphic horizons and laterally discontinuous beds of glacial deposits.

Overburden thickness in and around the T-25 Area ranges from approximately 155 feet at the northeast boundary (EB-42E-HP), to 199 feet at the southwest (EB-51E-HP) and northwestern (EB-208E-HP) boundaries. In general, overburden thickness increases to the west and north. The unconsolidated overburden deposits observed at SSC can be divided into six broad stratigraphic units listed generally in order of depth from ground surface : 1) sand and gravel, 2) fine-to-medium sand, 3) silty sand, 4) silt, 5) clayey silt, 6) glacial till. Bedrock at SSC is encountered at depths ranging from approximately 54 to 199 feet below ground surface (bgs), and elevations ranging from 34 feet below mean sea level (msl) to 107 feet above msl. The lithology of the bedrock at SSC is consistent with the regional bedrock descriptions, and consists primarily of Dedham Granodiorite and Diabase/Hornblende Gabbro Undivided. Bedrock cores collected at SSC displayed varying degrees of competency. A geologic cross section of the site is illustrated on Figure 4.

The soils borings and monitoring wells at the site are described using an alphabetic identification system, which corresponds to absolute elevations above msl, or depths bgs relative to the T-25 Area. All wells/borings whose depths are generally less than 30 bgs within the T-25 Area and are screened across the top of the water table, are in the A-interval. B-interval wells/borings are screened at the target depth of the Springvale wells, and/or those wells that are set on top of the clayey silt layer with depths typically ranging from 30 to 65 feet bgs within the T-25 Area. C-interval wells/borings are typically encountered in or immediately below the clayey silt layer, and have screens set at least 10 feet in elevation lower than the Springvale wells. D-interval wells/borings are defined as being below the C-interval but above the top of bedrock. Any wells/borings whose screens are set in bedrock are in the E-interval.

Site Hydrogeology

Ground water at the T-25 Area is generally encountered between 14 and 16 feet bgs. The overburden aquifer at the T-25 Area can be characterized by two main hydrostratigraphic units: an upper unconfined gravel to silty sand unit [which includes the A- (less than 30 feet bgs in the T-25 Area) and B- (30 to 65 feet bgs in the T-25 Area) intervals] and a lower silty sand to clayey silt unit. The upper and lower portions of the aquifer are separated by a layer of light olive gray clayey silt. The upper portion

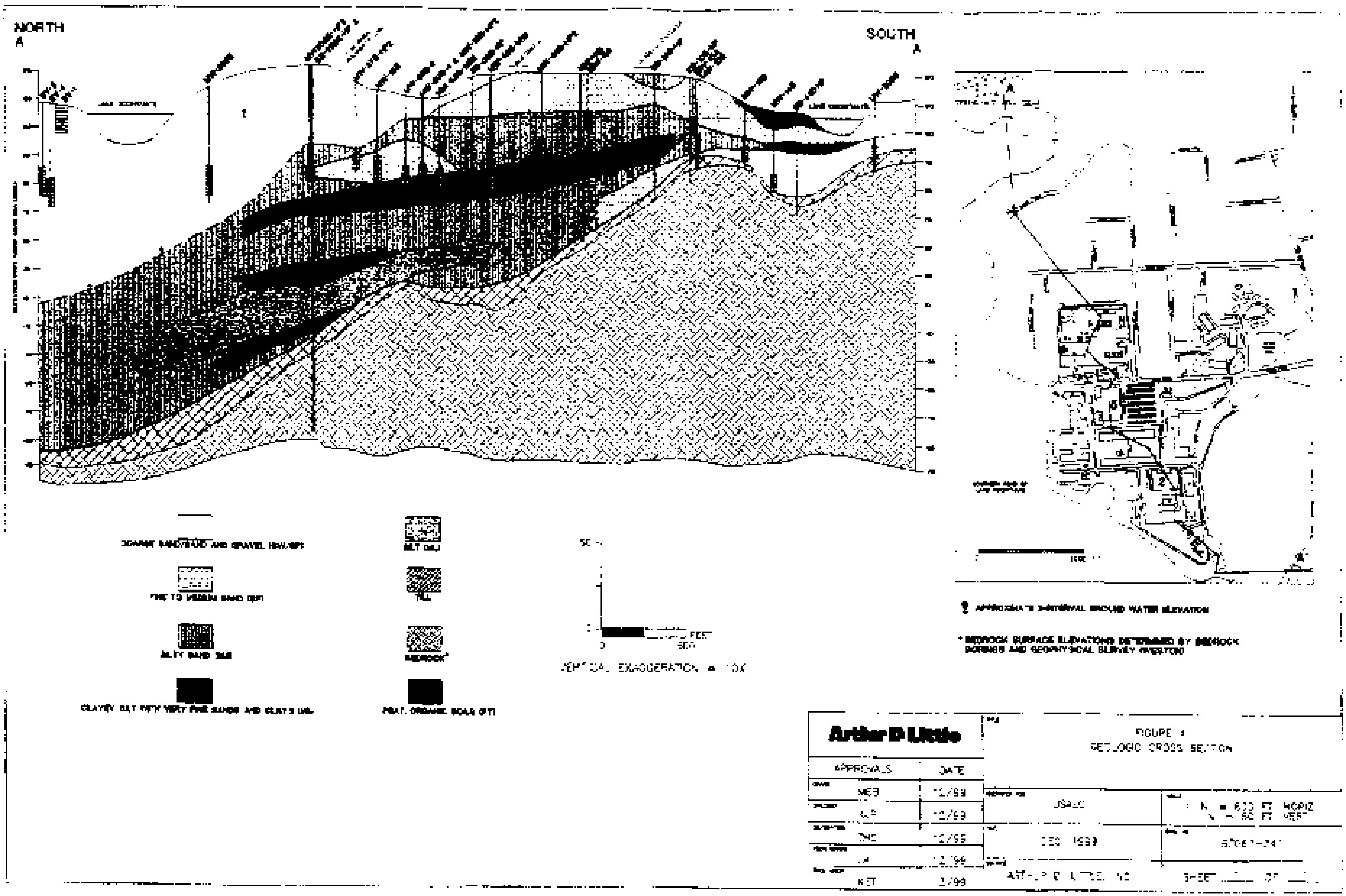

NORTH
A
SOUTH
A'
FINE TO MEDIUM SAND (SP)
SILTY SAND (SM)
TILL
BEDROCK*
PEAT, ORGANIC SOILS (PT)
VERTICAL EXAGGERATION = 10X
APPROXIMATE 3-INTERVAL GROUND WATER ELEVATION
* BEDROCK SURFACE ELEVATIONS DETERMINED BY BEDROCK BORINGS AND GEOPHYSICAL SURVEY
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FIGURE 4
GEOLOGIC CROSS SECTION
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of the aquifer (A- and B-intervals) was the focus of the Phase II investigation because it is where most of the PCE and TCE have been found in previous investigations. PCE and TCE concentrations up to approximately 1,000 to 2,000 μg/L have been found in ground water samples from the B-interval. PCE and TCE have generally not been detected at concentrations greater than 10 μg/L in any ground water samples collected from the shallow A-interval (water table). Field-screened ground water samples collected from depths below the B-interval (including the bedrock) were relatively free of PCE and TCE, with only sporadic detections at concentrations below 10 μg/L.

The geologic materials encountered in the T-25 Area are fairly heterogeneous with lenses of very fine material, and sands and gravels. As is commonly the case for glacial aquifers, ground water flow through the aquifer at the site was determined to be highly anisotropic with horizontal hydraulic conductivities higher than vertical hydraulic conductivities.

Ground water flows across the T-25 Area in the A-interval (less than 30 feet bgs) and B-interval (30 to 65 feet bgs) to the west-northwest with a downward vertical component, over a relatively gradual gradient. Ground water elevation and the magnitude of the horizontal gradient appear to fluctuate seasonally, though ground water flow direction generally remains constant. Long-term ground water elevation monitoring and the preliminary results from the ground water model indicate that a connection between Lake Cochituate and the aquifer exists.

The A- and B-intervals of the aquifer responded differently to aquifer stresses (e.g., pump tests and precipitation events) in the T-25 Area, suggesting they are weakly connected. Chemical data collected during the field screening and quarterly sampling programs also support this theory. PCE and TCE have generally not been detected at concentrations greater than 10 μg/L in any ground water samples collected from the A-interval. However, widespread and elevated concentrations of PCE (up to 2,000 μg/L) and TCE (up to 1,100 μg/L) have been detected in samples collected from the B-interval. The difference in response could also indicate a contrast in storage properties or differences between horizontal and vertical hydraulic conductivity of the A- and B-intervals.

The aquifer beneath the site has been classified by the state of Massachusetts as Groundwater 1 (GW-1) under the MCP, and was determined to be of high use and value. This classification is based on the proximity of the Interim Wellhead Protection Area for the Springvale Well Field, the existence of Potentially Productive Aquifers within the site, and the known regional ground water pathways that feed the Springvale Well Field.

The ground water model developed for the site consists of a three-dimensional grid that is sufficiently large enough to represent the relationship among Lake Cochituate, the local ground water, and the town of Natick drinking water supply wells. Appendix D includes a letter report summarizing the preliminary 1999 ground water model assumptions and results. A more detailed ground water model report is expected to be available in the Winter/Spring 2000.

Surface and Subsurface Features

SSC currently has two EPA-regulated underground storage tanks, one containing diesel and one containing gasoline. Both tanks have a 2,000-gallon capacity and currently meet 1998 specifications. SSC also has six consumptive-use 20,000-gallon heating oil (No. 6) tanks and one 10,000-gallon diethylbenzene (o,m,p mixture, 97 percent) tank, all of which are state regulated. SSC also has one 1,000-gallon underground propane tank.

Two oil/water separators are located in the T-25 Area for storm water drainage. A hazardous waste storage facility and a drum-holding area exist within the T-25 Area. Other structures located in the area include temporary storage facilities for Army supplies and a warehouse. A small office building is also located in the T-25 Area. There are no areas of archaeological or historical importance. A map of the T-25 Area is shown on Figure 2.

Sampling Strategy

The field sampling portion of the Phase I T-25 Area Remedial Investigation (RI) was conducted from July 1993 until December 1993. The purpose of this investigation was to (1) identify the source(s) of contamination at the T-25 Area, (2) identify the nature and extent of contamination from the T-25 Area, (3) identify any potential sensitive receptors of the ground water contamination, (4) estimate the potential risk to human health and the environment posed by the ground water contamination at the site, and (5) characterize the hydrogeology of the T-25 Area sufficiently for the design of a remedial system for the ground water in the area. Soil, ground water, surface water, and sediment samples were collected and analyzed to characterize contamination present, identify localized potential sources, and assess the likelihood and potential impact of off-facility contaminant migration.

The field sampling portion of the Phase II T-25 Area RI occurred from September 1995 until May 1996. During the Phase II RI, soil, ground water, surface water, and sediment samples were collected and analyzed to evaluate data gaps from the Phase I investigation. The analytical results were used to characterize contamination present, identify localized potential sources, and assess the likelihood and potential impact of off-facility contaminant migration. Both the Phase I and Phase II RIs involved a combination of a document review, interviews, a field-screening program, a hydrogeologic characterization, and a multimedia sampling program.

A phased approach was used for ground water characterization for both RIs. The first phase included a fast-paced screening program to identify potential contaminant sources and to assess the nature and extent of the contamination. Field screening samples were collected both on site and off site from small-diameter wells, soil borings, and bedrock borings. The second phase included installing standard monitoring wells in areas needed to characterize the lateral or vertical extent of contamination or in contaminant “hot spots”. Standard monitoring wells were also installed to obtain additional information on upgradient water quality and hydrogeologic conditions.

This ROD addresses ground water contamination at the T-25 Area of SSC only. All other media will be addressed in separate actions or as separate operable units at SSC.

Known or Suspected Sources of Contamination

Despite the exhaustive number of soil and ground water samples collected at the site, the present and previous investigations have not conclusively identified the source(s) of contamination to the ground water at the T-25 Area. Various activities throughout the T-25 Area over the past 40 years may have contributed minor contamination to the ground water at the site. These activities included metals parts washing, mobile dry cleaning, laboratory usage, and storage and transport of cooling brine containing TCE. Contamination released during these activities may have contributed to the TCE and PCE ground water contamination found at the site. In addition, leaky sanitary or storm water sewer lines to the south of the T-25 Area may have contributed to ground water contamination, through the transport of materials/liquids improperly disposed of in laboratory sinks, catch basins, floor drains, and/or storm drains.

There is no evidence of a current, active contaminant source(s). If the source(s) was current, the contaminant distribution would be different. One would expect the shallow aquifer in the T-25 Area to contain high contaminant concentrations. If the release(s) was recent and to the ground surface, significant contaminant concentrations also would be found in the unsaturated zone, and shallow ground water in relatively close proximity to the areas of elevated concentration. This is especially true because the majority of the site is currently covered by asphalt, preventing surface water infiltration and percolation through the unsaturated zone and, therefore, preventing the leaching of contaminants from the soil. A large number of soil samples from the unsaturated zone, and ground water samples from the shallow portions of the aquifer, have been collected across the T-25 Area, specifically near suspected source areas. PCE and TCE have not been detected in any of the soil samples, and only low levels of PCE and TCE have been detected in shallow ground water samples. These results do not indicate a current or recent source, active or inactive.

Types of Contamination and Affected Media
The nature and extent of ground water contamination are summarized below. A detailed description of the nature and extent of contamination for all media can be found in the *Phase II T-25 Area RI Report* (Arthur D. Little, Inc., 1998).

On-Facility Ground Water Contaminants. Data from the Phase I and Phase II T-25 Area RI field screening programs, and from 20 rounds of quarterly ground water monitoring, indicate that VOCs are present in the ground water beneath the T-25 Area at SSC. The VOCs are limited primarily to TCE, PCE, and to a much lesser extent, cis-1,2-dichloroethene (DCE). PCE and TCE are the only volatile organics listed as COCs. The total mass of PCE and TCE associated with Operable Unit 1 was estimated in the ground water flow and contaminant transport model as 78 kilograms (HydroGeologic, Inc.). During the first two years of the Treatability Study, a total of approximately 20 kilograms of PCE and TCE have been removed from the aquifer.

The ground water model is draft and is subject to change, as more data become available. Any changes to the model are not anticipated to substantially affect the analysis presented in this ROD. Appendix D includes a letter summarizing the current ground water model results and its assumptions (e.g., treatment system and town of Natick water supply pumping rates, lake contribution factors).

The highest PCE and TCE concentrations have been found in the B-interval (30 to 65 feet bgs within the T-25 Area) above the clayey silt layer, primarily from the southwestern to north-central portions of the T-25 Area. PCE and TCE have generally not been detected at concentrations greater than 10 µg/L is any ground water samples collected from the A-interval (less than 30 feet bgs within the T-25 Area) or from below the clayey silt layer (i.e., the C- or D-intervals). [The C-interval is generally defined as being at least 10 feet below the bottom of the screen for the deepest Springvale well (73.4 feet above msl). The D-interval is defined as being below the C-interval but above bedrock]. TCE and PCE were not detected in any bedrock ground water samples (E-interval).

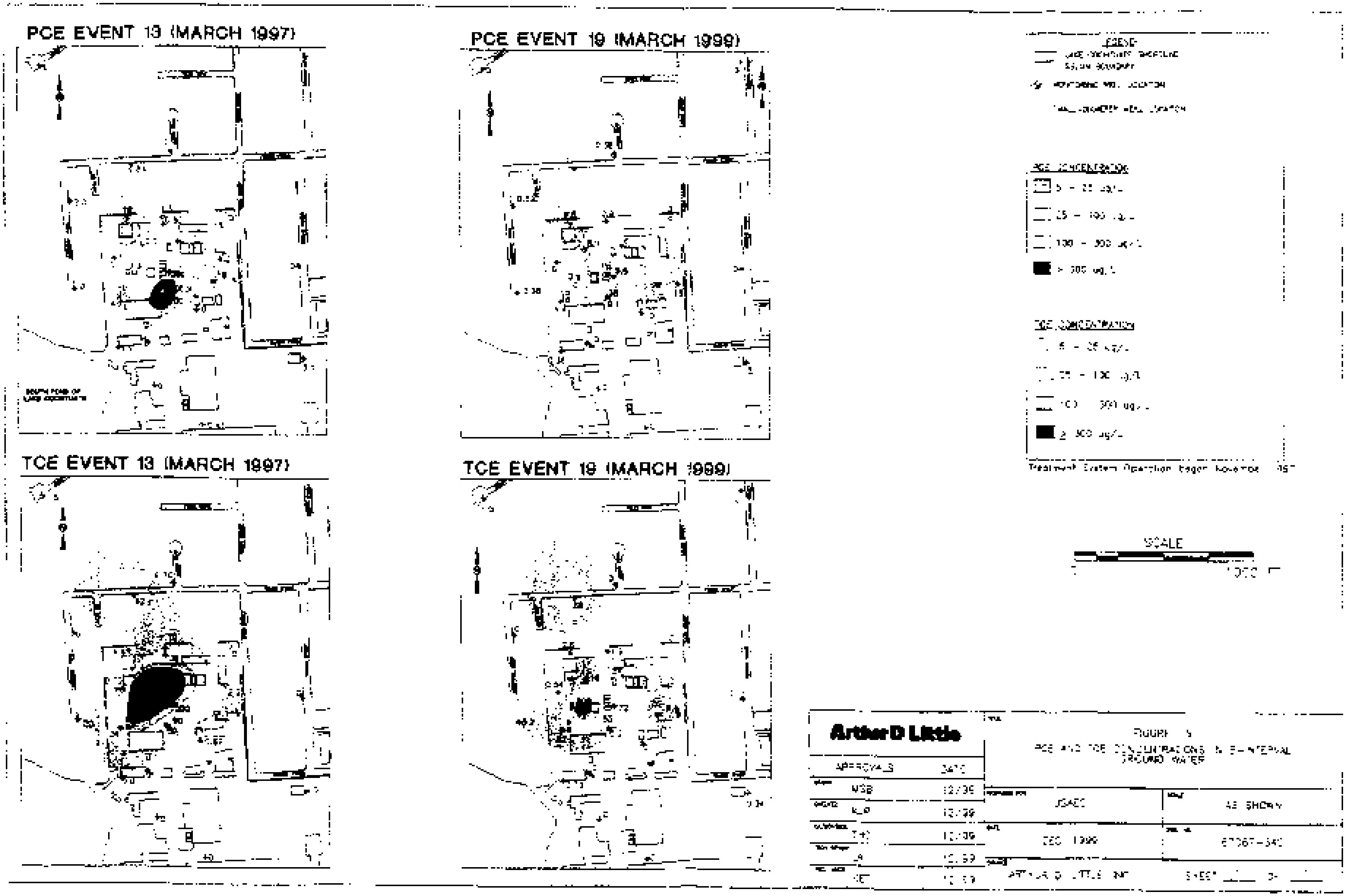
The highest PCE concentrations observed during quarterly monitoring (up to 2,000 µg/L during Round 4 in Summer 1994) were found in samples collected from the southwestern portion of the T-25 Area, immediately northeast of Building 20. PCE has been detected less frequently than TCE. The highest concentrations of TCE during quarterly monitoring (up to 1,100 µg/L during Round 4 in Summer 1994) have been found in samples collected from wells near Buildings T-24 and T-27 (in the northeast portion of the T-25 Area), as well as in samples from the southwestern portion of the T-25 Area near Buildings T-62, T-68, and 20. TCE is more widespread than PCE but is generally at lower concentrations. PCE and TCE concentration contours in the B-interval, based on Winter 1996/97 data (Event 13), are illustrated in Figure 5. Prior to the treatment system operation (beginning in November 1997), PCE and TCE concentrations in ground water associated with the T-25 Area had not changed significantly over six years of quarterly monitoring. The most recent quarterly ground water data following treatment system operation shows significant contaminant concentration decreases, as shown on Figure 5. In the T-25 Area, for example, the PCE concentration in well MW-18B-HP2 has decreased from 1000 µg/L to 9.1 µg/L; the PCE in MW-83B-2 has decreased from 300 µg/L to 9.6 µg/L; and the TCE in MW-37B-HP2 has decreased from 390 µg/L to 19 µg/L. Outside of the T-25 Area on Lakewood Road, the TCE in MW209B-HP2 has decreased from 23 µg/L to 5.7 µg/L.

In general, semivolatile organic compounds (SVOCs) and pesticides were detected sporadically and at low concentrations in ground water samples collected from the T-25 Area. Only bis(2-ethylhexyl)phthalate and DDT exceeded their GW-1 criteria (Maximum Contaminant Levels [MCLs] are not available for these chemicals). One polychlorinated biphenyl (PCB), Aroclor-1016, was detected at concentrations exceeding its MCL in five ground water samples collected from the T-25 Area, however, each detection was directly associated with inadvertent laboratory or field blank contamination. Bis(2-ethylhexyl)phthalate and Aroclor-1016 were also detected at concentrations exceeding GW-1 criteria or MCLs in samples from background wells.

Six metals exceeded their MCL or GW-1 criteria in unfiltered ground water samples collected from both the T-25 Area and background monitoring wells. These include beryllium, chromium, lead, nickel, thallium, and vanadium.

Off-Facility Ground Water Contaminants. Eight permanent monitoring wells have been installed and routinely monitored off-facility and downgradient of the T-25 Area to assess the extent of ground water contamination present at the site. They include three on Lakewood Road (MW-201A, MW-201B, and MW209B-HP2), two on Fisher Street (MW-205B and MW208B-HP2), two on Second Street (MW-203B and MW207B-HP2), one on Arcadia Road (MW-202B). Seven of these wells monitor the B-interval of the aquifer, because this is the interval where the highest concentrations of PCE and TCE have been detected on-facility. All of these off-facility wells have been sampled quarterly since their installation in 1992/93 and in 1995/96.

Well MW208B-HP2 was installed in 1995 to the north of the T-25 Area on Fisher Street and well MW209B-HP2 was installed in 1996 to the west of the T-25 Area on the southernmost end of Lakewood Road as part of the Phase II T-25 Area RI. These wells are screened within the B-interval at depths of 70 to 80 feet bgs and 65 to 75 feet bgs, respectively. Quarterly ground water samples from these wells have contained the highest VOC concentrations of any of the off-facility wells, however, the concentrations


PCE EVENT 13 (MARCH 1997)
PCE EVENT 19 (MARCH 1999)
TCE EVENT 13 (MARCH 1997)
TCE EVENT 19 (MARCH 1999)
LEGEND
PCE CONCENTRATION
5 - 25 ug/L
25 - 100 ug/L
100 - 300 ug/L
> 300 ug/L
TCE CONCENTRATION
5 - 25 ug/L
25 - 100 ug/L
100 - 300 ug/L
≥ 300 ug/L
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are significantly lower than on-facility concentrations. The highest TCE concentration in ground water samples from MW208B-HP2 was 73 µg/L (May 1996); the highest PCE concentration was 18 µg/L (July 1997). In March 1999 (after approximately one and one half years of treatment system operation), the concentration of TCE was 28 µg/L and PCE was not detected, in ground water samples from MW208B-HP2. The highest TCE concentration in ground water samples from MW209B-HP2 was 23 µg/L (March 1997) and PCE has not been detected above the detection limit; in March 1999 the concentration of TCE was 5.7 µg/L. PCE and TCE are the only VOCs detected in off-facility wells that exceed MCLs.

PCE and TCE concentrations in the remaining off-facility wells have generally been below 5 µg/L in B-interval wells (MW-201B, MW-202B, MW-203B, and MW-205B), and not detected (detection limit-2 µg/L) in the A-interval well (MW-201A). Low concentrations of TCE have been detected more consistently than PCE in wells MW-205B (Fisher Street) and MW-202B(Arcadia Road), while PCE has been detected more consistently than TCE in wells MW-201A and MW-201B (Lakewood Road). Approximately 2 µg/L of TCE (below the MCL of 5 µg/L) has been detected consistently in MW-202B, which is located on Arcadia Road, almost equidistant between the T-25 Area and the Springvale Well Field.

The PCE and TCE plume geometries extend to the west and northwest beyond the T-25 Area boundary, and reflect general ground water flow directions. TCE concentrations extend farther north (to MW-202B) than PCE concentrations. This is expected since TCE has a greater solubility and a lower K_{oc} than PCE, making it more mobile in ground water. PCE and TCE concentration contours in the B-interval prior to the treatment system operation (beginning in November 1997) and the most recent concentration contours are shown in Figure 5.

Chemicals of Concern

The primary (or principal threat) COCs in ground water are PCE and TCE. The secondary COCs in ground water include metals (chromium, lead, manganese, nickel, thallium, vanadium), bis(2-ethylhexyl) phthalate (a plasticizer), and DDT (a pesticide). While these secondary contaminants may contribute some risk, it is unclear whether their presence is site related. This uncertainty is due to some question about the sampling technique used during the investigation phases and/or whether they are present due to ambient conditions. Since they may contribute some risk, they are addressed in the T-25 Area ground water cleanup. No low-level threat wastes have been identified in the T-25 Area.

The COCs for the T-25 Area ground water, along with the characteristics underlying the concern, and cleanup goals are shown below in Table 1.

Table 1: Chemicals of Concern and Cleanup Goals

Chemicals	Cleanup Goal, µg/L
Primary Chemicals of Concern and Characteristic	
Perchloroethene (PCE) – Carcinogenic, Noncarcinogenic	5
Trichloroethene (TCE) – Carcinogenic, Noncarcinogenic	5
Secondary Chemicals of Concern and Characteristic	
Chromium – Noncarcinogenic	100
Lead – Toxic	15
Manganese – Noncarcinogenic	1,700
Nickel – Noncarcinogenic	100
Thallium – Toxic	2
Vanadium – Noncarcinogenic	50
DDT – Carcinogenic, Noncarcinogenic	0.3
Bis(2-ethylhexyl)phthalate – Carcinogenic, Noncarcinogenic	6

Location of Contamination and Known or Potential Routes of Off-facility Migration. Site data, along with the physical and chemical properties of individual contaminants, were used to evaluate the fate and transport of chemicals associated with the T-25 Area ground water. Potential contaminant sources, transport pathways, observed trends in behavior, and anticipated environmental fate is summarized below. Fate and transport mechanisms for ground water are discussed in more detail in the *Phase II T-25 Area RI Report* (Arthur D. Little, Inc., 1998).

TCE and PCE contamination in the B-interval is relatively widespread across the T-25 Area. The highest concentrations are primarily found from the southwestern to north-central portions of the T-25 Area at depths of 40 to 65 feet bgs; concentrations in other parts of the site are generally an order-of-magnitude lower. The data suggest that the clayey silt layer encountered at approximately 65 feet bgs in the T-25 Area effectively inhibits contaminant migration to deeper portions of the overburden aquifer and bedrock. Seasonal ground water contaminant concentrations do not appear to fluctuate significantly and have been relatively stable over time (since monitoring started in 1993), indicating limited migration (and/or steady-state equilibrium may have been achieved). Contaminants within the T-25 Area should migrate slowly to the west-northwest with ground water, based on the low tendency the compounds have for adsorption and low on-facility organic carbon content of the aquifer (the contaminants should be relatively unimpeded). PCE and TCE have been observed at lower concentrations in off-facility monitoring wells located close to and downgradient of the borders of the T-25 Area, in comparison to the T-25 Area concentrations. Because a current, ongoing source has not been found, contaminant concentrations are expected to decrease over time, due to mixing and dilution in the aquifer.

2.6 Current and Potential Future Site and Resource Uses

The T-25 Area consists of buildings and a ballfield used by SSC staff. Residential areas surround the T-25 Area to the west, north, and east. The T-25 Area storm water outfall is on Lake Cochituate and will be addressed under a separate operable unit. Future land use is expected to remain the same as current land use. SSC is currently operational and there are no plans or expectations that this will change in the future. Because future land use is expected to remain the same as current land use, it is unlikely that residences will be built on the T-25 Area. If, in the future, the facility is closed and transferred to residential use, the standard Army base closure procedures would be followed. These procedures would include an environmental baseline study to determine potential environmental risks.

Currently, portions of the T-25 Area lie within the Interim Wellhead Protection Area of the town of Natick's Springvale Municipal Water Supply Well Field. The state-required Zone II wellhead delineation of the Springvale Well Field has not been conducted, however, it is planned for in the near future. The aquifer beneath the T-25 Area has been classified by the state of Massachusetts as GW-1 and was determined to be of high use and value. This classification is based on the proximity of the Interim Wellhead Protection Area for the Springvale Well Field, the existence of Potentially Productive Aquifers within the site, and the known regional ground water pathways that feed the Springvale Well Field.

The Springvale Well Field is one of five municipal well fields (Springvale, Evergreen, Pine Oaks, Elm Bank, and Morse's Pond) that supplies drinking water to the town of Natick. The current drinking water source for SSC is the town of Natick drinking water supply system.

2.7 Summary of Site Risks

2.7.1 Human Health Risk Assessment

The baseline risk assessment estimates what risks the site poses if no action cleanup were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the

ROD summarizes the results of the baseline human health risk assessment for the T-25 Area at SSC.

The Army, together with input and oversight from EPA and MADEP, conducted a Human Health Risk Assessment (HHRA) to estimate the probability and magnitude of potential adverse human health effects from contaminants associated with the T-25 Area site. The results of the HHRA were used to determine the need for cleanup at the T-25 Area. A separate HHRA was conducted for the Storage Area surface and subsurface soils, resulting in a removal action for the soils from this area in fall 1997. The same risk assessment approach was taken for the T-25 Area and for the Storage Area. The risk of harm to human health is evaluated by calculating incremental cancer and non-cancer risks associated with potential public exposure to contaminants of concern, and comparing the estimated risks to risk limits published in the NCP.

The HHRA consisted of the four sections listed below in Table 2.

Table 2. Human Health Risk Assessment Sections

Section	Purpose
Identification of Chemicals of Concern	Compiled data, evaluated data, and selected chemicals of concern for each medium, focusing the HHRA on the chemicals of the most potential concern at the site
Exposure assessment	Identified exposure pathways and potential human receptors at the T-25 Area and surrounding areas
Toxicity Assessment	Quantified, where published data were available, the potential toxic effects associated with exposure to the selected chemicals of concern, including noncancer and cancer health effects
Risk characterization	Quantified the potential noncancer and incremental cancer health effects for each exposure pathway

Identification of Chemicals of Concern

When a large number of contaminants exist at a site, the HHRA may be simplified by selecting a subset of chemicals of concern (COCs) for each medium. The selection of a subset of COCs focuses the discussion of risk on those compounds that account for the greatest potential risks. The selection of COCs was based on four criteria: (1) comparison of the maximum detected concentrations in ground water to available risk-based criteria or guidelines; (2) comparison of the maximum detected concentrations in ground water to site-specific background (note: background was not used to eliminate any potential COCs in the risk assessment); (3) frequency of detection; or (4) professional judgement (e.g., blank contamination, essential nutrients).

Data for selected COCs in ground water are summarized in Table 3. The maximum detected concentration of each COC in ground water was used both in the selection of COCs and in the quantitation of potential human health risks, as recommended by EPA Region I. Selected COCs in each medium, estimated human health and ecological risks, and recommended actions are summarized in Table 4.

Exposure Assessment
Potential human health effects associated with exposure to the COCs in each medium were estimated quantitatively using several hypothetical exposure pathways and exposure routes (e.g., ingestion, dermal contact, and inhalation), as described in Section 6.4 of the *Phase II T-25 Area RI Report* and in the conceptual model (Section 2.5 and Figure 3). The conceptual site model assumes potential exposures to site soil, dust and/or volatile emissions, ground water, surface water, and/or sediments could occur for area residents, facility employees, and site trespassers. Exposure pathways were identified by considering current and potential future site uses, along with consideration of contaminated media. SSC is an operating research laboratory, with restricted access. The T-25 Area consists of buildings and a ballfield used by SSC staff. Residential areas surround the T-25 Area on three sides.

Future land use is expected to remain the same as current land use. The facility is currently operational and there are no plans or expectations that this will change in the future. Because future land use is expected to remain the same as current land use, it is unlikely that residences will be built on the T-25 Area and that residential soil contact or use of ground water will occur. However, the basis of the ground water risk assessment is the potential future use of ground water by future industrial workers and future residents who may install a well and use the ground water from beneath the T-25 Area. For potential future residential exposures to ground water, the HHRA evaluated ingestion and dermal contact during household water use. For future worker exposure routes to ground water, the HHRA evaluated inhalation and dermal contact. Potentially exposed populations evaluated are described in Table 5.

Table 3
Field Event: T-25 Area
Ground Water - Chemicals of Concern
Statistical Report

Chemical Name	Average	Minimum Detected	Maximum Detected	Location of Maximum	Detects/ Samples
Pesticides/PCBs (UGL)					
4,4'-DDE	0.0121	0.00223	0.0921	MW-32B-HP2	5 / 47
4,4'-DDT	0.0286	0.00782	0.549	MW-32B-HP2	6 / 47
Dieldrin	0.00980	0.00201	0.0233	MW-202B	5 / 47
Endrin Ketone	0.00910	0.0136	0.0139	MW-2B	2 / 22
Semivolatile Organics (UGL)					
Bis(2-Ethylhexyl)Phthalate	15.0	3.80	62.0	MW-18B-HP2	15 / 48
TAL Metals (UGL)					
Arsenic	6.55	1.08	28.8	MW208B-HP2	31 / 75
Barium	106	3.72	632	MW-37B-HP2	65 / 75
Beryllium	2.03	0.307	6.52	MW-37B-HP2	23 / 75
Chromium	104	4.72	2,700	MW-39B-HP4	53 / 75
Copper	25.7	2.28	293	MW-37B-HP2	53 / 75
Iron	14,200	49.9	233,000	MW-37B-HP2	74 / 75
Lead	9.69	1.35	64.9	MW-37B-HP2	49 / 75
Manganese	514	1.79	5,520	MW-37B-HP2	73 / 75
Molybdenum	51.0	8.96	172	MW209B-HP2	5 / 49
Nickel	49.6	14.2	928	MW209B-HP2	36 / 75
Thallium	4.76	2.43	4.91	MW-37B-HP2	16 / 75
Vanadium	32.4	2.18	403	MW-37B-HP2	33 / 75
TAL Metals (Filtered) (UGL)					
Arsenic	3.68	1.71	28.5	MW-51B-HP2	7 / 75
Barium	70.0	3.89	425	MW-8	62 / 75
Beryllium	2.17	0.239	1.03	MW-27B-HP2	12 / 75
Chromium	4.99	4.60	6.57	MW-3B	4 / 75
Copper	9.29	2.08	18.6	MW-2	16 / 75
Iron	357	25.2	8,270	MW209B-HP2	40 / 75
Lead	2.93	1.18	43.3	MW-51B-HP2	19 / 75
Manganese	117	1.48	1,190	MW-37B-HP2	60 / 75
Molybdenum	49.2	13.4	13.4	MW-3B	1 / 49
Nickel	22.4	11.3	68.3	MW-90B-4	13 / 75
Thallium	4.81	2.39	3.39	MW-8	7 / 75
Vanadium	24.0	1.20	24.1	MW-201B	4 / 75
Volatile Organics (UGL)					
Tetrachloroethene	74.5	0.280	2,000	MW-18B-HP2	127 / 228
Trichloroethene	43.1	0.470	500	MW-37B-HP2	146 / 228
cis-1,2-Dichloroethene	7.30	0.380	69.0	MW-18B-HP2	42 / 228

Table 4: Selected Chemicals of Concern and Estimated Risks at the T-25 Area

Media	Potential Chemicals of Concern	Estimated Human Health Risks	Risk to Environment	Recommended Action
Surface Soil	SVOCs, metals, pesticides (1)	Meets EPA guidelines (2)	Below background	Further Study (1)
Subsurface Soil	None	Meets EPA guidelines (2)	Not applicable	None (1)
Surface Water	VOCs, SVOCs, pesticides	Meets EPA guidelines (2)	Risks not high or widespread in absolute terms and relative to background	None
Sediments	SVOCs, metals, pesticides	Meets EPA guidelines (2)	Elevated levels	Further Study (4)
Ground Water	PCE, TCE, pesticides, metals	Exceeds EPA guidelines for potential future use (3)	Not applicable	Treat and monitor underground water

Notes:

(1) The soils associated with the T-125 Area do not pose an unacceptable human health or ecological risk. Further, nothing was detected in samples of the surface soils that would contribute to ground water contamination. Previously, an isolated area of soil contaminated with pesticides, which did pose some ecological risk to wildlife, was removed in December 1997 under a separate removal action. No current soil source area for the observed ground water PCE and TCE contamination was found during the investigation. Therefore, no action for soils is required under this ground water ROD. However, some small areas of soil associated with other operable units on-facility are under study for a possible limited soil removal action.

(2) EPA guidelines state that exposures at a site are acceptable if either or both of the following are true:
- Estimated incremental cancer risks are within or below the range of an increased risk (or probability) of cancer for an exposed individual of one in ten thousand to one in one million.
- Noncancer hazard indices are less than one (hazard indices compare site concentrations with acceptable doses of a chemical; acceptable doses are defined as doses that will not cause adverse noncancer health effects.)

(3) Risks were estimated for future residential or industrial use of ground water; however, use of this ground water is very unlikely in the future.

(4) Recommended a Tier II Ecological Risk Assessment. The sediments associated with the T-25 Area outfall are being treated as a separate action from the T-25 Area ground water (OU-1) for this ROD.

Table 5: Potentially Exposed Populations Considered in the Human Health Risk Assessment

Medium	Potentially Exposed Populations	Time Frame
Surface Soil	Facility employees using the ballfield Trespassers on the ballfield Residents near the site potentially exposed to windblown dust from the ballfield Construction workers in the T-25 Area	Current and future Current and future Current and future Future
Surface Water/Sediments	Recreational users of the beach next to the T-25 Area storm water outfall	Current and future
Ground Water	Workers using site ground water for industrial uses Residential users of ground water	Future Future

Quantification of exposure consists of determining exposure concentrations, then selecting exposure parameters. Both average and upper-bound exposure scenarios were quantified using the 95 percent upper confidence limit of the mean (UCL) in combination with average and upper-bound exposure parameters. The upper-bound scenario is less likely to occur for the potentially exposed populations, but is presented to provide a range of site risks, and to protect sensitive subpopulations, such as children or the elderly. Exposure parameters were selected based on EPA guidance or on best professional judgment, as described in Section 6.4.2.2 of the *Phase II T-25 Area RI Report.*

Toxicity Assessment

The dose-response assessment used published toxicity values derived by the EPA, that provide quantitative estimates of the toxicity of chemicals and resultant toxic effects. For substances suspected to cause noncarcinogenic chronic effects, a reference dose (RfD) is developed by EPA. The RfD is expressed as a chronic intake level (in units of mg/Kg/day) below which no adverse effects are expected. For carcinogenic effects, cancer slope factors (CSFs) have been developed. CSFs are quantitative risk estimates of carcinogenicity derived by the EPA. CSFs relate the lifetime probability of excess tumors to the lifetime average exposure dose of a substance. The EPA also provides a Weight-of-Evidence classification for carcinogenicity based on an evaluation of the likelihood that the agent is a human carcinogen. The most current toxicity values located in the Integrated Risk Information System (IRIS) (EPA, 1997) or in the Health Effects

Assessment Summary Tables (HEAST) (EPA, 1995) were used in the HHRA. Toxicity may vary by route of exposure, thus oral and inhalation toxicity values were used, when available, although for dermal exposure routes, oral toxicity values were used.

The toxicity values for COCs in ground water are listed in Table 6.

Risk Characterization

Risk characterization combines the exposure assessment and the toxicity assessment to calculate the potential for noncancer or cancer health effects as a result of exposures to the selected COCs. Noncancer effects are estimated by dividing the average daily dose by the appropriate toxicity value (chronic RfD or subchronic RfD) to yield a hazard quotient (HQ) for individual chemicals and a hazard index (HI), the total of all HQs for a particular exposure route. An HQ or HI greater than one indicates the potential for noncancer health effects to occur. An HQ or HI less than one indicates that noncancer effects are not likely to occur, based on the estimated exposures.

Cancer risks are estimated by multiplying the average daily dose by the appropriate toxicity value (CSF or inhalation unit risk) to estimate the potential incremental cancer risk. Cancer risk estimates are compared to EPA's generally allowable risk limit range, which represents an increased (incremental) risk (or probability) of cancer for an individual potentially exposed to site contaminants, in addition to each individual's baseline cancer risk. The incremental allowable risk limit range is presented in scientific notation as 1×10^{-4} to 1×10^{-6}, defined as an incremental risk of cancer for potentially exposed individuals of one in ten thousand to one in one million. In other words, if the estimated cancer risks are less than 1×10^{-4} (one in ten thousand, or 0.0001), these risks are considered acceptable. For example, an estimated risk of 3×10^{-5} (three in one hundred thousand, or 0.00003) is less than 1×10^{-4}, and within the range of 10^{-4} to 10^{-6} generally considered acceptable by the EPA, while an estimated risk of 1×10^{-3} (one in one thousand, or 0.001) is greater than 1×10^{-4}, and thus would be considered unacceptable. Cancer risks are presented in another scientific notation format in the tables, for example, 1.00E-4, which is the same as 1×10^{-4}.

The risk characterization results are summarized below, and are summarized in Table 6-220 of Section 6 of the *Phase II T-25 Area RI Report*. The upper bound risks for ground water are driven by PCE and TCE, and are shown in Table 7.

Table 6
Summary of Toxicity Values
SSC T-25 Area Human Health Risk Assessment

	Chronic Oral Reference Dose (mg/kg/day)		Uncertainty Factor	Noncarcinogenic Effects				Chronic Inhalation Reference Dose (mg/kg/day)		Uncertainly Factor	Carciogenic Effects					
				Subchronic Oral Reference Dose (mg/kg/day)		Uncertainty Factor	Health Effects of Concern				Oral Cancer Potency Factor (mg/kg/day)$^{-1}$		Type of Cancer	Inhalation Cancer Potency Factor (mg/kg/day)$^{-1}$		EPA Class
4,4'-DDE	ND		ND	ND		ND	ND	ND		ND	3.40E-01	[a]	liver	ND		B2
4,4'-DDT	5.00E-04	[a]	100	5.00E-04	[b]	100	liver lesions	ND		ND	3.40E-01	[a]	liver	3.40E-01	[a]	B2
Dieldrin	5.00E-05	[a]	100	5.00E-05	[b]	100	liver lesions	ND		ND	1.60E+01	[a]	liver	1.61E+01	[a]	B2
Endrin Ketone	3.00E-04	[j]	100	3.00E-04	[j]	100	convulsions and liver lesions	ND		ND	ND		ND	ND		D
Bis(2-ethylhexyl)phthalate	2.00E-02	[a]	1000	2.00E-02	[h]	1000	increased liver weight	ND		ND	1.40E-02	[a]	liver	ND		B2
Arsenic	3.00E-04	[a]	3	3.00E-04	[b]	3	karatosis, hyperpigmentation, vascular effects	ND		ND	1.50E+00	[a]	lung, organs, skin	1.51E+01		A
Barium	7.00E-02	[a]	3	7.00E-02	[b]	3	increased blood pressure	ND		ND	ND		ND	ND		ND
Beryllium	5.00E-03	[a]	100	5.00E-03	[b]	100	none	ND		ND	4.30E+00	[a]	tumors	8.40E+00	[a]	B2
Chromium	5.00E-03	[a][g]	500	2.00E-02	[b][g]	100	none	ND		ND	ND		lung	4.20E+01	[a]	A
Copper	ND		ND	ND		ND	ND	ND		ND	ND		ND	ND		D
Iron	ND		ND	ND		ND	ND	ND		ND	ND		ND	ND		ND
Lead	ND		ND	ND		ND	central nervous system effects	ND		ND	ND		ND	ND		B2
Manganese	2.30E-02	[a]	1	5.00E-03	[b]	1	central nervous system effects	1.43E-08	[a]	1000	ND		ND	ND		D
Molybdenum	5.00E-03	[a]	30	5.00E-03	[b]	30	uric acid levels	ND		ND	ND		ND	ND		ND
Nickel	2.00E-02	[a]	300	2.00E-02	[b]	300	reduced body and organ weight	ND		ND	ND		ND	ND		ND
Thallium	ND		ND	ND		ND	ND	ND		ND	ND		ND	ND		ND
Vanadium	7.00E-03	[b]	100	7.00E-03	[b]	100	none	ND		ND	ND		ND	ND		ND
Tetrachloroethene	1.00E-02	[a]	1000	1.00E-01	[b]	100	liver toxicity	ND		ND	5.20E-02	[c]	ND	2.03E-03	[c]	ND
Trichloroethene	6.00E-03	[c]	ND	6.00E-03	[c]	ND	ND	ND		ND	1.10E-02	[c]	liver	6.00E-03	[c]	B2
cis-1,2-dichloroethene	1.00E-02	[b]	3000	1.00E-01	[b]	300	blood chemistry	ND		ND	ND		ND	ND		D

NOTES:

[a] USEPA, Integrated Risk Information System (IRIS). Toxicology Data Network (TOXNET). National Library of Medicine. Database checked January 13, 1997.
[b] USEPA, Health Effects Assessment Summary Tables (HEAST). Office of Research and Development/Office of Emergency and Remedial Response. May 1995
USEPA, Health Effects Assessment Summary Tables (HEAST). Supplement No. 1 to the May 1995 Update. Office of Research and Development/Office of Emergency and Remedial Response. July 1995.
[c] These values have been withdrawn from IRIS, however, are approved for use by EPA Region I.
[d] Toxicity values for endosulfan I and endosulfan II are those for endosulfan; values for alpha- and gamma•chlordane are those for chlordane
[e] Applies naphthalene RfD toxicity values (EPA Region I, personal correspondence).
[f] Applies relative potency values for carcinogenic PAHs relative to benzo[a]pyrene cancer slope factor (Risk Updates, Number 2, August 1994, EPA Region I).
[g] RfD for chromium VI, the more conservative value
[h] Apples chronic RfD for subchronic RfD, when not available
[I] Oral toxicity values applied as dermal toxicity values (EPA Region I, personal correspondence)
[j] Endrin toxicity values are substituted for endrin ketone
[k] Gamma•BHC toxicity values are substituted for delta•BHC
[l] U.S. EPA Region III Risk-Based Concentration Table, First Quarter 1994
CAS = Chemical Abstracts Registry
Class. = EPA classification system for characterizing the extent to which the available data indicate that an agent is a human carcinogen (see text).
ND = Value or information not detemined by references cited in Notes [a] and [b].

Table 7: Risk Results for Ground Water Chemicals of Concern – Upper Bound Adult Estimates

Ground Water Chemicals of Concern	Ingestion Cancer Risk	Dermal Cancer Risk	Total Ground Water Cancer Risk	Ingestion Noncancer Risk	Dermal Noncancer Risk	Total Ground Water Noncancer Risk
4,4'-DDE	3.68E-07	2.03E-07	5.71E-07	NC	NC	
4,4'-DDT	2.19E-06	2.17E-06	4.36E-06	0.03	0.03	0.06
Dieldrin	4.38E-06	1.61E-07	4.54E-06	0.01	0.0005	0.01
Endrin Ketone	NC	NC		0.001	0.00005	0.001
Bis(2-ethylhexyl)phthalate	1.02E-05	1.22E-07	1.03E-05	0.09	0.001	0.09
Arsenic	5.07E-04	1.17E-06	5.08E-04	2.63	0.01	2.64
Barium	NC	NC		0.25	0.001	0.25
Beryllium	3.29E-04	7.57E-07	3.30E-04	0.36	0.0001	0.36
Chromium	NC	NC		14.80	0.07	14.87
Copper	NC	NC		NC	NC	
Iron	NC	NC		NC	NC	
Lead	NC	NC		NC	NC	
Manganese	NC	NC		6.58	0.02	6.60
Molybdenum	NC	NC		0.94	0.02	0.96
Nickel	NC	NC		1.27	0.0003	1.27
Thallium	NC	NC		NC	NC	
Vanadium	NC	NC		1.58	0.004	1.58
Tetrachloroethene	1.22E-03	1.35E-04	1.36E-03	5.48	0.61	6.09
Trichloroethene	6.46E-05	2.38E-06	6.70E-05	2.28	0.84	3.12
cis-1,2-dichloroethene	NC	NC		0.19	0.004	0.19
Total Ground Water Risks			**2.E-03**			**37**

NOTES:
NC=Not Calculated (chemical not a carcinogen or non carcinogen, or chemical has no published toxicity value.)

The estimated cancer and noncancer risks for surface soil contact for all potentially exposed populations (employees on the ballfield, trespassers on the ballfield, off-facility residents exposed to outdoor and indoor dust from the ballfield) show that incremental risks are below or within the range considered acceptable by the EPA. Since no COCs were selected in subsurface soil, because the maximum detected concentrations did not exceed the COC screening concentrations (the risk-based criteria or guidelines) or chemicals in subsurface soil were detected at concentrations similar to background, human health risks associated with potential exposures to subsurface soils were not evaluated. Surface soil data indicate that there is nothing currently contributing to ground water contamination. A removal action has occurred for the soils from the Storage Area. No calculated risks associated with surface or subsurface soil exposures exceeded acceptable levels, for either noncancer or cancer risks. For potential sediment and surface water contact during swimming at the T-25 Area stormwater outfall, incremental human health risks are below or within the range considered acceptable by the EPA. Risks calculated separately for shoreline samples are also considered acceptable.

For ground water beneath the T-25 Area, estimated noncancer and cancer risks for PCE and TCE exceeded the EPA's acceptable levels for future residential ground water use and for dermal contact during future industrial use. Thus, these contaminants are the focus of the cleanup effort. Although it is very unlikely that water from beneath the T-25 Area will be used for either residential or industrial development, these risk results indicated that ground water was a priority for cleanup.

In addition, six metals (chromium, lead, manganese, nickel, thallium, and vanadium), along with bis(2-ethylhexyl)phthalate and DDT, exceeded their regulatory drinking water standards, and/or caused some increases in site-related risks. Thus, these chemicals have been designated secondary COCs, since it is unclear whether their presence is site-related. This uncertainty is due to some questions about the sampling technique used during the investigation phases and/or whether the metals are present due to ambient conditions. Since these chemicals do contribute some risk, they are addressed in the T-25 Area ground water cleanup. The selected remedy should address the site risks by preventing exposures to the ground water and by remediating the ground water to drinking water standards for the primary contaminants of concern, TCE and PCE.

Uncertainties/Limitations

Although each step of the HHRA has uncertainties and limitations, conservative assumptions were used in order to protect the potentially most exposed and/or most sensitive individuals, and to provide conservative estimates of risk to determine the need for and extent of cleanup activities at the T-25 Area.

The general conclusions regarding uncertainties associated with data usability were that there were no systemic problems, and there was no large-scale rejection of data. The results of some quality control data affected the use of data, but mainly for common laboratory contaminants and for inorganics that are considered essential nutrients. Blank contaminants that were potentially site-related were included in the HHRA, as well as all estimated data.

Uncertainties were also inherent in the dose-response evaluations. The extrapolation of dose-response relationships derived from animal studies is based on dose-response relationships developed in high-dosage animal studies. The estimated human intakes associated with this site are proportionally many times lower than would cause any observable effects in laboratory cancer studies. The lack of toxicity values for each detected chemical for each exposure pathway also introduces uncertainty into the HHRA. In addition, selected COCs may have differing toxicity for different exposure routes, such as oral versus dermal, although the oral toxicity values were used for both pathways.

Uncertainty is also associated with estimating the true average concentration at a site, therefore the 95 percent UCL of the average was used to calculate average and upper-bound risks (except for ground water, where average and maximum concentrations were used). This provides a conservative estimate of the site average, and results in a conservative approach that is likely to overestimate risks at the site. Nondetected results were represented by one-half of the detection limit in the averaging calculation. This approach acknowledges the possibility that a chemical may actually be found at a location which has nondetected results (i.e., exists at concentrations below the detection limit).

The use of both regulatory guidelines and professional judgment in determining exposure assumptions introduces uncertainty into the risk assessment. These assumptions could overestimate or underestimate actual exposure frequencies, leading to either an overestimation or underestimation of risks for individuals within this potentially exposed population. This problem was addressed to some extent by calculating both average and upper-bound exposure scenarios, although parameters selected for both scenarios were usually conservative.

Many of the permeability constants used to predict the transfer of chemicals in water through skin are predicted values. The uncertainty of predicted permeability constants is within plus or minus one order of magnitude from the predicted value, indicating that the actual risks could be greater or lower than the calculated risks.

Because EPA Region I approves the use of dermal absorption values for uptake of contaminants from the soil through skin for only three chemicals (or classes of chemicals), cadmium, TCDD, and PCBs, risks were not calculated for many COCs in surface soil and sediments, possibly underestimating total risks at the site.

An additional uncertainty associated with the exposure assessment is the lack of a model for inhalation of volatile compounds from ground water during showering for theoretical future residential exposures. Because all calculated risks for ground water exceed the EPA's levels of concern for both noncancer and cancer effects, the doubling of the calculated hazard indices and cancer risks would not change the conclusions of the HHRA.

There is uncertainty in assessing the toxicity of a mixture of chemicals, as is typically found in a contaminated site. In this HHRA, potential toxic effects resulting from exposure to each chemical were calculated separately, and then summed. This EPA approach assumes that all chemicals have the same noncarcinogenic endpoint for calculation of hazard indices, and the same carcinogenic endpoint for calculation of incremental cancer risks. In addition, this approach does not take into account interactions between chemicals in a mixture, which may result in effects greater or less than expected. Since data on synergistic or antagonistic interactions were limited, we assume that the effects of chemical exposures at the site are additive, possibly overestimating or underestimating risks.

2.7.2 Ecological Risk Assessment

A Tier I ecological risk assessment (ERA) was conducted to assess the ecological impact and risks associated with the surface soil, sediment, and surface water at the T-25 Area. Ecological risks were not evaluated for the T-25 Area ground water, the focus of this ROD. However, because of the potential for a direct relationship/interaction between soil and lake environments with ground water, risks associated with surface soils and lake water and sediments are summarized in this ROD.

No significant ecological risks were found for the surface soils in the T-25 Area ball field. However, elevated levels of pesticides were found in soils in the small, isolated Storage Area, and did pose some ecological risks to wildlife. These soils were removed from the area and disposed of off-facility, under a separate time-critical removal action. No current soil source area for the observed ground water PCE and TCE contamination was found during the investigation. Therefore, this ROD does not address soil at the T-25 Area.

A potential ecological risk was found for invertebrates (e.g., worms, insects, freshwater mussels) assumed to be living in the sediments associated with the T-25 Area storm water outfall. The ecological risks are driven primarily by the pesticides and PAHs in the sediment. These potential risks are being studied further (as a separate operable unit) to assess if sediment remedial action is necessary. This ROD for the T-25 Area ground water does not address sediments of surface water associated with the T-25 Area storm water outfall. Any investigation or remedial activities at the T-25 Area storm water outfall will be conducted independently of OU-1, the T-25 Area ground water. A Tier II ERA is currently ongoing at the T-25 Area storm water outfall.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.8 Remediation Objectives

Based on the types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore, and/or prevent existing and future potential threats to public health and the environment. The RAOs for the selected remedy for the T-25 Area ground water (OU-1) are to:

- Prevent contamination in the ground water, above federal and more stringent state drinking water standards, from migrating outside of the T-25 Area toward off-facility receptors
- Prevent any potential exposure to ground water beneath the T-25 Area and off-facility with contaminant concentrations in excess of federal and more stringent state drinking water standards
- Restore aquifer to drinking water standards within a reasonable time frame
- Monitor potential future migration of ground water contamination to verify that elevated concentrations decrease over time

These RAOs were developed in order to prevent exposure to the contaminated ground water and to restore the aquifer to meet federal and more stringent state drinking water standards. The RAOs address the site risks by preventing human exposures to the contaminated ground water from the T-25 Area and ensuring the reduction of contaminant concentrations in that ground water to below federal and more stringent state drinking water standards.

2.9 Development and Screening of Alternatives

Statutory Requirements/Response Objectives
Under its legal authorities, the lead agencies primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA’s remedial action, when complete, must comply with all federal and more stringent state environmental standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and

alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with the Congressional mandates.

Technology and Alternative Development and Screening
CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the T-25 Area site.

With respect to ground water response action, the FFS/TS developed a limited number of remedial alternatives that attain site specific remediation levels within different time frames using different technologies; and a no action alternative.

As discussed in Section 4.3 of the FFS/TS, ground water treatment technology options were identified, assessed, and screened based on implementability, effectiveness, and cost. These technologies were combined into management of migration alternatives. Section 4.4 of the FFS/TS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in Section 5 of the FFS/TS.

In summary, of the numerous management of migration remedial alternatives screened in Section 4.3, six were retained as possible options for cleanup of the site. From this initial screening, remedial options were combined, and five management of migration alternatives were selected for detailed analysis.

2.10 Description of Alternatives

A summary of each alternative is described below:

Alternative 1: No Action **–** No response to contamination would be made, activities previously initiated would be abandoned, and no further active human intervention would occur. Natural attenuation of the PCE and TCE contamination is allowed to occur over time through dilution and natural biological and chemical degradation. Consideration of a No Action alternative is required by the NCP to serve as a baseline comparison for the other remedial alternatives.

Alternative 2: Limited Action/Institutional Controls and Monitored Natural Attenuation **–** Natural attenuation of the PCE and TCE contamination is allowed to occur over time and would be actively monitored to assess to what extent it is occurring and to what extent both on-facility and off-facility. MNA would follow EPA guidance. Institutional controls would be implemented to restrict access to ground water during remedial action. Specifically a municipal ordinance would prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in a prescribed area off of the facility, while on-facility use of ground water would be restricted through the Army Master Plan for SSC. If the SSC property were to be transferred out of federal ownership, the United States would impose appropriate enforceable land-use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds of other transfer documents relating to the property.

Description of Remedy Components

- **Treatment Technologies**. None

- **Containnient Components**. None

- **Long-Term Monitoring**. Long-term ground water monitoring would be conducted to determine the efficacy of the alternative to cleanup the ground water to meet federal and more stringent state drinking water standards. A Long-Term Monitoring Plan would be developed after the ROD is signed, and would describe in detail the procedures for chemical ground water monitoring and hydrologic monitoring. The plan would be developed using EPA guidance documents. It would also describe the procedures for notification and evaluation if an exceedance in protective point-of-compliance wells has occurred, and for field observations and corresponding documentation/certification of whether institutional controls remain in place.

- **Monitored Natural Attenuation:** This alternative includes MNA as part of the treatment alternative. MNA is expected to reduce contaminant concentrations in ground water over time through natural in situ processes that include biodegradation, dispersion, sorption, volatilization, and chemical or biological stabilization. Natural attenuation of primary and secondary contaminants, on-facility and off-facility would be actively monitored. An MNA Evaluation Plan, based on EPA guidance, would be developed after the ROD is signed.

- **Institutional Controls**. Institutional controls would be implemented as part of this alternative to restrict access to the ground water both on-facility and off-facility throughout the remedial action. The Army's Master Plan for SSC would restrict the on-facility use of ground water. If the SSC property were to be transferred out of federal ownership, the United States would impose appropriate enforceable land use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property. Off-facility, ground water use restrictions would be effected through a municipal ordinance covering the area where contaminated ground water has been found. More specifically, a town of Natick Board of Health ordinance (see Appendix C) would prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in the area to prevent any access or exposure to contaminated ground water. If the town were to repeal or modify the ordinance in any way during the remedial action, the Army would immediately notify EPA and MADEP of the repeal or modification and would evaluate the remedy to determine whether it is still effective in protecting human health and the environment. The town of Natick would have primary responsibility for monitoring and enforcing the ordinance, while the Army would be ultimately responsible to ensure that the institutional control remains in place and is effective and protective of human health and the environment.

- **Five-Year Reviews**. Reviews of the alternative would occur at least every five years to ensure adequate protection of human health and the environment. The review may determine that cleanup goals have been met or that the remedy may be modified to meet remedial action objectives. Also at each review, new remedial technologies may be evaluated to determine applicability. At any time, if a different technology becomes available in the future that provides a more effective and cost-efficient means of achieving the cleanup goals, the Army may consider the use of such a technology. The Army would propose any viable technologies to the USEPA and MADEP.

- **Additional Protection of Public Health and Safety**. To further protect the drinking water of the town of Natick, the Army will support a portion of the operation and maintenance of the treatment system at the town's Springvale Drinking water plant. The town's selected treatment system is a separate process that has been developed to address an area-wide problem within Natick. The town's independent selection of air stripping treatment technology is unrelated to, and has no impact upon, any of the alternatives presented, evaluated, or ultimately selected by the Army. The town's system -- which is already built and operating -- ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards. Copies of the Memorandum of Agreement and Cooperative Agreement between the town of Natick and the Army are presented in Appendices B and F, respectively.

Alternative 3: Ground Water Extraction with Air Stripping/Carbon Adsorption and Long-Term Monitoring, Institutional Controls, and MNA

Treatability Study. In November 1997, the Army constructed a ground water extraction/treatment system (extraction wells with air-stripping and granular activated carbon) as part of a TS. The TS is currently ongoing, and will do so until the signing of this ROD. The purpose of the TS was to determine if the extraction system could

Current estimates from the ground water model indicate that this alternative could meet the established cleanup goals in 27 years. This estimate includes a projected 10-year operation of the pump-and-treat system followed by a 17-year MNA period. The 10-years of pump-and-treat operation was estimated as the time during which treatment system operation would be efficient and effective, and not subject to diminishing returns (as determined by EPA guidance documents). Any on-facility or off-facility residual contamination remaining after the shutdown of the treatment system would be addressed during the estimated 17-year MNA period. The ground water model is draft and is subject to change, as more data become available. Appendix D includes a letter summarizing the current ground water model results and its assumptions. It is important to note that these cleanup times are estimated and do not prescribe when the ground water extraction and treatment system will be shut off.

- **Ground Water Containment Components.** Containment technologies for this alternative consist of extraction wells that create a capture zone. At the current pumping rates thus far in the TS, contained areas include the entire T-25 Area, areas to the west bounded by Lakewood Avenue, areas to the north bounded by Fisher Street, and areas to the east bounded by Second Street. The B-interval (approximately 30 to 65 feet below ground surface in the T-25 Area) is captured vertically. A clayey silt layer serves as a barrier to downward migration.

- **Long-Term Monitoring.** Long-term ground water monitoring would be conducted to determine the efficacy of the alternative to cleanup the ground water to meet federal and more stringent state drinking wader standards. A Long-Term Monitoring Plan would be developed after the ROD is signed, and would describe in detail the procedures for chemical ground water monitoring and hydrologic monitoring. The plan would be developed using EPA guidance documents. It would also describe the procedures for notification and evaluation if an exceedance in protective point-of-compliance wells has occurred, and for field observations and corresponding documentation/certification of whether institutional controls remain in place. Air and water discharged from the treatment system would also be monitored regularly to ensure that they meet federal and state ARARs. An Operations and Maintenance Plan would be developed after the ROD is signed, and would describe the frequency of treatment system sampling and notification procedures in case of an exceedance of discharge limits. Operation and maintenance activities required to maintain the integrity of the system include aqueous carbon backwashing, particulate filter changeouts, pressure washing system components, and other minor maintenance items.

- **Monitored Natural Attenuation.** This alternative includes MNA as part of the treatment alternative. MNA is expected to reduce contaminant concentrations in ground water over time through natural in situ processes that include dispersion, dilution, sorption, biodegradation, volatilization, and chemical or biological stabilization. MNA would address any on-facility and/or off-facility contamination that is not captured by the extraction and treatment system during its operation, as well as any on-facility and off-facility ground water contamination from the T-25 Area remaining after that system is shut off due to diminishing returns (as determined by EPA guidance documents). Natural attenuation of primary and secondary contaminants, on-facility and off-facility would be actively monitored. An MNA Evaluation Plan, based on EPA's MNA guidance, would be developed after the ROD is signed.

- **Institutional Controls.** Institutional controls would be implemented as part of this alternative to restrict access to the ground water both on-facility and off-facility throughout the remedial action. The Army's Master Plan for SSC would restrict the on-facility use of ground water. If the SSC property were to be transferred out of federal ownership, the United States would impose appropriate enforceable land use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property. Off-facility, ground water use restrictions would be effected through a municipal ordinance covering the area where contaminated ground water has been found. More specifically, a town of Natick Board of Health ordinance (see Appendix C) would prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in the area to prevent any access or exposure to contaminated ground water. If the town were to repeal or modify the ordinance in any way during the remedial action, the Army would immediately notify EPA and MADEP of the repeal or modification and would evaluate the remedy to determine whether it is still effective in protecting human health and the environment. The town of Natick would have primary responsibility for monitoring and enforcing the ordinance, while the Army would be ultimately responsible to ensure that the institutional control remains in place and is effective and protective of human health and the environment.

- **Five-Year Reviews.** Reviews of this alternative would occur at least every five years to ensure adequate protection of human health and the environment. The review may determine that cleanup goals have been met or that the extraction and treatment system or other components of the remedy may be modified to meet remedial action objectives. Also at each review, new remedial technologies may be evaluated to determine applicability. At any time, if a different technology becomes available in the future that provides a more effective and cost-efficient means of achieving the cleanup goals, the Army may consider the use of such a technology. The Army would propose any viable technologies to the USEPA and MADEP.

- **Additional Protection of Public Health and Safety.** To further protect the drinking water of the town of Natick, the Army will support a portion of the operation and maintenance of the treatment system at the town's Springvale Drinking Water plant. The town's selected treatment system is a separate process that has been developed to address an area-wide problem within Natick. The town's independent selection of air stripping treatment technology is unrelated to, and has no impact upon, any of the alternatives presented, evaluated, or ultimately selected by the Army. The town's system -- which is already built and operating -- ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards. Copies of the Memorandum of Agreement and Cooperative Agreement between the town of Natick and the Army are presented in Appendices B and F, respectively.

Alternative 4: Ground Water Extraction with Liquid-Phase Activated Carbon and Long-Term Monitoring, Institutional Controls and MNA

The EPA considers the extraction/treatment portion of this alternative to be a presumptive remedy for dissolved volatile organics in ground water.

- **Ground Water Extraction and Treatment Components:** Contaminated ground water would be extracted at previously identified contaminant hot spots using two extraction wells, MW-90B-4 and MW-15B, into tanks containing activated carbon that remove PCE and TCE from the water. The carbon tanks would consist of two canisters each containing 10,000 pounds of activated carbon. The carbon tanks would be capable of treating 120 gpm. The treated ground water would be discharged to Lake Cochituate. The spent carbon from this process is regenerated off-facility and in the process the contaminants are destroyed. Remedy refinements for this alternative may include the installation of additional monitoring or extraction wells, adjusting the extraction flow rates to optimize contaminant capture or containment, and/or pulsed pumping of extraction wells.

  Current estimates from the ground water model indicate that this alternative could meet the established cleanup goals in 27 years. This estimate includes a projected 10-year operation of the pump-and-treat system followed by a 17-year MNA period. The 10-years of pump-and-treat operation was estimated as the time during which treatment system operation would be efficient and effective, and not subject to diminishing returns (as determined by EPA guidance documents). Any on-facility or off-facility residual contamination remaining after the shutdown of the treatment system would be addressed during the estimated 17-year MNA period. The ground water model is draft and is subject to change, as more data become available. Appendix D includes a letter summarizing the current ground water model results and its assumptions. It is important to note that these cleanup times are estimated and do not prescribe when the ground water extraction and treatment system will be shut off.

- **Ground Water Containment Components.** Containment technologies for this alternative consist of extraction wells that create a capture zone. At the current pumping rates thus far in the TS, contained areas include the entire T-25 Area, areas to the west bounded by Lakewood Avenue, areas to the north bounded by Fisher Street, and areas to the east bounded by Second Street. The B-interval (approximately 30 to 65 feet below ground surface in the T-25 Area) is captured vertically. A clayey silt layer serves as a barrier to downward migration.

- **Long-Term Monitoring.** Long-term ground water monitoring would be conducted to determine the efficacy of the alternative to cleanup the ground water to meet federal and more stringent state drinking water standards. A Long-Term Monitoring Plan would be developed after the ROD is signed, and would describe in detail the procedures for chemical ground water monitoring and hydrologic monitoring. The plan would be developed using EPA guidance documents. It would also describe the procedures for notification and evaluation if an exceedance in protective point-of-compliance wells has occurred, and for field observations and corresponding documentation/certification of whether institutional controls remain in place. Air and water discharged from the treatment system would also be monitored regularly to ensure that they meet federal and state ARARs. An Operations and Maintenance Plan would be developed after the ROD is signed, and would describe the frequency of treatment system sampling and notification procedures in case of an exceedance of discharge limits. Operation and maintenance activities required to maintain the integrity of the system include aqueous carbon backwashing, particulate filter changeouts, pressure washing system components, and other minor maintenance items.

- **Monitored Natural Attenuation.** This alternative includes MNA as part of the treatment alternative. MNA is expected to reduce contaminant concentrations in ground water over time through natural in situ processes that include dispersion, dilution, sorption, biodegradation, volatilization, and chemical or biological stabilization. MNA would address any on-facility and/or off-facility contamination that is not captured by the extraction and treatment system during its operation, as well as any on-facility and off-facility ground water contamination from the T-25 Area remaining after that system is shut off due to diminishing returns (as determined by EPA guidance documents). Natural attenuation of primary and secondary contaminants, on-facility and off-facility would be actively monitored. An MNA Evaluation Plan, based on EPA's MNA guidance, would be developed after the ROD is signed.

- **Institutional Controls.** Institutional controls would be implemented as part of this alternative to restrict access to the ground water both on-facility and off-facility throughout the remedial action. The Army's Master Plan for SSC would restrict the on-facility use of ground water. If the SSC property were to be transferred out of federal ownership, the United States would impose appropriate enforceable land use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property. Off-facility, ground water use restrictions would be effected through a municipal ordinance covering the area where contaminated ground water has been found. More specifically, a town of Natick Board of Health ordinance (see Appendix C) would prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in the area to prevent any access or exposure to contaminated ground water. If the town were to repeal or modify the ordinance in any way during the remedial action, the Army would immediately notify EPA and MADEP of the repeal or modification and would evaluate the remedy to determine whether it is still effective in protecting human health and the environment. The town of Natick would have primary responsibility for monitoring and enforcing the ordinance, while the Army would be ultimately responsible to ensure that the institutional control remains in place and is effective and protective of human health and the environment.

- **Five-Year Reviews.** Reviews of this alternative would occur at least every five years to ensure adequate protection of human health and the environment. The review may determine that cleanup goals have been met or that the extraction and treatment system or other components of the remedy may be modified to meet remedial action objectives. Also at each review, new remedial technologies may be evaluated to determine applicability. At any time, if a different technology becomes available in the future that provides a more effective and cost-efficient means of achieving the cleanup goals, the Army may consider the use of such a technology. The Army would propose any viable technologies to the USEPA and MADEP.

- **Additional Protection of Public Health and Safety.** To further protect the drinking water of the town of Natick, the Army will support a portion of the operation and maintenance of the treatment system at the town's Springvale Drinking Water plant. The town's selected treatment system is a separate process that has been developed to address an area-wide problem within Natick. The town's independent selection of air stripping treatment technology is unrelated to, and has no impact upon, any of the alternatives presented, evaluated, or ultimately selected by the Army. The town's system -- which is already built and operating -- ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards. Copies of the Memorandum of Agreement and Cooperative Agreement between the town of Natick and the Army are presented in Appendices B and F, respectively.

Alternative 5: Ground Water Extraction with Ultraviolet/Oxidation and Long-Term Monitoring, Institutional Controls, and MNA

The EPA considers the extraction/treatment portion of this alternative to be a presumptive remedy for dissolved volatile organics in ground water.

- **Ground Water Extraction and Treatment Components:** Contaminated ground water would be extracted at previously identified contaminant hot spots using two extraction wells, MW-90B-4 and MW-15B, and into equipment that destroys contamination by the addition of oxidizing chemicals and ultraviolet light. The ultraviolet/oxidation system would be capable of treating 120 gpm. The water would then be further treated using granular activated carbon. The treated ground water would be discharged to Lake Cochituate. The spent carbon is regenerated off-facility and the contaminants destroyed in the process. Remedy refinements for this alternative may include the installation of additional monitoring or extraction wells, adjusting the extraction flow rates to optimize contaminant capture or containment; and/or pulsed pumping of extraction wells.

  Current estimates from the ground water model indicate that this alternative could meet the established cleanup goals in 27 years. This estimate includes a projected 10-year operation of the pump-and-treat system followed by a 17-year MNA period. The 10-years of pump-and-treat operation was estimated as the time during which treatment system operation would be efficient and effective, and not subject to diminishing returns (as determined by EPA guidance documents). Any on-facility or off-facility residual contamination remaining after the shutdown of the treatment system would be addressed during the estimated 17-year MNA period. The ground water model is draft and is subject to change, as more data become available. Appendix D includes a letter summarizing the current ground water model results and its assumptions. It is important to note that these cleanup times are estimated and do not prescribe when the ground water extraction and treatment system will be shut off.

- **Ground Water Containment Components.:** Containment technologies for this alternative consist of extraction wells that create a capture zone. At the current pumping rates thus far in the TS, contained areas include the entire T-25 Area, areas to the west bounded by Lakewood Avenue, areas to the north bounded by Fisher Street, and areas to the east bounded by Second Street. The B-interval (approximately 30 to 65 feet below ground surface in the T-25 Area) is captured vertically. A clayey silt layer serves as a barrier to downward migration.

- **Long-Term Monitoring.** Long-term ground water monitoring would be conducted to determine the efficacy of the alternative to cleanup the ground water to meet federal and more stringent state drinking water standards. A Long-Term Monitoring Plan would be developed after the ROD is signed, and would describe in detail the procedures for chemical ground water monitoring and hydrologic monitoring. The plan would be developed using EPA guidance documents. It would also describe the procedures for notification and evaluation if an exceedance in protective point-of-compliance wells has occurred, and for field observations and corresponding documentation/certification of whether institutional controls remain in place. Air and water discharged from the treatment system would also be monitored regularly to ensure that they meet federal and state ARARs. An Operations and Maintenance Plan would be developed after the ROD is signed, and would describe the frequency of treatment system sampling and notification procedures in case of an exceedance of discharge limits. Operation and maintenance activities required to maintain the integrity of the system include aqueous carbon backwashing, particulate filter changeouts, pressure washing system components, and other minor maintenance items.

- **Monitored Natural Attenuation.** This alternative includes MNA as part of the treatment alternative. MNA is expected to reduce contaminant concentrations in ground water over time through natural in situ processes that include dispersion, dilution, sorption, biodegradation, volatilization, and chemical or biological stabilization. MNA would address any on-facility and/or off-facility contamination that is not captured by the extraction and treatment system during its operation, as well as any on-facility and off-facility ground water contamination from the T-25 Area remaining after that system is shut off due to diminishing returns (as determined by EPA guidance documents). Natural attenuation of primary and secondary contaminants, on-facility and off-facility would be actively monitored. An MNA Evaluation Plan, based on EPA's MNA guidance, would be developed after the ROD is signed.

- **Institutional Controls.** Institutional controls would be implemented as part of this alternative to restrict access to the ground water both on-facility and off-facility throughout the remedial action. The Army's Master Plan for SSC would restrict the on-facility use of ground water. If the SSC property were to be transferred out of federal ownership, the United States would impose appropriate enforceable land use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property. Off-facility, ground water use restrictions would be effected through a municipal ordinance covering the area where contaminated ground water has been found. More specifically, a town of Natick Board of Health ordinance (see Appendix C) would prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in the area to prevent any access or exposure to contaminated ground water. If the town were to repeal or modify the ordinance in any way during the remedial action, the Army would immediately notify EPA and MADEP of the repeal or modification and would evaluate the remedy to determine whether it is still effective in protecting human health and the environment. The town of Natick would have primary responsibility for monitoring and enforcing the ordinance, while the Army would be ultimately responsible to ensure that the institutional control remains in place and is effective and protective of human health and the environment.

- **Five-Year Reviews.** Reviews of this alternative would occur at least every five years to ensure adequate protection of human health and the environment. The review may determine that cleanup goals have been met or that the extraction and treatment system or other components of the remedy may be modified to meet remedial action objectives. Also at each review, new remedial technologies may be evaluated to determine applicability. At any time, if a different technology becomes available in the future that provides a more effective and cost-efficient means of achieving the cleanup goals, the Army may consider the use of such a technology. The Army would propose any viable technologies to the USEPA and MADEP.

- **Additional Protection of Public Health and Safety.** To further protect the drinking water of the town of Natick, the Army will support a portion of the operation and maintenance of the treatment system at the town's Springvale Drinking Water plant. The town's selected treatment system is a separate process that has been developed to address an area-wide problem within Natick. The town's independent selection of air stripping treatment technology is unrelated to, and has no impact upon, any of the alternatives presented, evaluated, or ultimately selected by the Army. The town's system -- which is already built and operating -- ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards. Copies of the Memorandum of Agreement and Cooperative Agreement between the town of Natick and the Army are presented in Appendices B and F, respectively.

Common Elements and Distinguishing Features of Each Alternative:

- Key ARARs - The key ARARs associated with all alternatives are the federal Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs) under the Safe Drinking Water Act and the state MCLs under the state drinking water regulations, which are relevant and appropriate as on-facility and off-facility ground water cleanup goals; and the federal Clean Water Act National Pollutant Discharge Elimination System regulations and state Surface Water Discharge Treatment Program regulations, for the aqueous emissions from the treatment system. State air emissions regulations are a key ARAR for Alternative 3 - Ground Water Extraction with Air Stripping/Carbon Absorption and Long-Term Monitoring, Institutional Controls, and MNA.

- Long-Term Reliability of Remedy – The No Action and Limited Action/MNA Alternatives (Alternatives 1 and 2) depend on only natural attenuation processes. The long-term reliability of these processes depends on the actual subsurface conditions. The ground water extraction and treatment components of the active remediation alternatives (Alternatives 3, 4, and 5) are considered presumptive remedies by EPA and have demonstrated long-term reliability.

- Untreated Waste and Treatment Residuals - The No Action and Limited Action/MNA Alternatives (Alternatives 1 and 2) do not have untreated waste stored on-facility for off-facility disposal. Alternatives 3, 4, and 5 would have spent carbon generated containing removed PCE and TCE. Since starting the TS, in November 1997, using the Alternative 3 air stripping alternative, one batch of vapor-phase carbon has been shipped off-facility for regeneration. This batch of carbon had captured 99 percent of the volatile contaminants for the first eight months of operation and was classified as nonhazardous by Resource Conservation and Recovery Act Toxicity Characteristic Leaching Procedure (TCLP) testing methods. Therefore, Alternatives 3, 4, and 5 are not expected to generate hazardous wastes. Waste stored on-facility would include purge water from treatment system sampling and maintenance containing low levels of PCE and TCE and precipitated iron. Since starting the TS, this waste has also been characterized as nonhazardous and disposed of off-facility, during the TS.

- Estimated Time for Design and Constructions - The No Action and Limited Action/MNA Alternatives (Alternatives 1 and 2) do not have design or construction times. Alternative 3 has already been designed, constructed, and is currently operating. Alternatives 4 and 5 would include approximately eight months of design, preparation, and construction activities.

- Estimated Time to Reach Remediation Goals – The ground water model for the site is used to estimate time to reach remediation goals for each alternative. Alternatives 1 and 2 are estimated to reach the established cleanup goals via natural attenuation processes in approximately 50 years. Alternatives 3, 4, and 5 are estimated to reach the established cleanup goals in 27 years, including a 10-year pumping period and a 17-year MNA period. The 5-year post cleanup monitoring period is not included in the estimated time to reach cleanup goals. Each alternative would not be discontinued until actual chemical monitoring data meet the established cleanup goals.

- Estimated Capital, Annual O&M, and Total Present Worth Costs – The costs for each alternative are summarized in Table 8.

- Uses of Presumptive Remedies and/or Innovative Technologies – The EPA considers the extraction/treatment portions of Alternatives 3, 4, and 5 to be presumptive remedies for dissolved volatile organics in ground water.

Expected Outcome of Each Alternative

Land use will allow for either residential or industrial development and ground water would be suitable for drinking water use following attainment of cleanup goals. The time frame for attaining cleanup goals is summarized above under Estimated Time to Reach Remediation Goals.

2.11 Summary of Comparative Analysis of Alternatives

This section of the ROD comprises the comparative analysis section of the FFS/TS Report for OU-1. This section evaluates the relative performance of the alternatives with respect to the nine CERCLA criteria. Below, the nine CERCLA criteria are bolded prior to the discussion of relative performance for each alternative. A comparison of CERCLA alternatives and CERCLA evaluation criteria are given in Table 9.

Overall Protection of Human Health and the Environment
Overall Protection of Human Health and the Environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled, through treatment, engineering controls, and/or institutional controls.

Table 8: Remedial Alternative Cost Summary

Alternative	Capital Cost *	O&M NPV ** Cost	Total NPV **
1 - No Action	$0 $0	$0	$0
2 – Limited Action/ MNA	$20,000 $3,100,000	$2,562,938	$5,682,938
3 - Air Stripping	$372,972*** $3,100,000	$4,043,301	$7,516,273
4 – GAC	$393,780 $3,100,000	$4,269,054	$7,762,834
5 - UV/Oxidation	$480,300 $3,100,00	4,622,066	$8,242,366

Alternatives 3, 4, and 5 costs assume a 10-year treatment system operational period, a 17-year monitored natural attenuation period, and a 5-year post cleanup ground water monitoring period. An operational period of 50 years was assumed for the No Action and Limited Action/MNA alternatives.
* The first number in the capital cost column represents equipment and installation costs (as described in Table 11a). The second number in the capital cost column represents a one-time payment of $3,100,000 that the Army has agreed to pay the town of Natick to support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant (as described in Appendices B and F).
** NPV – Net Present Value. This cost calculation accounts for the future value of 1998 dollars and allows for comparison between options that have different costs and varying O&M periods.
*** The capital cost for Alternative 3 includes the $350,000 already expended for the full-scale treatment system, designed and constructed for the presently ongoing TS for the T-25 Area ground water.

The implementation of Alternatives 3, 4, and 5 would be protective of human health and the environment, and would be able to meet the RAOs. The ground water extraction and treatment system in each alternative would permanently reduce the concentrations of PCE and TCE in the T-25 Area ground water, and MNA processes are expected to reduce the on-facility and off-facility PCE and TCE concentrations to MCLs over time. In addition, Alternatives 3, 4, and 5 would also minimize the migration of contamination toward the Springvale Well Field by generating a capture zone that extends from the extraction wells and encompasses the T-25 Area contamination. By minimizing migration of the contaminant plume these alternatives would also minimize the potential for human exposure to the contaminants. The spent carbon from the adsorption systems would be taken off facility by the vendor and regenerated, which would destroy the organic contaminants.

Alternatives 3, 4, and 5 also include institutional controls to restrict access to and prevent exposure to contaminated ground water.

Table 9: Comparison of Alternatives with CERCLA Evaluation Criteria

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Criteria	**No Action**	**Limited Action/Institutional Controls and MNA**	**Ground Water Extraction with Air Stripping/Carbon Adsorption and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water Extraction with Liquid-Phase Activated Carbon and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water with UV/Oxidation and Long-Term Monitoring, Institutional Controls, and MNA**
Institutional Controls	No controls over remaining contamination.	Legal restriction to restrict access to contaminated ground water would be required until the cleanup levels are met or there is no threat to human health or the environment.	See Alternative 2.	See Alternative 2.	See Alternative 2.
Monitoring	No ground water monitoring is used.	Long-term ground water monitoring (e.g., chemical and hydrologic) would be conducted to determine the efficacy of the alternative to cleanup the ground water.	See Alternative 2.	See Alternative 2.	See Alternative 2.
Need for a Five-Year Review	No five year reviews.	Reviews of the alternative would occur at least every five years to ensure adequate protection of human health and the environment. New remedial technologies would be reviewed to determine applicability.	See Alternative 2.	See Alternative 2.	See Alternative 2.
Time to Meet Ground Water Cleanup Levels or Remedial Objectives	Estimated to meet established cleanup goals in approximately 50 years.	See Alternative 1.	Estimated to meet established cleanup goals in approximately 27 years.	See Alternative 3.	See Alternative 3.
***NCP Evaluation Criteria* - Overall Protection of Human Health and the Environment**	No reduction in risk.	This alternative would limit the potential for exposure to the contaminants by restricting the use of the contaminated portion of the aquifer. However, the contamination in the aquifer would be left in place, meaning that the reduction in the risk would be due to restriction and natural attenuation.	This alternative includes institutional controls that would prevent exposure to the contaminated ground water. The ground water extraction and treatment system, combined with the MNA portion of the remedy, would permanently reduce the concentrations of the primary and secondary COCs in ground water to below federal and state drinking water standards over time. Air omissions would not pose a risk.	See Alternative 3.	See Alternative 3.
NCP Evaluation Criteria* - Compliance with ARARs *Federal and State Ground Water and Drinking Water Standards	Would comply with federal and state drinking water standards in an estimated 50 years.	See Alternative 1.	Would meets or attain all ARARs and requirements that apply to the site.	See Alternative 3.	See Alternative 3.

Table 9: Comparison of Alternatives with CERCLA Evaluation Criteria

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Criteria	**No Action**	**Limited Action/Institutional Controls and MNA**	**Ground Water Extraction with Air Stripping/Carbon Adsorption and Long- Term Monitoring, Institutional Controls, and MNA**	**Ground Water Extraction with Liquid-Phase Activated Carbon and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water Extraction with UV/Oxidation and Long-Term Monitoring, Institutional Controls, and MNA**
NCP Evaluation Criteria* -Compliance with ARARs *Federal/State Air Regulations	No regulations are applicable.	See Alternatives 1.	Air stripper emissions would be treated with vapor phase GAC adsorption system to comply with all federal and state air regulations. Risk would be below acceptable levels of exposure to final emissions.	See Alternative 1.	See Alternative 1.
***NCP Evaluation Criteria* - Long-Term Effectiveness Protection of Human Health and the Environment**	Would not provide long-term protection of human health and the environment and the potential for direct exposure to future users of the aquifer remains.	Would provides limited long-term protection by restricting the access to the contaminated ground water. However, the contamination would only undergo natural attenuation over time.	Alternative would serve as containment/control measure that would reduce VOC concentrations by removing and treating the contaminated ground water beneath the T-25 Area. Residual contaminants would be reduced by MNA. Institutional controls would prevent exposure to contaminated ground water. Contaminants would be destroyed off-facility when the carbon is regenerated. Air emissions would not pose a risk.	Alternative would serve as containment/control measure that would reduce VOC concentrations by removing and treating the contaminated ground water beneath the T-25 Area. Residual contaminats would be reduced by MNA. Institutional controls would prevent exposure to contaminated ground water. Contaminants would be destroyed off-facility when the carbon is regenerated.	Alternative would serve as containment/control measure that would reduce VOC concentrations by removing and treating the contaminated ground water beneath the T-25 Area. Residual contaminants would be reduced by MNA. Institutional controls would prevent exposure to contaminated ground water. Contaminants would be destroyed on-facility by the UV/oxidation system or off-facility when the carbon is regenerated.
***NCP Evaluation Criteria* -Long-Term Effectiveness Magnitude of Residual Risk**	Contamination would remain in the ground water for an estimated 50 years. Risk would be reduced over time due to natural attenuation of the contaminants.	See Alternative 1.	Risk from contamination in the ground water would be reduced by contaminant/control measures in the T-25 Area. This alternative would be operated until the established cleanup goals are met. Residuals would be disposed of in a manner to eliminate unacceptable risk.	See Alternative 3.	See Alternative 3.
***NCP Evaluation Criteria* - Long-Term Effectiveness Type and Quatity of Residuals Remaining After Treatment**	No residuals would be left because there is no treatment.	See Alternative 1.	Spent aqueous/vapor phase carbon (-6,000 pounds per year) would be regenerated off-facility, however, the need for activated carbon may be eliminated after extensive testing confirms the efficacy of the air stripper and compliance with state air emissions ARARs. Equalization tank solids would be treated and disposed of off-facility.	Spent aqueous phase carbon (-20,000 pounds per year) would be regenerated off-facility. Solids from the equalization tank would be treated and disposed of off-facility	Spent aqueous phase carbon (-2,000 pounds per year) would be regenerated off-facility. Solids from the equalization tank would be treated and disposed of off-facility. No wastes are generated as byproducts of oxidation.
***NCP Evaluation Criteria* -Long-Term Effectiveness Adequacy and Reliability of Controls**	No controls over remaining contamination.	The controls to limit access to ground water from the site would be adequate. However, because the contamination only undergoes natural attenuation over time, institutional controls would be required for 50 years.	The contamination would be removed, therefore, no long-term controls would be necessary. These treatment methods are proven and reliable.	See Alternative 3.	The contamination would be removed, therefore, no long-term controls would be necessary. The more innovative technologies used in this system are considered reliable.

Table 9: Comparison of Alternatives with CERCLA Evaluation Criteria

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Criteria	**No Action**	**Limited Action/Institutional Controls and MNA**	**Ground Water Extraction with Air Stripping/Carbon Adsorption and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water Extraction with Liquid-Phase Activated Carbon and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water with UV/Oxidation and Long-Term Monitoring, Institutional Controls, and MNA**
NCP Evaluation Criteria **-Reduction in Toxicity, Mobility, and Volume through Treatment**	Reduction due primarily to natural attenuation, however, no reduction through treatment.	See Alternative 1.	The alternative would use active treatment to reduce VOCs in ground water to below established cleanup goals. The volume and toxicity of ground water contamination would be significantly reduced. The extraction system would also control the migration of the contaminant plume, and minimize migration to downgradient receptors.	See Alternative 3.	See Alternative 3.
NCP Evaluation Criteria **-Reduction in Toxicity, Mobility, and Volume through Treatment: Degree to which Treatment is Irreversible**	No remediation treatment process would be used, only natural attenuation of contaminants over time.	See Alternative 1.	Air stripping and GAC aqueous and vapor phase treatments are irreversible.	This treatment is irreversible.	This treatment is irreversible
NCP Evaluation Criteria **-Short Term Effectiveness**	There would be no short-term impacts to workers, the public, or the environment since no remedial activities would be conducted.	See Alternative 1.	With proper safety practices, risk to workers is minimal. Protection of the community from exposure to ground water is enhanced during the short-term. Exposure to VOCs from emissions is mitigated by the carbon adsorption system.	With proper safety practices, risks to workers is minimal. Protection of the community from exposure to ground water is enhanced during the short-term.	See Alternative 4.
NCP Evaluation Criteria **-Implementation** ***Technical Feasibility***	This alternative is technically feasible.	This alternative is technically feasible.	This alternative is technically feasible and has already been implemented for the treatability study. It has been proven successful at similar sites. The system is flexible for improvements and increase of capacity.	This alternative is technically feasible, and readily implementable. Meeting performance goals has been proven, as demonstrated at similar sites. The system is flexible for improvements and increase of capacity.	This alternative would be implementable, but less so than Alternatives 3 and 4 because there are fewer vendors and less experience with it. The system is flexible for improvements and increase of capacity.
NCP Evaluation Criteria **-Implementability** ***Administrative Feasibility***	Unlikely to be acceptable to regulatory agencies or favorable to local communities. Existing contamination would require legal restrictions of future site use.	See Alternative 1.	This alternative is administratively favorable. The ground water extraction and treatment portion of this alternative is considered a presumptive remedy by EPA. It has been well received by government agencies and the community at similar sites.	See Alternative 3.	See Alternative 3.

Table 9: Comparison of Alternatives with CERCLA Evaluation Criteria

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Criteria	**No Action**	**Limited Action/Institutional Controls and MNA**	**Ground Water Extraction with Air Stripping/Carbon Adsorption and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water Extraction with Liquid-Phase Activated Carbon and Long-Term Monitoring, Institutional Controls, and MNA**	**Ground Water with UV/Oxidation and Long-Term Monitoring, and Institutional Controls, and MNA**
NCP Evaluation Criteria* - Cost *Capital Cost	$0	$20,000 for legal deed restrictions & $3,100,000 for agreement between Army and town of Natick	$372,972 for air stripping assembly, equalization tank, and carbon adsorption systems & $3,100,000 for agreement between Army and town of Natick	$393,780 for carbon adsorption treatment system & $3,100,000 for agreement between Army and town of Natick	$480,300 for reactor and power supply, hydrogen peroxide delivery system, and the system controller & $3,100,000 for agreement between Army and town of Natick
NCP Evaluation Criteria* - Cost *Annual Operating and Maintenance Cost	$0	$120,250	$341,614	$369,352	$417,639
***NCP Evaluation Criteria* - Cost *NPV Operating and Maintenance Cost* (using 2% inflation rate and 7% interest rate)**	$0 for a 50-year clean-up scenario	$2,562,938 for a 50-year clean-up scenario	$4,043,301 for 10-year pumping period, 17-year MNA period, and 5-year post cleanup monitoring period	$4,269,054 for 10-year pumping period, 17-year MNA period, and 5-year post cleanup monitoring period	$4,662,066 for 10-year pumping period, 17-year MNA period, and 5-year post cleanup monitoring period
State Acceptance	Not Acceptable	Not Acceptable	Acceptable	Acceptable	Acceptable
Community Acceptance	Not Acceptable	Not Acceptable	Acceptable	Acceptable	Acceptable

Alternative 2, Limited Action/MNA, would reduce the potential for human exposure by implementing institutional controls on the access to the ground water. The contamination would undergo natural attenuation processes that would decrease contaminant concentrations over time. Contaminant migration would not be controlled using only limited action.

Alternative 1, no action, would not be protective of human health.

Compliance with ARARs

SARA and the NCP require that ARARs be identified during the development of remedial alternatives. One of the criteria under the NCP (40 CFR 300.430) states that site remediation activities must comply with all “applicable or relevant and appropriate public environmental and health requirements” (ARARs) with certain exceptions, including where technically impracticable or if the action would result in an unacceptable environmental impact. ARARs are federal and more stringent state human health and environmental requirements used to (1) evaluate the appropriate extent of site cleanup; (2) define and formulate remedial action alternatives; and (3) govern implementation and operation of the selected action.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. An example of an applicable requirement is the use of RCRA regulations or more stringent state hazardous waste regulations for the management of hazardous wastes generated by a ground water treatment system.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. For example, MCLs for drinking water would be relevant and appropriate requirements at a site where ground water contamination is affecting a current or potential future drinking water source.

Alternatives 3, 4, and 5 would meet or attain all applicable or relevant and appropriate federal and more stringent state requirements that apply to the site. Federal laws from which ARARs for these alternatives are derived include the Clean Water Act (40 CFR 122), RCRA (40 CFR 262), and the Safe Drinking Water Act (40 CFR 141). The state environmental regulations that are applicable or relevant and appropriate to these alternatives are the Massachusetts Surface Water Discharge Permit Program (314 CMR

3.00), Massachusetts Drinking Water Standards (310 CMR 22.00), Massachusetts Hazardous Waste Regulations (310 CMR 30.00), and Massachusetts Contingency Plan (310 CFR 40.00).

Chemical-Specific ARARs. Chemical-specific ARARs that are relevant and appropriate to this alternative include MCLs and non-zero MCLGs promulgated under the federal Safe Drinking Water Act (40 CFR 141.11-141.16, 141.61, 141.62). Massachusetts drinking water standards are identical to the federal requirements for the contaminants of concern. For those COCs that do not have a federal or state MCL or federal non-zero MCLG, the chemical-specific ARARs are the Massachusetts Contingency Plan (MCP) Method 1 GW-1 standards (except for manganese, for which the Region 9 risk-based concentration (RBC) is being used to set a cleanup goal).

Alternatives 1 and 2 would comply with the chemical-specific ARARs over time because contamination in the ground water would undergo natural attenuation until concentrations are less than MCLs, MCLGs, or MCP Method 1 GW-1 standards, as appropriate. As Alternatives 3, 4, and 5 are projected to achieve cleanup goals in 27 years, implementation of these alternatives would result in compliance with the chemical-specific ARARs.

Action-Specific ARARs. The three active remediation alternatives would have to comply with the Massachusetts Air Pollution Control Regulations, with remedial activities being conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions would be managed through engineering controls. In addition, Alternative 3 would have to satisfy certain federal and state policy requirements regarding the operation of air strippers. To meet these requirements, the air stripper off-gas would be treated with a vapor-phase GAC adsorption system to achieve compliance with this ARAR. The off-gas heater would raise the temperature of the stripper off- gas, decrease the relative humidity, and ensure adequate adsorption efficiency to reduce the organic emissions to less than allowable concentrations. Alternatives 3, 4, and 5 would generate spent carbon and particulate filters waste streams. Federal (40 CFR 262) and state (310 CMR 30.00) hazardous waste regulations would be applicable ARARs for these alternatives and wastes generated through implementation of these alternatives would be managed according to these regulations to comply with these ARARs.

Long-Term Effectiveness and Permanence

Long-term Effectiveness and Permanence evaluates the effectiveness of each alternative in maintaining protection of human health and the environment after response objectives have been met. This criterion considers the magnitude of the residual risk (in this case, risk from treatment residuals, if any) measured by numerical standards where possible. It also considers the adequacy and reliability of controls, if any, that are used to manage treatment residuals or untreated wastes that remain at the site.

The implementation of Alternatives 3, 4, or 5 would serve as containment/control measures that would result in the reduction of VOCs by removing and treating a portion of the ground water in the contaminated aquifer mainly beneath the T-25 Area. The residual contaminants remaining in the ground water would be reduced by natural attenuation processes over time. Throughout the entire remediation, institutional controls would prevent exposure to the contaminated ground water. These alternatives would be operated until the ground water cleanup goals are met. All of the technologies that would be used in these alternatives are considered reliable and are included in the EPA's presumptive remedy remedial guidance. Any risks associated with operating these treatment systems would be minimal if the proper handling and safety procedures are followed.

Treatment residuals that are generated during the remediation of the ground water would be disposed of in a manner that eliminates unacceptable risks. Any solids removed from the equalization tank would be shipped off-facility for treatment and disposal (likely as a nonhazardous waste, based on results from the TS). The GAC supply vendor would regenerate spent GAC off-facility and incinerate the contaminants, which would result in their destruction. The contaminants would be destroyed on-facility in Alternative 5, UV/oxidation, and off-facility in Alternative 3 and 4, air stripping and carbon adsorption.

All of the technologies are well-documented and proven technologies for VOC removal from ground water at the estimated contaminant concentration. However, UV/Oxidation systems (Alternative 5) have problems with inorganics scaling the UV lamps resulting in downtime and increased maintenance and waste generation. Also, carbon adsorption (Alternative 4) relies on only one process unit for contaminant removal where the air stripping and UV/Oxidation alternatives have carbon canisters as backup in case of problems with the primary treatment technology. The carbon adsorption alternative may result in inefficient treatment if inorganic or bacterial fouling or other problems affect the GAC canisters. Any contaminants that pass through the air stripping or UV/oxidation system would be removed by the aqueous-phase GAC adsorption system. Assuming VOC contaminant levels do not increase significantly from those estimated, there are no exceptional uncertainties associated with the long-term effectiveness of any of the three alternatives.

Alternative 2 would provide limited long-term protection through institutional controls, but less than Alternatives 3, 4, and 5, by restricting the access to the contaminated ground water. However, the contamination would be left in place to only undergo natural attenuation. Contaminant migration would not be controlled.

Alternative 1 provides the least long-term protection because it only leaves the contamination in the aquifer for natural attenuation and does not limit access to the ground water.

Alternatives 2 through 5 would require five-year reviews to evaluate whether the alternatives are protective of public health and the environment. The five-year reviews would be initiated five years after the start of the remedial action and would continue until cleanup goals are attained.

Reduction in Toxicity, Mobility, and Volume Through Treatment
Reduction of Toxicity, Mobility, and Volume through Treatment evaluates the anticipated performance of the specific treatment technologies that each alternative might employ. Where possible, numerical comparisons before and after remediation are presented. This criterion also considers the degree to which treatment is irreversible, the type and quantity of residuals that would remain following treatment, and the degree to which the treatment reduces the inherent hazards posed by the site.

Alternatives 3, 4, and 5 would use active treatment to reduce VOCs in ground water to concentrations below the established cleanup goals. Through these alternatives, the volume and toxicity of ground water contamination would be significantly reduced. The extraction system would also control the migration of the contaminant plume during remediation, thus minimizing migration of the contaminants to the municipal well supply and Lake Cochituate.

In Alternative 3, the VOC contamination in the ground water would be irreversibly transferred to the air phase in the air stripper, and would be subsequently removed by carbon. During the TS, greater than 96 percent of the primary COCs in the extracted ground water were removed by the air stripper. Any remaining VOCs in the ground water would also be treated with activated carbon. Since the carbon regeneration process irreversibly removes contamination from the carbon, concerns about the presence of a treatment residue are negligible, provided that safe handling practices are followed during removal and regeneration by the vendor. An estimated 6,000 pounds of carbon per year would need to be treated from this process, plus wastes from carbon backwashing.

If the water and air discharges for Alternative 3 are shown to be in compliance with ARARs, the system may be operated without activated carbon, but only after comprehensive testing demonstrates that the activated carbon system is not necessary to be in compliance. The elimination of activated carbon beds from the system could eliminate waste handling for this alternative.

In Alternative 4, the VOCs would be irreversibly adsorbed from the ground water onto the activated carbon. The carbon would then be regenerated and the contamination destroyed. This alternative would produce treatment residue in the form of spent carbon. Since the carbon regeneration process irreversibly removes contamination from the carbon, concerns for the presence of a treatment residue are negligible, provided that safe handling practices are followed during removal and regeneration by the vendor. This alternative would require the management of a large amount of waste carbon with an estimated 21,000 pounds of carbon per year needing to be treated from this process. Since the 20,000 pounds of carbon would have to be backwashed an estimated four times per year, a large amount of waste solids from inorganic and bacterial fouling of the GAC would be generated.

In Alternative 5, UV/oxidation would be used to degrade the contamination to carbon dioxide, water, oxygen, and nontoxic salts. This treatment method should achieve a greater than 99 percent removal efficiency for TCE and PCE. Since an oxidation reaction requires energy from its oxidants, it is irreversible under normal conditions in the environment. Additionally, the contaminants are detoxified and can be released to the environment without further treatment. Optimally, no wastes or contaminant-concentrated media would be generated from the destruction of contaminants. However, scale removal from the UV lamp, the associated downtime in treatment, increased labor and electrical costs, and handling of potentially dangerous hydrogen peroxide outweigh the benefit of contaminant destruction by one process unit.

Alternative 5 would produce treatment residue in the form of spent carbon. Since the carbon regeneration process irreversibly removes contamination from the carbon, concerns for the presence of a treatment residue are negligible, provided that safe handling practices are followed during removal and regeneration by the vendor. An estimated 4,000 pounds of carbon residuals per year would need to be treated from this process plus wastes generated from carbon backwashing.

If the water discharges for Alternative 5 are shown to be in compliance with ARARs, the system may be operated without activated carbon, but only after comprehensive testing has shown that the activated carbon system is not necessary to be in compliance. The elimination of activated carbon beds from the system could eliminate waste handling for this alternative.

Alternatives 1 and 2 would achieve reduction in the toxicity, mobility, or volume of the contaminants present at the site, through natural attenuation of the volatile contaminants. However, no reduction in toxicity, mobility, or volume would occur through active treatment.

Short-Term Effectiveness

Short-Term Effectiveness examines the effectiveness of each alternative in protecting public health, worker health, and the environment during the construction and implementation of a remedy until response objectives have been met. The time until protection is achieved is also considered here.

The potential risks to workers during the construction of the remedial systems for Alternative 3, 4, and 5 should easily be managed by using appropriate safety equipment, following proper decontamination procedures, and wearing protective clothing. During implementation of the system, the risks to workers should also be minimal if the proper safety practices are followed.

Since these alternatives provide containment of the contamination, protection of the community from exposure to contaminated ground water would be enhanced during the short term. The system should work efficiently if the operating and monitoring procedures are performed.

Alternative 1 and 2 would have no short-term impacts to workers, the public, or the environment since no remedial activities would be conducted.

Implementability

Implementability evaluates the technical and administrative feasibility of each alternative and the availability of required goods and services necessary to implement the alternative. Technical feasibility includes the ability to construct the system, the ability to operate and maintain the equipment, and the ability to monitor and review the effectiveness of operations. Administrative feasibility refers to the ability to obtain normal legal approvals (e.g., site access) and coordination with government regulatory agencies.

Alternative 3 was implemented for the TS and is currently operating. Alternative 4 may pose construction concerns due to the large size and weight of the liquid GAC canisters. Alternative 5 would be readily implementable and would pose no construction difficulties. These alternatives would be technically feasible, based on the ease of implementation of similar treatment systems at comparable sites. The air stripping, GAC, and UV/oxidation processes are commonly used water treatment process and there would be no difficulty in identifying vendors, design engineers, or contractors to supply the required equipment, materials, or services. UV/oxidation may have operation and maintenance concerns associated with metals precipitation on the UV lamps.

The treatment systems in Alternatives 3, 4 and 5 have proved reliable in meeting the performance goal of reducing TCE and PCE to cleanup goals at similar sites and are considered presumptive remedies by the EPA. In addition, the capacity of each of the treatment systems can be easily increased if additional ground water requires treatment or the contaminant concentration is greater than expected. As an on-facility treatment action, Alternatives 3, 4, and 5 would all be administratively favorable.

There is no technical reason that MNA could not be implemented. Because MNA is used in combination with and/or as a follow-up to active remediation for Alternatives 3, 4, and 5, regulatory acceptance may be granted.

Alternatives 1 and 2 would also be readily implementable.

Table 9 presents a summary of how the various remedial alternatives compare against the criteria.

Costs
Cost includes the capital and O&M costs of each alternative. Capital cost refers to the expenditures required to develop and construct the facilities necessary to implement the alternative. O&M costs refer to the expenditure of time and materials throughout the project, including costs to lease equipment. The one-time payment of $3,100,000 that the Army has agreed to pay the town of Natick to support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant (as described in Appendices B and F), is also factored into the total cost of each alternative. To compare the final cost of remedial alternatives, a net present value (NPV) calculation was performed on the operations and maintenance (O&M) costs each alternative. This calculation accounts for the future value of 1998 dollars and allows for a comparison between options that have different costs and varying O&M periods. An NPV was not calculated for the capital costs for these options, since these were calculated with 1998 dollars. An NPV was also not calculated for the cost of the agreement between the Army and the town of Natick, since this was a one-time payment. However, capital costs and agreement costs were added to the O&M NPV to obtain the total cost for each alternative. An inflation rate of 2 percent was used to escalate the cost for each consecutive annual O&M payment. To compare the value of these cash flows in 1998 dollars, each future inflated O&M payment was discounted back to 1998 dollars. A discount rate of 7 percent was selected and a factor that discounts the future O&M payment to 1998 dollars was applied. These discounted cash flows were summed to determine the final NPV.

The total cost of each of the alternatives is given in Section 2.9 (see Table 8).

The costs of Alternatives 3, 4, and 5 are similar. The difference in all three costs is within the accuracy of the estimates (+50 percent and -30 percent) used for evaluating remedial technologies at this level. A 10-year treatment system operational period followed by a 17-year MNA period and a 5-year ground water monitoring period are assumed. In the cost estimate model, a large majority of the annual operating cost of an alternative is associated with ground water monitoring, which would occur whether the treatment system is pumping or not. If the treatment system would have to be pumped longer than the estimated 10-year period, the additional continuing operating costs would not significantly affect the analysis of total remedial alterative costs.

Alternative 3, air stripping, has the lowest total cost out of all the active remediation alternatives. The total cost would be even lower (by approximately $350,000) if the capital expenses already invested in the full-scale treatment system designed and constructed for the presently ongoing TS are taken into account.

Alternative 5, UV/oxidation, has the highest total cost out of all the active remediation alternatives. The total cost would be somewhat lower (by approximately $165,000) if the capital expenses related to the construction of the treatment system building and discharge piping to Lake Cochituate already invested in the presently ongoing TS are taken into account. This same cost would also apply to Alternative 4, GAC.

If the flow rate to the system increases, the air stripper in Alternative 3 would have to be enlarged and the liquid- and vapor-phase GAC systems would have to be increased. The primary increases in the operating cost would be for GAC purchase and disposal, and the cost can be assumed to increase linearly with the increase in flow rate.

Alternative 4 consists of one primary unit operation, aqueous-phase GAC adsorption. If the flow rate to the system increases, the liquid-phase GAC systems would have to be increased. The primary increases in the operating costs would be for GAC purchase and disposal, and the cost can be assumed to increase linearly with the increase in flow rate.

If the flow rate or the contaminant concentration to the system is increased in Alternative 5, an additional UV/oxidation system would have to be installed, and the primary increase in the O&M costs would be for electricity and GAC purchase and disposal. These O&M costs can be assumed to increase linearly with the increase in flow rate. Both labor and monitoring are relatively fixed.

It is also important to note that the cost effectiveness of the UV/oxidation system would increase and the cost-effectiveness of the air stripper and GAC would decrease as the total quantity of the contamination that is remediated increases. The cause of this relationship is the dependence of air stripping and GAC on off-facility treatment of the GAC contaminants versus the ability of the UV/oxidation system to destroy these compounds on-facility.

State/Support Agency Acceptance
The state of Massachusetts has expressed its support for Alternative 3 based on the favorable results of the TS thus far. The state did not consider Alternatives 1 and 2 to be adequately protective. The state believes alternatives 4 and 5 could meet the cleanup goals, however, these alternatives would not be cost effective given that treatment technology components of Alternative 3 are already designed, constructed and operating.

Community Acceptance
The community has been involved in the T-25 Area ground water cleanup process through regular newsletters and open houses, and through direct involvement as a result of a Restoration Advisory Board (RAB). The RAB has allowed the community easy access to the remediation process, kept the community informed, and given them the opportunity to make recommendations that affect the community. The Lakewood Association, a local community group formed using a Technical Assistance Grant (TAG), hired a consultant in 1998, and since then, the consultant has reviewed and commented on a number of planning and report documents produced in association with the T-25 Area.

The TAG consultant, the town of Natick, and some community representatives have expressed their support for Alternative 3 based on the favorable results of the TS thus far. However, some of the public have expressed concerns about the selected remedy. These concerns are presented in Part 3 - Responsiveness Summary of this ROD, and have been addressed as part of this ROD.

2.12 Selected Remedy

The Army has selected Alternative 3 for the remedy of Operable Unit 1, the T-25 Area ground water. Alternative 3 includes ground water extraction with air stripping/carbon adsorption and long-term monitoring, institutional controls, and monitored natural attenuation. This alternative includes EPA's presumptive technology for treating ground water contaminated with volatile organics in the dissolved phase.

The ultimate objective for this remedial action is to restore the aquifer underlying the Site to its beneficial uses. The primary beneficial use for the aquifer is as a source of drinking water; off-facility to the northwest, the aquifer is currently being used for that purpose. Based on the information obtained during the RI and the TS, and a careful analysis of all remedial alternatives, the Army believes that the combination of actions comprising Alternative 3 would meet both the established cleanup goals (which are set out in Table 12 below) and the established RAOs for the T-25 Area site (which are described in Section 2.8) in a reasonable timeframe.

In summary, the ground water extraction and treatment system will contain the T-25 Area ground water contamination within SSC boundaries and bring back off-facility contamination, while MNA will address on-facility and off-facility contamination not captured by the extraction and treatment system during its operation, as well as any contamination remaining after the system is shut off due to diminishing returns. Statistical guidance presented in Methods for Monitoring Pump-and-Treat Performance (EPA, 1994) will be used to determine when diminishing returns (e.g., when contaminant concentrations become asymptotic) occur during the remedy process, and when MNA is used. The efficacy of the remedy will be monitored on-facility and off-facility. Current estimates from the ground water model indicate that cleanup levels could be met with a 10-year pumping period and a 17-year MNA period. The time period of 27 years is considered reasonable. It is important to note that these cleanup times are estimated and do not prescribe when the ground water extraction and treatment system will be shut off.

Long-term monitoring and operations data will be used to assess whether the remedy continues to be effective. In addition, the long-term monitoring and operations data will be used to assess whether adjustments or modifications need to be made to the extraction and treatment system to enhance remedy performance or maintain performance at a reduced cost. One or more of the following adjustments or modifications could be made on the basis of these data:

- Adjusting the rate of extraction from some or all wells
- Discontinuing pumping at individual wells, where cleanup goals have been attained
- Installing additional ground water extraction wells to facilitate or accelerate cleanup of the contaminant plume
- Installing additional ground water monitoring wells to evaluate the effectiveness of the remedial action
- Utilizing pulsed pumping during ground water extraction
- Modifying treatment system for more cost effective treatment, e.g. eliminate granulated activated carbon for the aqueous or gaseous stream, install inorganic removal processes, or incorporate new innovative technologies

Institutional controls will prohibit anyone from using the contaminated on-facility and off-facility ground water; natural attenuation processes will be actively monitored on-facility and off-facility, and all actions will be regularly reviewed to ensure continued protection of human health and the environment. In addition to institutional controls, the town of Natick operates an air stripping system at its Springvale Treatment Plant located to the northwest of the T-25 Area. As an element of this remedial action, the Army will support a portion of the O&M of the town's air stripper, as documented in Appendices B and F.

Three documents in support of this remedial action will be developed after the ROD has been signed. These documents will provide the necessary procedures for obtaining and evaluating data to ensure the remedial action's efficacy and determine whether adjustments need to be made. The Long-Term Monitoring Plan and the Operations and Maintenance Plan would also describe the specific procedures for notification and evaluation if an exceedance of cleanup goals in protective point-of-compliance wells or treatment system discharge limits has occurred. The three documents include:

- *Long-Term Monitoring Plan*: Provides the chemical and hydrogeologic monitoring data and confirmation that institutional controls remain in place.

- *Operations and Maintenance Plan*: Provides procedures for the treatment system, including
  monitoring the air and water discharges and evaluating the treatment system effectiveness.
- *Monitored Natural Attenuation Evaluation Plan*: Using the data from the Long-Term Monitoring Plan provides the procedures for evaluating the effectiveness of MNA on-facility and off-facility.

Further details about the Selected Remedy are provided in the next section.

Description of the Selected Remedy
The selected remedy includes the following major components:

- Ground Water Extraction and Treatment System
  - Extraction of ground water from extraction wells
  - Collection of extracted ground water in an equalization vessel with aeration to precipitate out metals
  - Filtration of ground water to remove suspended solids and metals
  - Treatment of the contaminated ground water in an air stripper to transfer volatile contaminants to an off-gas stream
  - Secondary treatment (polishing) of the air stripper's aqueous effluent by GAC adsorption to further reduce organic contaminant concentrations to less than the cleanup levels
  - Reduction of the stripper off-gas relative humidity in a heater followed by treatment of the heated off-gas containing the stripped contaminants in a vapor-phase GAC adsorbent system
  - Discharge of treated ground water to Lake Cochituate or other approved alternative uses
  - Off-facility treatment and disposal of solids collected in the equalization vessel
  - Off-facility regeneration of spent GAC from both aqueous- and vapor-phase GAC adsorbent systems
- Long-term ground water monitoring including MNA parameters both on-facility and off-facility
- Implementation of institutional controls
- MNA
- Five-year reviews
- Participating in the operation and maintenance of the Springvale Treatment Plant air stripping system

Ground Water Extraction and Treatment System. As part of a TS, the Army installed a full-scale ground water extraction and treatment system in the T-25 Area. This system has been in operation since November 1997. The Selected Remedy incorporates that system. The ground water extraction and treatment system includes pumping contaminated ground water from beneath the T-25 Area into a treatment system.

Extraction wells are located in the areas where the highest PCE and TCE concentrations have been found. Pumping from the extraction wells removes the main portion of the contamination from the ground, and prevents further contamination from migrating off-facility. Currently, the extraction system consists of two extraction wells, MW-15B and MW-90B-4. The effectiveness of the extraction wells will continue to be evaluated using the data generated as part of the procedures and data requirements, which will be established in the Long-Term Monitoring Plan and Operations and Maintenance Plan. The chemical and hydrogeological data will be evaluated on a regular basis to assess the effectiveness of the extraction wells. As a result of the continued evaluation (including modelling), the Army may consider adjusting the number and location of the extraction wells and/or the rate of extraction from some or all the wells to increase the efficiency of the system and decrease the overall remedial costs.

Current estimates from the ground water model indicate that the selected remedy could meet the established cleanup goals in 27 years. This estimate includes a projected 10-year operation of the pump-and-treat system followed by a 17-year MNA period. The 10-years of pump-and-treat operation was estimated as the time during which treatment system operation would be efficient and effective, and not subject to diminishing returns (as determined using EPA guidance documents). Any on-facility or off-facility residual contamination remaining after the shutdown of the treatment system would be addressed during the estimated 17-year MNA period. The ground water model is draft and is subject to change, as more data become available. Appendix D includes a letter summarizing the current ground water model results and its assumptions. It is important to note that these cleanup times are estimated and do not prescribe when the ground water extraction and treatment system will be shut off.

The contaminated ground water is pumped to the treatment system housed in a building in the T-25 Area. The treatment system has the following process units and is illustrated in Figure 6:

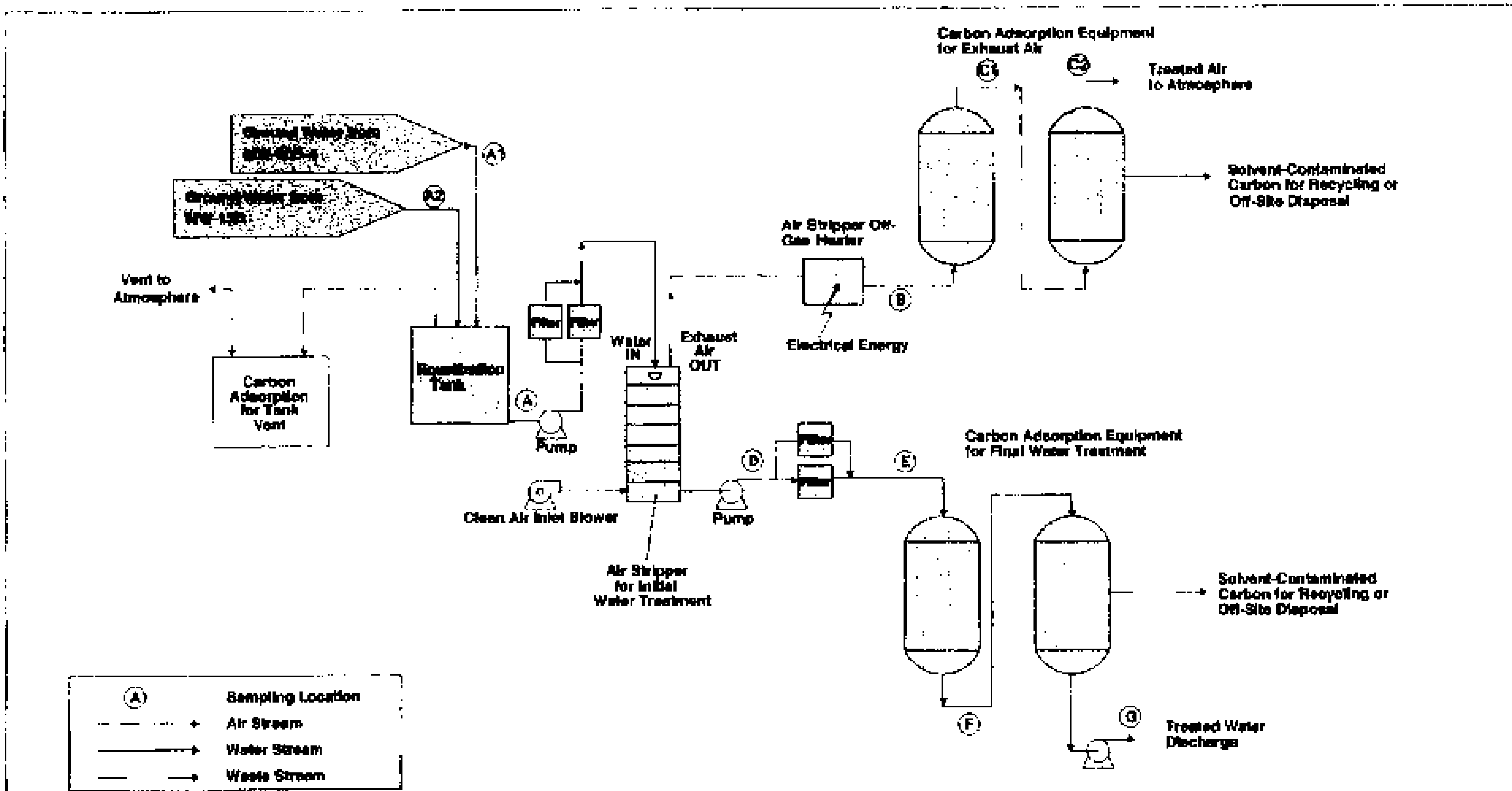
- Influent equalization tank
- Air stripper
- Vapor-phase activated carbon adsorption
- Particulate filter system for oxidized metals and suspended solids
- Liquid-phase activated carbon adsorption

The contaminated ground water is treated by a low-profile air stripper that forces the dissolved solvents out of the water into a controlled air stream. As an additional safeguard, the water is further cleaned by GAC before being discharged to Lake Cochituate. The air from the air stripper is also treated by GAC. Air and aqueous effluents are regularly monitored to ensure emissions that comply with ARARs. The solvents trapped by the carbon are recycled/disposed at a permitted off-facility facility.

The extraction system prevents the migration of the T-25 Area contaminants during remediation.

Following the signing of the ROD, an O&M Plan will be developed, which will include the procedures for operating and maintaining the extraction wells and treatment system. This includes monitoring the effluents from the treatment system to Lake Cochituate.

Air and water discharged from the treatment system will be monitored regularly to ensure that they meet federal and state ARARs. The frequency of sampling and notification procedures in case of an exceedance of discharge limits will be specified in the Operations and Maintenance Plan. The limits will be based on ARARs under the Federal Clean Water Act and the Massachusetts Surface Water Discharge Permit Program and federal and state guidelines for emissions for air-strippers. Contaminants of concern will be monitored and include primary contaminants PCE and TCE, and secondary contaminants DDT, bis(2-ethylhexyl) phthalate, chromium, lead, manganese, nickel, thallium, and vanadium. If there is an exceedance, the Army will immediately notify U.S. EPA Region I, MADEP, Massachusetts Department of Environmental Management (MADEM), and the town of Natick (community notification).



Arthur D Little

APPROVALS		DATE
DRAWN	MSB	12/99
CHECKED	KJP	12/99
QA/CONTROL	THC	12/99
TECH REVIEW	LA	12/99
PROJ MNGR	KET	12/99

TITLE

FIGURE 6
TREATMENT SYSTEM FOR T-25 AREA GROUND WATER

PREPARED FOR: USAEC	SCALE: NOT APPLICABLE
DATE: DEC. 1999	DWG NO: 67067-342
SOURCE: ARTHUR D. LITTLE, INC.	SHEET 1 OF

Long-Term Monitoring**.** Following the signing of this ROD, a Long-Term Monitoring Plan will be developed, which will describe in detail the procedures for chemical ground water monitoring and hydrologic monitoring. The plan will be developed using EPA guidance documents, such as Methods for Monitoring Pump-and-Treat Performance (EPA, 1994) and the Final OSWER Directive on MNA, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (EPA, 1999). It will also describe the procedures for notification and evaluation if an exceedance in protective point-of-compliance wells has occurred, and for field observations and corresponding documentation/certification of whether institutional controls remain in place. The following sections briefly describe the major portions of the plan.

Chemical Ground Water Monitoring. Ground water conditions will be regularly monitored to make sure both that the primary contaminant (TCE and PCE) levels are decreasing both on-facility and off-facility and that contamination is not moving away from the T-25 Area. Secondary contaminants will also be monitored in ground water to ensure that these will meet the cleanup goals. These secondary contaminants include metals (chromium, lead, manganese, nickel, thallium, and vanadium), a pesticide (DDT), and a plasticizer [bis(2-ethylhexyl) phthalate]. The results of monitoring on-facility and off-facility wells will be used to determine if cleanup goals have been met. In addition, a series of protective point-of compliance (POC) wells will be selected in areas downgradient of the contaminant plume that currently show contaminant concentrations below the established cleanup goals. These POC wells will be monitored regularly to ensure that contaminant concentrations do not exceed the cleanup goals during the remedial action. The Army will immediately notify U.S. EPA Region I, MADEP, MADEM and the town of Natick (community notification) if the cleanup goals are exceeded in these protective POC wells. The protective POC wells serve as a sentinel system that indicates whether or not the remedial action is effective. Long-term monitoring for the primary and secondary ground water contaminants at selected monitoring wells will continue for a period of five years after the achievement of cleanup goals, to ensure that aquifer clean up is maintained.

The wells selected for long-term monitoring and the monitoring schedule will be described in the Long-Term Monitoring Plan. As part of an effort to monitor the effectiveness of the selected remedy, the Army will install additional monitoring wells in both on-facility and off-facility locations. The Army will install an additional water table (A-interval) monitoring well in the area to the north of the T-25 Area on Fisher Street. A deep overburden monitoring well will also be installed to the north of the T-25 Area. Other monitoring wells are also planned, however the exact location and depth of these wells is currently under discussion with the regulators.

Hydrologic Monitoring. Water level elevations will be measured in selected standard monitoring wells, piezometers, and lake staff gauges to assess whether hydraulic containment of the T-25 Area ground water contamination is being achieved.

Monitored Natural Attenuation Parameters. In support of the MNA (discussed below) portion of the remedy, additional parameters will be monitored, including, but not limited to: oxygen, ferric and ferrous iron, nitrate, sulfate, oxidation/reduction potential, pH, total organic carbon, carbon dioxide, temperature, alkalinity, chloride, PCE and TCE breakdown products, and hydrogen. Hydrogeologic parameters including hydraulic conductivity, transmissivity, porosity, specific yield, and dispersivity will also be estimated for any additional boring/wells, installed.

Institutional Controls. Institutional controls will be implemented to restrict access to the ground water both on-facility and off-facility throughout the remedial action. The Army's Master Plan for SSC would restrict the on-facility use of ground water. If the SSC property were to be transferred out of federal ownership, the United States would impose appropriate enforceable land use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property. . . Off-facility, ground water use restrictions would be effected through a municipal ordinance covering the area where contaminated ground water has been found. More specifically, a town of Natick Board of Health ordinance (see Appendix C) would prohibit both the installation of new private drinking water wells and the use of existing private water wells in the area to prevent any access or exposure to contaminated ground water. If the town were to repeal or modify the ordinance in any way during the remedial action, the Army would immediately notify EPA and MADEP of the repeal or modification and would evaluate the remedy to determine whether it is still effective in protecting human health and the environment. The town of Natick will have primary responsibility for monitoring and enforcing the ordinance, while the Army will be ultimately responsible to ensure that the institutional control remains in place and is effective and protective of human health and the environment. The U.S. Army will provide regular certification that the institutional controls are in place. The procedures for reviewing the institutional controls will be in the Long-Term Monitoring Plan.

Monitored Natural Attenuation Evaluation. The selected remedy for the T-25 Area ground water includes MNA as part of the remedy. Based on detailed ground water flow and contaminant transport modeling conducted for the site, MNA is expected to reduce contaminant concentrations in ground water over time through natural in situ processes that include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants. MNA will address any on-facility and/or off-facility areas that are not contained by the ground water extraction system, and if necessary, as a follow-up treatment for any on-facility contamination that is not actively remediated by the extraction/treatment system. Natural attenuation of primary and secondary contaminants on-facility and off-facility will be actively monitored through the long-term monitoring program discussed above. As part of the long-term monitoring program, ground water samples will be collected and submitted for natural attenuation parameters given above. These parameters will help to address the efficacy of nonbiological natural attenuation processes, such as dilution and dispersion. Any new data collected related to natural attenuation will be evaluated, and incorporated into the ground water flow and contaminant transport model for the site.

An MNA Evaluation Plan will be developed after the ROD is signed. The guidance provided in the Final Office of Solid Waste and Emergency Response (OSWER) Directive on MNA, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (EPA, 1999)* will be followed during the development of the MNA Evaluation Plan, as well as the Long-Term Monitoring Plan. One or more of the following observations could lead to reconsideration of the MNA portion of the remedy, if confirmed by successive rounds of sampling:

- Increase in concentrations of parent contaminants, indicating that other sources may be present
- Concentrations of parent contamination and/or daughter products differ significantly from modeling predictions
- Contaminant plume for parent contaminants and daughter products increases significantly in aerial or vertical extent and/or volume from that predicted by modeling estimates

Five-year Reviews. Reviews of this remedy will occur at least every five years to ensure adequate protection of human health and the environment. The review may determine that cleanup goals have been met or that the extraction and treatment system or other components of the remedy may be modified to meet remedial action objectives. Also at each review, new remedial technologies may be evaluated to determine applicability. At any time, if a different technology becomes available in the future that provides a more effective and cost-efficient means of achieving the cleanup goals, the Army may consider the use of such a technology. The Army will propose any viable technologies to the EPA.

Additional Protection of Public Health and Safety. To further protect the drinking water of the town of Natick, the Army will support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant. This system, which is already built and operating, ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards.

Summary of Estimated Remedy Costs
The estimated capital and O&M costs for the Selected Remedy are summarized below in Table 10, and given in detail on Tables 11a and 11b. The one-time payment of $3,100,000 that the Army has agreed to pay the town of Natick to support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant (as described in Appendices B and F), is included in the capital cost of the Selected Remedy.

Table 10: Summary of Selected Remedy Costs

Alternative	Capital Cost*	O&M NPV Cost	Total NPV
3 – Air Stripping	$372,972 ** $3,100,000	$4,043,301	$7,516,273

Alternative 3 costs assume a 10-year treatment system operational period, a 17-year monitored natural attenuation period, and an additional 5-year ground water monitoring period.
* The first number in the capital cost column represents equipment and installation costs (as described in Table 11a). The second number in the capital cost column represents the one-time payment of $3,100,000 that the Army has agreed to pay the town of Natick to support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant (as described in Appendices B and F).

**The capital cost for Alternative 3 includes the $350,000 already expended for the full-scale treatment system, designed and constructed for the presently ongoing TS for the T-25 Area ground water.

Alternative 3, air stripping, has the lowest total cost out of all the active remediation alternatives. The total cost would be even lower (by approximately $350,000) if the capital expenses already invested in the full-scale treatment system designed and constructed for the presently ongoing TS were taken into account.

Expected Outcomes of the Selected Remedy
The purpose of this response action is to control risks posed by the potential future ingestion of ground water and to minimize migration of contaminants in ground water. The results of the baseline HHRA indicate that existing conditions at the T-25 Area pose an excess lifetime cancer and noncancer risk that exceed the acceptable EPA risk levels for ingestion of contaminated ground water. The risks relate primarily to the PCE and TCE, and to a lesser extent, the secondary contaminants. Cleanup levels for the

Table 11a
Capital Costs - Selected Remedy

Item No.	Item	Units	Unit Cost (1997 $)	# of Units	Total Cost (1997 $)
Purchased Equipment Costs					
100	**Extraction**				
101	GW Well Pump - 2hp	Pump	700	2	1,400
102	Well Flow Meters	Meter	1,150	2	2,300
200	**Equalization**				
201	Equalization/Setting - 3,000 gal	Tank	5,340	1	5,340
202	Pump - 3hp	Pump	800	1	800
300	**Filtration**				
301	Bag Filters, 25 micron	Filter	6,425	4	25,700
400	**Low Profile Air Stripper (LPAS)**				
401	Liquid Flow Meter	Meter	1,300	1	1,300
402	Low Profile Air Stripper and 10 hp blower	Air Stripper	29,000	1	29,000
403	5 hp Transfer Pump	Pump	1,000	1	1,000
500	**LPAS Off-Gas Treatment**				
501	GAC Vapor Adsorber - 1,000 lb	Bed	3,173	2	6,346
502	Space Heater - 10kWh	Heater	3,900	1	3,900
503	5 hp Process Blower	Blower	3,900	1	3,900
600	**LPAS Effluent Treatment**				
601	GAC Adsorber - 2,000 lb	Bed	5,500	2	11,000
Purchased Equipment Costs Subtotal					**$91,986**
Installation Costs					
Piping (plumbing and support)		30% of Purchased Equipment Cost			27,596
Electrical		10% of Purchased Equipment Cost			9,199
Instrumentation and Controls		10% of Purchased Equipment Cost			9,199
Construction and Installation		30% of Purchased Equipment Cost			27,596
Engineering and Supervision		10% of Purchased Equipment Cost			9,199
Contingency		10% of Purchased Equipment Cost			9,199
Treatment System Building (Includes Installation)		Each	1	150,000	150,000
Discharge to Lake Cochituate (Labor and Materials)			1	15,000	15,000
Installation Costs Subtotal					**$256,986**
RCRA Testing (a)		Test	1,000	4	4,000
Institutional Controls		Set	20,000	1	20,000
Total Capital Costs					**$372,972**

Note:
(a) - Testing is required by vendor prior to accepting spent carbon for regeneration.

Table 11b
Annual Operating Costs - Selected Remedy

Item	Units	Units/ Year	Unit Cost (1998 $)	Annual Cost (1998 $)
Variable Costs				
Ground Water Monitoring (a)				
Sample Collection	hours	200	65	13,000
Supervision	hours	100	80	8,000
Sample Analysis (including QC)	samples	56	650	36,400
Data Review and Reporting	hours	160	80	12,800
Equipment	wells	40	425	17,000
Water Level Measurements (b)	hours	20	65	1,300
Five-Year Review (c)	hours	50	80	4,000
Electrical (d)	kwh	308,080	0.1	30,808
Granular Activated Carbon (e)				
GAC Vapor Replacement	bed	4	2,500	10,000
GAC Liquid Replacement	bed	2	5,000	10,000
Disposal (f)	drums	20	300	6,000
Operational Monitoring				
Air analysis (including QC)	samples	41	175	7,175
Water analysis (including QC)	samples	56	175	9,800
Data Review and Reporting	hours	194	80	15,520
Labor				
Operator (g)	hours	416	65	27,040
Supervisor (h)	hours	208	80	16,640
Variable Costs Subtotal				**$225,483**
Fixed Costs				
Maintenance				
Labor and Materials (i)	10% of Capital Investment			37,297
Fixed Costs Subtotal				**$37,297**
Annual Operating Costs				**$262,780**
Total Annual Operating Cost with 30% Contingency Factor *				**$341,614**

Notes:
(a) - Assumes semi-annual sampling and analysis of 20 wells for PCE, TCE, and natural attenuation parameters.
(b) - Assumes semi-annual water level monitoring of up to 50 wells.
(c) - The cost of the Five-Year Review has been divided evenly over five years.
(d) - Electrical includes power for heating the air stream from the air stripper, pumps, and misc. electrical for lighting, etc.
(e) - Carbon cost include replacement, transportation, and off-site regeneration
(f) - Includes disposal of any solids from equalization tank and carbon backwash solids
(g) - One operator on-site per week for sampling, inspection, particulate filter changeouts and emergency response
(h) - One supervisor per well to review operation of process
(I) - Maintenance costs are 10% of the air stripping system equipment and installation costs.
- Total Annual Operating Cost = $456,664/year for first 2 years of alternative, when quarterly ground water monitoring (chemical and water level) is conducted.

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primary and secondary COCs are provided in Table 12, and are based on the most stringent of federal, state, and regional drinking water criteria. Treatment shall be monitored to ensure that cleanup levels are achieved.

The Army expects that by implementing the Selected Remedy, the ground water associated with the T-25 Area will ultimately be restored to drinking water standards within a reasonable time frame. The current modeled time estimate is 27 years. Prior to meeting drinking water standards, institutional controls will prohibit the use of contaminated ground water on-facility and off-facility. In addition, the Army is supporting the operation of the air stripping system at the town of Natick's Springvale Treatment Plant, ensuring that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards into the future.

No socio-economic or community revitalization impacts are anticipated while the site remains a military operation. However, if SSC closes or expands its tenancy, positive impacts would be anticipated for redevelopment of the land.

The anticipated environmental benefit of the remedial action is the restoration of a contaminated aquifer that lies within the Interim Wellhead Protection Area of the town of Natick's Springvale Well Field. The remedy will prevent the further migration of contaminated T-25 Area ground water. While there are no current ecological risks associated with the lake water near the SSC facility, the selected remedy will ensure that elevated concentrations of PCE and TCE from the T-25 Area do not discharge to Lake Cochituate, thereby providing an ecological benefit of the selected remedy.

Table 12. Cleanup Levels for Chemicals of Concern

Media: Ground Water
Site Area: Operable Unit 1-T-25 Area Ground Water
Available Use: Residential
Controls to Ensure Restricted Use: Army Master Plan on-facility, town of Natick ordinance off-facility.

Chemicals of Concern	Cleanup Level	Basis for Cleanup Levels[1]
Primary Chemicals of Concern		
Perchloroethene (PCE)	5 µg/L	MCL
Trichloroethene (TCE)	5 µg/L	MCL
Secondary Chemicals of Concern		
Chromium	100 µg/L	MCL
Lead	15 µg/L	Action Level
Manganese	1,700 µg/L	Region 9
Nickel	100 µg/L	MCL
Thallium	2 µg/L	MCL
Vanadium	50 µg/L	MCP
DDT	0.3 µg/L	MCP
Bis(2-ethyl hexyl)phthalate	6 µg/L	MCP

1. MCL - Federal Safe Drinking Water Act, Maximum Contaminant Level
   MCP - Massachusetts Contingency Plan Groundwater-1 Criteria
   Region - Federal EPA Region 9 risk-based concentration for drinking water

2.13 Statutory Determinations

The Selected Remedy is consistent with CERCLA, and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs, is cost effective, utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for treatment.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy for Operable Unit 1- T-25 Area ground water will protect human health and the environment through containment, treatment, and institutional controls.

Specifically, the ground water extraction with air stripping and carbon adsorption portion of the remedy contains the contaminated ground water within the T-25 Area, prevents contamination from reaching downgradient receptors, pulls back some off-facility contamination, and treats the extracted ground water and air streams to cleanup levels prior to discharge. As previously noted, an ongoing full-scale TS has demonstrated the efficacy of this ground water pump-and-treat system. The treatment system and ground water conditions will continue to be monitored to ensure the system’s effectiveness and provide data for any needed adjustments to the system. Natural attenuation processes will also be actively monitored to ensure that cleanup goals are being met for any contamination outside the influence of the treatment system, and any residual contamination within the T-25 Area remaining after the treatment system is shut down due to diminishing returns. Therefore, the Selected Remedy will result in human exposure levels to downgradient receptors (Springvale Wells) that are within federal and/or state drinking water standards.

Further, institutional controls will prevent anyone from using contaminated on-facility or off-facility ground water. A town of Natick Board of Health ordinance will prohibit both the installation of new private drinking water wells and the use of existing private drinking water wells in a prescribed area, while the Army’s Master Plan for SSC will restrict the on-facility use of ground water. If the SSC property is transferred out of federal ownership, the United States will impose appropriate enforceable land-use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property. Finally, to further protect the drinking water of the town of Natick, the Army has committed to support a portion of the operation of the air stripping system at the town's Springvale Treatment Plant. This system is already built and operating, and ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards.

Implementing the Selected Remedy will not pose any unacceptable short-term risks or cross-media impacts. The treatment system is already built and installation of any additional subsurface piping and ground water monitoring wells are not expected to expose the public to contaminants. Regardless, borings are monitored for organics, and cuttings and development water are contained in drums and tested prior to any disposal. Prior to drilling, the existence of underground structures are checked with DigSafe. If there is any remaining question about underground structures during drilling, geophysical techniques would be used to check for their presence. Planning and the implementation of engineering controls will minimize impacts from construction on roads, traffic movement, and noise.

2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy will attain all applicable or relevant and appropriate federal and state chemical-, location- and action-specific requirements. The ARARs are provided in Table 13.

2.13.3 Cost Effectiveness

The Army believes that the Selected Remedy is cost-effective and represents a reasonable value for the money spent. In making this determination, the following definition was used: “remedy shall be cost-effective if its costs are proportional to its overall effectiveness.” (40 CFR 300.430(f)(1)(ii)(D). This was accomplished by evaluating the “overall effectiveness” of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represent a reasonable value for the money to be spent.

For this site, Alternatives 1 (No Action) and 2 (Limited Action/Institutional Controls and Monitored Natural Attenuation) were not considered to be cost-effective because

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Table 13: ARARS, Criteria, Advisories, and Guidance

SELECTED REMEDY
T-25 AREA AT US ARMY SOLDIER SYSTEMS CENTER

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
CHEMICAL-SPECIFIC REQUIREMENTS				
GROUND WATER **Federal**	Safe Drinking Water Act (SDWA) – Maximum Contaminant Levels (MCLs); 40 CFR 141.11-141.16,141.61, 141.62	Relevant and Appropriate	MCLs are enforceable standards that have been promulgated for a number of organic and inorganic contaminants in public drinking water systems.	The remedy will consist of ground water extraction followed by air stripping/carbon adsorption for the on-facility contamination, with MNA for on-facility contamination not contained by the ground water extraction system while it is in operation, and for any on-facility and off-facility contamination remaining after system shut-off.. It will also include long-term monitoring and institutional controls. The remedy will meet federal MCLs for the primary COCs PCE and TCE, and the secondary COCs chromium, lead, nickel, and thallium throughout the ground water plume at completion.
	SDWA – Non-Zero Maximum Containment Level Goals (MCLGs), 40 CFR 141.50-141.52	Relevant and Appropriate	MCLGs are nonenforceable health goals for public water systems that are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety.	For those contaminants for which MCLs have not been established, at completion the remedy will meet non-zero MCLGs throughout the ground water plume.

Table 13: ARARS, Criteria, Advisories, and Guidance (continued)

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
	USEPA Carcinogen Assessment Group, Cancer Slope Factors (CSFs)	To Be Considered	CSFs are used to compute the incremental cancer risk from exposure to site contaminants and represent the most up-to-date information on cancer risk from USEPA's Carcinogen Assessment Group.	CSFs were considered to assess health risks at the site.
	U.S. EPA Risk Reference Doses (RfDs)	To Be Considered	RfDs were considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for lifetime.	RfDs were considered to assess health risks from contaminants at the site.
	EPA Region 9 Preliminary Remediation Goals	To Be Considered	EPA Region 9 Preliminary Remediation Goals (PRGs) are risk-based guidelines for evaluating and cleaning up contaminated sites. PRGs can be used to screen pollutants in environmental media, trigger further investigation, and provide an initial cleanup goal if applicable, but are not enforceable regulatory standards. The PRGs are developed using accepted risk assessment algorithms and default exposure factors for residential exposure scenarios, assuming exposure in each medium occurs through multiple routes, in combination with current EPA toxicity values. PRGs are based on a risk level of 1 x 10-6 and/or a hazard quotient of 1.	The remedy will consist of ground water extraction followed by air stripping/carbon adsorption for the on-facility contamination, with MNA for on-facility contamination not contained by the ground water extraction system while it is in operation, and for any on-facility and off-facility contamination remaining after system shut-off. It will also include long-term monitoring and institutional controls. The remedy will meet the EPA Region 9 PRG for the secondary COC manganese (which PRG is a drinking water risk-based guideline) throughout the ground water plume at completion.

Table 13: ARARS, Criteria, Advisories, and Guidance (continued)

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State	Massachusetts Drinking Water Standards, 310 CMR 22.00	Relevant and Appropriate	These standards establish MCLs for a number of organic and inorganic contaminants, in public water systems.	The remedy will consist of ground water extraction followed by air stripping/carbon adsorption for the on-facility contamination, with MNA for on-facility contamination not contained by the ground water extraction system while it is in operation, and for any on-facility and off-facility contamination remaining after system shut-off. It will also include long-term monitoring and institutional controls: The remedy will meet state MCLs for the primary COCs PCE and TCE, and the secondary COCs chromium, lead, nickel, and thallium throughout the ground water plume at completion.
	Massachusetts Contingency Plan (MCP) Method S-1/GW-1 Standards, 310 CMR 40.0000	Applicable	These standards consider the potential risk or harm resulting from direct exposure to hazardous materials in the soil and the potential impacts on the ground water at a site.	The remedy will consist of ground water extraction followed by air stripping/carbon adsorption for the on-facility contamination, with MNA for on-facility contamination not contained by the ground water extraction system while it is in operation, and for any on-facility and off-facility contamination remaining after system shut-off. It will also include long-term monitoring and institutional controls. The remedy will meet the MCP Method 1 S-1/GW-1 standards for the secondary COCs bis(2-ethylhexyl)phthalate, DDT, and vanadium throughout the ground water plume at completion.

Table 13: ARARS, Criteria, Advisories, and Guidance (continued)

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
LOCATION-SPECIFIC REQUIREMENTS				
OTHER NATURAL RESOURCES **Federal**	Fish and Wildlife Coordination Act; 16 USC 661-666, 40 CFR Part 6.302(g)	Applicable	These regulations require protection of fish and wildlife resources related to federal actions that control or modify water bodies.	Remedial activities will be in compliance with these regulations.
ACTION-SPECIFIC REQUIREMENTS				
Federal	CWA – National Pollutant Discharge Elimination System, 40 CFR Part 122-125, 131	Applicable	These regulations contain discharge limitations, monitoring requirements and best management practices for discharges into navigable waters, i.e., surface waters.	The aqueous discharge from the treatment system will be treated using aeration, filtration, air stripping, and carbon adsorption and will be regularly monitored to comply with these regulations. Discharges of treated ground water to surface waters will comply with these regulations.
	Resource Conservation and Recovery Act (RCRA) – Identification and Listing of Hazardous Wastes; Toxicity Characteristic, 40 CFR Part 261.24	Applicable	These requirements identify the maximum concentrations of contaminants for which the waste would be a RCRA-characteristic hazardous waste for toxicity.	Wastes generated from ground water treatment will be analyzed to determine if they are RCRA-characteristic hazardous waste. If analysis results exceed the standards in 261.64, the waste will be disposed of in a RCRA Subtitle C facility.

Table 13: ARARS, Criteria, Advisories, and Guidance (continued)

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
	RCRA – Standards Applicable to Generators of Hazardous Waste, 40 CFR Part 262	Applicable	These standards establish standards for generators of hazardous waste. Massachusetts has been delegated the authority to administer these standards through its state hazardous waste regulations. The applicable portions of 40 CFR Part 262 are incorporated by reference.	Management of hazardous waste generated from ground water treatment will be managed in accordance with these regulations.
	RCRA – Air Emission Standards for Process Vents, 40 CFR Part 264, Subpart AA	Relevant and Appropriate	These regulations establish requirements for controlling emissions from process vents associated with treatment processes that manage hazardous wastes with organic concentrations of 10 ppmw or more.	The air streams from the air stripper and the equalization tank will be treated using carbon adsorption and monitored before and after the carbon tanks to meet these standards. To date these streams have not exceeded 10 ppmw,.
	RCRA – Air Emission Standards for Equipment Leaks, 40 CFR Part 264, Subpart BB	Relevant and Appropriate	These regulations contain standards for equipment that contains or contacts hazardous waste with organic concentrations of at least 10% by weight.	The air streams from the air stripper and the equalization tank will be treated using carbon adsorption and monitored before and after the carbon tanks to meet these standards. To date these streams have not exceeded 10 ppmw.

Table 13: ARARS, Criteria, Advisories, and Guidance (continued)

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
	USEPA Policy on Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-28	To Be Considered	This policy provides guidance on the control of air emissions from air strippers used at Superfund sites.	The air streams from the air stripper and the equalization tank will be treated using carbon adsorption and monitored before and after the carbon tanks to satisfy this policy.
	USEPA Region I 1 Memorandum, 12 July 1989 from Louis Gitto to Merril S. Hohman	To Be Considered	This memorandum states that Superfund air strippers in ozone nonattainment areas generally merit controls on all VOC emissions.	The air streams from the air stripper and the equalization tank will be treated using carbon adsorption and monitored before and after the carbon tanks to satisfy this policy.
State	Massachusetts Surface Water Discharge Permit Program, 314 CMR 3.00	Applicable	These standards regulate the discharge of pollutants to Massachusetts surface waters.	The aqueous discharge from the treatment system will be treated by carbon adsorption after the air stripper and monitored before and after the carbon to meet these standards.
	Massachusetts Air Pollution Control Regulations, 310 CMR 7.00	Applicable	These regulations set emissions limits necessary to attain ambient air quality standards.	Remedial actions will be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction and demolition (310 CMR 7.09); and volatile organic compounds (310 CMR 7.18). If standards are exceeded, emissions will be managed through engineering controls.

Table 13: ARARS, Criteria, Advisories, and Guidance (continued)

ARARs	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
	Massachusetts Hazardous Waste Management Regulations (HWMR), Requirements for Generators, 310 CMR 30.300	Applicable	These regulations contain requirements for generators, including testing of wastes to determine if they are hazardous wastes and accumulation of hazardous waste prior to off-facility disposal.	Any hazardous waste generated from ground water treatment will be managed in accordance with these regulations.
	Massachusetts HWMR, Use and Management of Containers, 310 CMR 30.689	Applicable	These regulations set forth requirements. for use and management of containers at hazardous waste facilities.	Any hazardous waste generated from ground water treatment will be managed in accordance with these regulations.
	Massachusetts HWMR, Storage and Treatment in Tanks, 310 CMR 30.699	Applicable	These regulations set forth requirements, for use and management of tanks at hazardous waste facilities.	Any hazardous waste generated from ground water treatment will be managed in accordance with these regulations.
	MADEP Off-Gas Treatment of Point Source Remedial Air Emissions (Policy No. WSC-94-150)	To Be Considered	This policy establishes permitting requirements for air stripper installations.	This policy will be considered when planning and designing the use of air strippers in remedial activities at the site.

NOTES:

ARARs Applicable or Relevant and Appropriate Requirements
CFR Code of Federal Regulations
CMR Code of Massachusetts Regulations
MADEP Massachusetts Department of Environmental Protection

Table 14: Matrix of Cost and Effectiveness Data for Operable Unit Number 1-T-25 Area Ground Water Alternatives

RELEVANT CONSIDERATIONS FOR COST-EFFECTIVENESS DETERMINATION:

- Springvale Well Field is located approximately 2,000 feet downgradient of the site
- Baseline adult, drinking water ingestion cancer risk is 2 x10^{-3} and non-cancer risk HI is 37.

Alternative (check box if cost effective)	Net Present Value Cost	Incremental Cost	Long-Term Effectiveness and Permanence	Reduction of TMV through Treatment	Short-Term Effectiveness
1) No Action ☐	$0	——	• No reduction in long-term risk to human health and the environment • Baseline individual cancer risk = 2 x10^{-3} and non-cancer risk HI = 37	• No reduction of toxicity (T) • No reduction of mobility(M) • No reduction of volume (V)	• No short-term risk to workers • No short-term risk to community • No short-term impact on environment • More than 50 years before remedial goals achieved through natural attenuation
2) Limited Action including Institutional Controls and MNA ☐	$5,680,000	+$5,680,000	↔ Limited reduction in long-term risk to human health and the environment by restricting access to the contaminated ground water ↔ Aquifer restored to drinking water standards over time by natural attenuation	↔ No reduction of toxicity ↔ No reduction of mobility ↔ No reduction of volume	• 2 months to implement ↔ No short-term risk to workers ↔ No short-term risk to community ↔ No short-term impact on environment ↔ More than 50 years before remedial goals achieved through natural attenuation
3) Ground Water Extraction with Air Stripping/Carbon Adsorption and Long Term Monitoring, Institutional Controls and MNA X	$7,520,000	+$1,840,000 (without expended capital costs) +$1,490,000 (with expended capital costs)	• Treatment system currently operating ↑ Reduction in long-term risk by active treatment, in addition to restricted access to contaminated ground water and monitored natural attenuation ↑ Aquifer restored to drinking water standards	↑ Reduction in toxicity ↑ Reduction in mobility ↑ Treatment of entire volume of contaminated ground water	↔ 2 months to implement ↔ No short term risk to workers ↔ No short-term risk to community ↔ No short-term impact on environment ↑ Potential to achieve remedial goals in approximately 27 years
4) Ground Water Extraction with Liquid-Phase Activated Carbon and Long-Term Monitoring, Institutional Controls and MNA X	$7,760,000	+$240,000	↓ Replace operating air stripper/carbon adsorption with carbon only ↔ Reduction in long term risk by active treatment, in addition to restricted access and monitored natural attenuation ↔ Aquifer restored to drinking water standards	↔ Reduction in toxicity ↔ Reduction in mobility ↔ Treatment of entire volume of contaminated ground water	↓ 8 months to implement ↔ No short term risk to workers ↔ No short-term risk to community ↔ No short-term impact on environment ↔ Potential to achieve remedial goals in approximately 27 years
5) Ground Water Extraction with UV/Oxidation, Long-Term Monitoring, Institutional Controls and MNA X	$8,240,000	+$480,000	↔ Replace operating carbon with UV/Ox system ↔ Reduction in long term risk by active treatment, in addition to restricted access and monitored natural attenuation ↔ Aquifer restored to drinking water standards	↔ Reduction in toxicity ↔ Reduction in mobility ↔ Treatment of entire volume of contaminated ground water	↓ 8 months to implement ↔ No short term risk to workers ↔ No short-term risk to community ↔ No short-term impact on environment ↔ Potential to achieve remedial goals in approximately 27 years

COST-EFFECTIVENESS SUMMARY: (Summary of individual cost-effectiveness evaluations and relative cost effectiveness determinations)

- Alternatives 1 and 2 are not considered cost effective.
- Alternatives 3, 4 and 5 are considered to be cost effective, however, Alternative 3 provides a potentially greater return on investment

Key: • Baseline characteristic
↑ More "effective" compared to previous alternative
↓ Less "effective" compared with previous alternative
↔ No change compared with previous alternative

selected remedy however, these alternatives will take longer to implement and cost more since the selected remedy is already designed and constructed.

Short-Term Effectiveness. The Selected Remedy did not pose any risks to workers during the construction of the remedial system for Alternative 3. The construction was easily managed by using appropriate safety equipment, following proper decontamination procedures, and wearing protective clothing. During implementation of the system, the risks to workers were also minimal since the proper safety practices were followed. The community was protected from ground water exposure since the selected remedy provides containment of the contaminated ground water. The selected remedy has worked very efficiently with proper operating and maintenance procedures.

Alternatives 4 and 5 should also be easily constructed and implemented, however potential risks exist since these systems are not constructed. Since Alternatives 4 and 5 provide containment of the contamination, protection of the community from exposure to contaminated ground water would be enhanced during the short term. These alternatives should also work efficiently if the proper operating and maintenance procedures are performed.

Implementabilty. The Selected Remedy was implemented for the TS and is currently operating. Alternative 4 may pose construction concerns due to the large size and weight of the liquid GAC canisters. Alternative 5 would be readily implementable and would pose no construction difficulties. These alternatives would be technically feasible, based on the ease of implementation of similar treatment systems at comparable sites. The air stripping, GAC, and UV/oxidation processes are commonly used water treatment processes and there would be no difficulty in identifying vendors, design engineers, or contractors to supply the required equipment, materials, or services. UV/oxidation may have O&M concerns associated with metals precipitation on the UV lamps.

Cost. The Selected Remedy has the lowest total cost out of all of the active remediation alternatives. The total cost would be even lower (by approximately $350,000) if the capital expenses already invested in the full-scale treatment system designed and constructed for the presently ongoing TS are taken into account.

Alternative 5, UV/oxidation, has the highest total cost out of all the process options. The total cost would be somewhat lower (by approximately $165,000) if the capital expenses related to the construction of the treatment system building and discharge piping to Lake Cochituate already invested in the presently ongoing TS were taken into account. This same cost reduction would also apply to Alternative 4, GAC.

State/Support Agency Acceptance
The State of Massachusetts has expressed its support for Alternative 3 based on the favorable results of the TS thus far. The State did not consider Alternatives 1 and 2 to be adequately protective. The State believes alternatives 4 and 5 could meet the established cleanup goals, however, these alternatives would not be cost effective given that treatment technology components of Alternative 3 are already designed, constructed, and operating.

Community Acceptance
The community has been involved in the T-25 Area ground water cleanup process through regular newsletters and open houses, and through direct involvement as a result of a Restoration Advisory Board (RAB). The RAB has allowed the community easy access to the remediation process, kept the community informed and given them the opportunity to make recommendations which affect the community. The Lakewood Association, a local community group formed using a TAG, hired a consultant in 1998, and since then, the consultant has reviewed and commented on a number of planning and report documents produced in association with the T-25 Area.

The TAG consultant, the town of Natick, and some community representatives have expressed their support for Alternative 3 based on the favorable results of the TS thus far. However, some members of the public have expressed concerns about the selected remedy. These concerns are presented in Part 3 - Responsiveness Summary of this ROD, and have been addressed as part of this ROD.

2.13.5 Preference for Treatment as a Principal Element
The selected remedy uses treatment to address the principal threat posed by the site, dissolved PCE and TCE in ground water. Although a definitive source was not identified, the current dissolved PCE and TCE concentrations appear to be a result of past operations within the T-25 Area. The treatment methods used to reduce their toxicity, mobility, and volume include various components of Alternative 3. The toxicity of the dissolved PCE and TCE will be reduced by their removal with air stripping and carbon adsorption technologies. The mobility of the contaminants toward sensitive receptors will be reduced due to the ground water extraction and the capture zone created by pumping. The volume of the contaminants will be reduced due to their removal from the aquifer and adsorption on the activated carbon and ultimate destruction during carbon regeneration.

2.13.6 Five-Year Review Requirements
Because this remedy will result in hazardous substances remaining on-facility above concentrations that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. This review will also consider additional and/or new technologies that may be more

effective than the selected technologies. The five-year review will also evaluate modifications to the system that would be more protective of human health and the environment.

2.14 Documentation of Significant Changes from Preferred Alternative of Proposed Plan

The Proposed Plan was released for public comment in August 1999. It identified Alternative 3, Ground Water Extraction with Air Stripping/Carbon Adsorption and Long-Term Monitoring, Institutional Controls, and MNA, as the Preferred Alternative for ground water remediation. As a component of Alternative 3, the Army made a commitment to participate in the operation of the air stripping system at the town of Natick's Springvale Treatment Plant. However, the cost of the agreement between the Army and the Town of Natick was not included in the Proposed Plan released to the public. The only significant change from the preferred alternative of the Proposed Plan is therefore related to the agreement between the Town of Natick and the Army, and the costs associated with the agreement.

The Army has agreed to pay the town a one-time payment of $3,100,000 to support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant. This system, which is already built and operating, ensures that Natick's drinking water will continue to meet all federal and more stringent state safe drinking water standards. Copies of the Memorandum of Agreement and Cooperative Agreement between the town of Natick and the Army are presented in Appendices B and F, respectively.

As a result of this information, the $3,100,000 agreement cost has been incorporated into the total cost for each of the five remedial alternatives evaluated in this ROD, including the Selected Remedy. While negotiations between the Army and the Town of Natick have been ongoing for approxiinately 2 years, it was an oversight by the Army that the actual cost of the agreement should be included in the cost analysis of the different remedial alternatives. The addition of the agreement cost does not effect the results of the comparative analysis of the remedial alternative, because the $3,100,000 was added to each of the five alternatives. The Selected Remedy continues to have the lowest cost out of all three of the active remedial alternatives.

PART 3: RESPONSIVENESS SUMMARY

The Army received written comments on the *Proposed Plan to Clean Up Ground Water at the T-25 Area* (August 1999) from the TAG consultant, from a RAB member, and from a member of the public. Verbal comments were received at a Public Hearing held September 23, 1999, at the SSC Officers' Club. This section summarizes the issues raised by a number of individual commentors. Detailed responses to all comments received by the Army are provided in an attachment to this Responsiveness Summary.

<u>1. Several commentors had questions regarding the estimated 27-year cleanup time, including how that period of time was estimated, and how it would be applied during the time remedial action was being implemented.</u>

A remedial alternative is discontinued when actual chemical monitoring data meet the goals of the cleanup, as noted in the Proposed Plan. No specific time for ceasing pumping or the remedial alternative is stipulated in the Proposed Plan. The time period of 27 years was estimated based on a ground water computer model, only for use in the cost criteria comparisons presented in the Proposed Plan and the Focused Feasibility Study/Treatability Study (FFS/TS). These estimated cleanup do not indicate when an alternative would be "shut off." Rather they are used to develop costs for various remedial alternatives using a consistent period basis and known assumptions. ***A remedial alternative is discontinued only when the actual chemical monitoring data meet the established cleanup goals.***

<u>2. Several commentors asked whether additional monitoring and/or extraction wells would be installed.</u>

The Army will install additional off-site monitoring wells to monitor the effectiveness of the selected remedy. These will include an additional water table (A-interval) monitoring well in the area to the north of the T-25 Area on Fisher Street and a deep overburden monitoring well to the north of the T-25 Area. Other monitoring wells are also planned, however the exact location and depth of these wells is currently under discussion with the regulators. The specific details regarding the additional wells the Army will install will be described in the Long-Term Monitoring Plan, which will be developed after the signing of the Record of Decision (ROD).

In order to modify the existing system, it is necessary to evaluate the chemical and hydrogeological data collected during the operation of that system. The Army has been operating the treatment system for about a year and a half; it takes time for the system to fully develop, e.g., affect areas beyond the immediate extraction wells. The Army has to reach the cleanup goal of drinking water standards (5 parts per billion) for PCE and TCE, both on site and off site. The effectiveness of the current extraction wells will continue to be evaluated using the data generated as part of the procedures and data requirements, which will be given in the Long-Term Monitoring Plan and Operations and Maintenance Plan. If the evaluation of the data indicate that cleanup goals are not being attained in the off-site and/or on-site portions of the plume, contingencies are developed. Those contingencies have already included the additional monitoring wells noted above. As a result of the continued evaluation (including modeling), the Army may consider adjusting the number and location of the extraction wells and/or the rate of extraction from some or all of the wells to increase the efficiency of the system and/or to decrease the overall remedial costs. It is in the Army's best interest to clean up the contamination as fast as possible; lengthy cleanups result in higher costs and sometimes in decreased effectiveness. If an additional extraction well would decrease the time to clean up or improve the effectiveness of the cleanup, the Army would certainly implement that modification.

3. Several questions were raised concerning the ground water model, especially with regard to the potential for increased pumping rates from the town's Springvale well field and regarding how the model applies to drought conditions.

As part of the continued development of the model, a sensitivity analysis will be conducted. This sensitivity analysis includes using a range of representative pumping rates (including increased rates) at the Springvale wells. The flow and contaminant transport results from this range of pumping rates will be evaluated to determine the influence of varying pumping rates on contaminant transport rates (how fast ground water contamination may be traveling). Also, a range of representative aquifer levels (during wet, dry, and average conditions) will be modeled, and the flow and contaminant transport results will be evaluated to determine the influence of these varying levels on contaminant transport rates.

The Army is aware that pumping rates may increase in the future as water demand increases (due to development). However, the current Springvale wells can only pump up to a certain rate, because of their physical size (depth, diameter, screen length) and hydraulic conditions of the aquifer. It is these physical limitations that will dictate the upper limit of the pumping rates used in the model. If water usage in Natick increases beyond the current capacity of all of the town's wells, the town would likely have to explore alternative sources.

The ground water flow and contaminant model developed in support of the T-25 Area remedial action currently uses average pumping rates and drawdown measurements for the Springvale and Evergreen wells. These averages were computed using actual recorded pumping data available from the town data from the past couple of years. The ground water model also currently uses average ground water elevations (i.e., aquifer levels, collected from more than eight years of quarterly ground water monitoring. The Army is aware that during the summer of 1999, aquifer levels were low.

While it is conceivable that the pumping rates at the town wells may be greater during times of drought or high-use periods, these events are relatively short-term occurrences (relative to the model run time), and are not expected to impact the overall results of the ground water model. For example, if one assumes that a drought could last an entire summer, that would be a time frame of 90 days. The model scenarios are typically run for a period of 50 years or 18,250 days. The period of drought (90 days) in this example represents only about 0.5 percent of the total model run time. Due to this relatively low percentage, drought conditions are not expected to influence the overall results of the model significantly.

4. Several commentors questioned the safety of the treatment and asked about safety checks and prevention of treatment system failures.

The treatment system effluent has been monitored and will continue to be monitored regularly throughout the remedial action. The effluent must meet the legal discharge limits, and, to date, has met these limits. If these concentrations are exceeded, the Army will notify U.S. EPA New England Region, Massachusetts Department of Environmental Protection (MADEP), and Town of Natick officials. Notification procedures for treatment system effluent exceedances will be described in the Operations and Maintenance Plan to be completed after the ROD has been signed.

To prevent discharge of untreated water to the lake, numerous safety-related design features and emergency shutdown conditions have been included in the treatment system. Many of these safety features overlap in purpose and therefore provide multiple, redundant treatment processes and safety shutdowns to prevent the release of untreated water. These safety-related design features are as follows:

1. The untreated ground water passes through three treatment process units: an air stripper, a primary liquid-phase carbon tank, and a secondary liquid-phase carbon tank. Each of these tanks is individually capable of successfully cleaning the water to meet state and federal requirements. The Army has included three treatment processes in a row to ensure that all contamination is successfully removed from water that is released back to the environment.

2. A floor sump water sensor has been installed in the sump in the building floor near the equalization tank. The entire floor of the building slopes toward this sump. Also, the edges of the floor all have a sealed curbing to contain any spilled waters within the building. If the sensor in the sump detects water, the entire system is shut down, including the extraction well pumps. The system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition from the sump water sensor.

3. High water-pressure switches are included for all bag filters and liquid-phase carbon tanks. If water pressure increases past a set point for a filter pressure switch, the other filter in the pair is enabled, the previously operating filter is closed, and the autodialler contacts up to four equipment operators to change out the spare filter. If the pressure in both filters of a pair increase past a set point, the entire system is shut down and the system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition. The pressure switches prevent overworking the pumps and reduce the possibility for leaks caused by too much pressure in the system.

4. Water level switches are located in the equalization tank and the air stripper. Emergency high-level switches are set in the equalization tank and air stripper tank to prevent overflow and spillage of untreated water in the building. The emergency low-level switch in the equalization tank is set to detect leaks in the equalization tank and to prevent continued pumping in the event of a catastrophic failure of the tank or a malfunction of the operational low-level switch. If an emergency water level switch is tripped, the entire system is shut down and the system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition.

5. Conductivity probes have been installed in the extraction wells to detect free product (DNAPL – dense, nonaqueous phase liquid) and to regulate the operation of the extraction well pumps. If the conductance differs from the conductance of the ground water or if the probes fail, the extraction well pump is shut down. Although free product and high concentrations associated with free product have never been observed near these wells, the Army has installed these probes as an additional safety feature to prevent free product from entering the system and overloading the equipment. In addition, the conductivity probes will sense if the water level in the extraction well drops too low, and will shut the extraction well pumps off to prevent the well from dewatering and causing potential damage to the well pump.

6. A low air-pressure switch has been installed in the air stripper. If the air stripper blower fails, then air pressure in the air stripper sump tank will drop and cause the alarm switch to shut down the entire system.

7. The control system is programmed to require manual reset of the system if any alarm condition occurs. The system will not automatically restart once water levels, for example, return to operational ranges. The on-call operator must physically inspect the system, determine the cause for the alarm condition, and correct the problem before restarting the system manually.

8. Water is sampled from the treatment system regularly to ensure that the contamination is successfully removed that the system is operating correctly. Samples of water are collected before and after each stage of the treatment system. The results of analyzing these water samples allow the Army to monitor how the amounts of chemicals are decreasing in the untreated water as more and more water is removed, and demonstrate that only successfully treated water is being released from the building. Further, the monitoring data provide a warning if contaminant levels are rising sufficiently soon enough, that corrective actions could be taken well before any contaminant was released to the environment. Analyses of the treatment system water being discharged to the lake to date have shown no detectable concentrations of PCE and TCE (at a detection limit of 2 ug/L). Calculations associated with the hypothetical discharge of PCE and TCE in untreated effluent and at concentrations at/below the detection limits are presented in Appendix I of the Final FFS/TS.

9. Treatment system inspection and maintenance activities are performed at least weekly, with more extensive inspection and maintenance performed during quarterly shutdowns that coincide with the long-term ground water monitoring program across SSC.

To prevent discharge of untreated air, the Army has selected the most protective option described in the Massachusetts Department of Environmental Protection (MADEP) "Remedial Air Emissions" requirements. The MADEP requirements state that applicable treatment systems may elect to apply off-gas treatment that ensures 95 percent removal of volatile emissions. The treatment system at SSC exceeds this 95 percent limit for volatile emissions.

1. The air stripper unit of the water treatment process cleans the water by transferring the volatile contaminants from the water to the air. This air is contained within a sealed system that passes the stripper air through a heater, then through two vapor-phase carbon units. Each of the carbon units can successfully treat this air to meet federal and state requirements. The spent carbon would be recycled/disposed at a permitted off-site facility. The Army has included two treatment processes in a row to ensure that all contamination is successfully removed from air that is released back to the environment.

2. Air pressure is monitored and air samples are collected regularly from the air treatment portion of the system. Samples and pressure are monitored after the air stripper, and in between and after the carbon units. Sample and pressure information ensure that the carbon units are operating correctly. Data are available soon enough that if any corrective action were necessary, there is more than enough time to implement that action.

A diagram of the treatment system is presented in Figure 6.

5. Questions were raised regarding the agreement reached between the Town of Natrick and the Army concerning the operation of the Springvale Treatment Plant.

To further protect the drinking water of the Town of Natick, the Army will support a portion of the operation and maintenance of the treatment system at the town's Springvale Treatment Plant. The agreement between the Army and the Town of Natick was developed through negotiations between the Town and the Army, with the involvement of the regulators. The Army believes that the agreement was fair, and that it will benefit both parties involved. The agreement includes several provisions including:

- The Army will provide the Town with a one-time payment of $3.1 million, representing the present value of operation and maintenance of the Springvale Treatment Plant.
- Agreements by the Town to continue operation of the Springvale Treatment Plant, and the Army to continue operation of source area containment of contaminated ground water at the SSC site.
- Agreements by both parties that, upon fulfillment of all obligations and covenants, the parties will not sue each other.
- Agreements that upon fulfillment of all obligations and covenants, both parties are released from past and future response costs incurred or to be incurred and claim for response costs and damages related to PCE, TCE, or breakdown compounds in Town drinking water supplies.

PART 3: DETAILED RESPONSES

Comments on the Proposed Plan by Environmental Insight, September 29, 1999

Comment

1. Time Scale of Treatment: Pumping and treatment of ground water should continue until Preliminary Remediation Goals (PRGs) are met or until monitoring data show leveling off of concentrations with no reduction over several monitoring periods. The Record of Decision (ROD) should not stipulate a specific time for ceasing pumping; the decision to stop pumping ground water should be based on performance.

Response

1. As stated in the Proposed Plan (page 9), "A remedial alternative is discontinued when actual chemical monitoring data meet the goals of the cleanup." No specific time for ceasing pumping or the remedial alternative is stipulated in the Proposed Plan, nor will it be stipulated in the ROD. The time period of 27 years was estimated based on a ground water computer model, only for use in the cost criteria comparisons presented in the Proposed Plan and Focused Feasibility Study/Treatability Study (FFS/TS). This was done to provide a consistent basis and known assumptions for estimating the cost of the various remedial alternatives. These estimated cleanup times do not indicate when an alternative would be "shut off." ***A remedial alternative is discontinued only when the actual chemical monitoring data meet the established cleanup goals.***

Comment

2. Monitoring Issues

The Army addressed these issues at the Public Hearing. However, we would like to emphasize our concerns about data gaps in the ground water monitoring plan at the T-25 Area, and how these gaps can best be eliminated.

   a. Additional monitoring wells are required north and west of the T-25 Area, particularly in the area between Fisher and Arcadia Streets. The existing monitoring wells are not screened in the soil strata most likely to contain contaminants based on the subsurface information from the most highly contaminated wells on the site. In addition, there are data gaps in this area regarding stratigraphy, particularly north of MW-208. At a minimum, additional monitoring wells should be installed between MW-208 and MW-202; these wells should be screened in the medium sand layer, and the extent of that layer should be identified.

b. Additional monitoring wells are needed west of MW-208, between Lakewood Avenue and the Lake, to evaluate migration in this direction and to evaluate subsurface stratigraphy.

c. The ROD should include provisions to include monitoring for primary and secondary Contaminants of Concern (COCs) in influent, effluent and monitoring wells throughout the remediation period.

Response

2a/b. The Army will install additional off-site wells to monitor the effectiveness of the selected remedy. These include an additional water table (A-interval) monitoring well in the area to the north of the T-25 Area on Fisher Street and a deep overburden monitoring well to the north of the T-25 Area. Other monitoring wells are also planned, however the exact location and depth of these wells is currently under discussion with the regulators. The specific details regarding the additional wells the Army will install will be described in the Long-Term Monitoring Plan, which will be developed after the signing of the ROD.

The Army currently has seven permanent off-site monitoring wells to the west and north of the T-25 Area, and has advanced two off-site borings to and into bedrock to the north and west of the T-25 Area. In addition, the town of Natick has installed two permanent monitoring wells at the end of Arcadia Road (near Army well MW-202B). Many of the existing permanent Army wells are screened in zones where the highest contaminant concentrations were detected during field screening. The well screens in MW208B-HP2 (on Fisher Street – north of the T-25 Area) and MW209B-HP2 (on Lakewood Road – west of the T-25 Area) were set at their current elevations, because these are the intervals where the highest field screening PCE and TCE results were found during installation of the wells. While some of the off-site wells are not screened in the same soil strata as the on-site, more highly contaminated wells, these off-site wells are screened at intervals that were determined to have the highest contaminant, which is more important than the particular soil strata.

2c. The details of the monitoring program that will support the selected remedial action will be described in the Operations and Maintenance Plan and the Long-Term Monitoring Plan. These documents will be developed after the ROD has been signed, and will provide the necessary procedures for obtaining and evaluating data to ensure the selected remedial action's effectiveness. The influent to and effluent from the treatment system are currently monitored for the primary and secondary COCs on a regular basis, and will continue to be throughout the remediation period. The treatment system effluents (air and water) will be monitored to ensure that contaminant levels meet federal and more stringent state regulations (Proposed Plan, page 10); these effluents are currently beneath the regulatory requirements. The Long-Term Monitoring Plan will include provisions to monitor both primary and secondary contaminant levels in both on-site and off-site wells.

Comment

3. Reporting Issues: The ROD should include provisions to set action levels that will trigger specific reporting to the community if exceeded in the Point of Compliance (POC) monitoring wells, in the treatment effluent, or in off-site monitoring wells.

Response

3. The protective POC wells will be a series of wells off site and downgradient of the T-25 Area that currently show primary contaminant concentrations below Maximum Contaminant Levels (MCLs). The specific wells that will be designated as POC wells will be selected and monitored as will be described in detail in the Long-Term Monitoring Plan. If the levels in these protective POC wells exceed the PRGs, notification will occur, following procedures to be described in the Long-Term Monitoring Plan. The “action levels” for POC wells are the cleanup goals (or PRGs), and the “action levels” for the treatment system effluent are the legal discharge limits. If these concentrations are exceeded the Army will notify U.S. EPA New England Region, MADEP, and Town of Natick officials. Notification procedures for treatment system effluent exceedances will be described in the Operation and Maintenance Plan to be completed after the ROD has been signed. Long-term monitoring of selected off-site monitoring wells will continue to make sure the primary contaminant concentrations are decreasing, and these wells will continue to be monitored for a period of five years after the achievement of cleanup goals. The results of this monitoring will be reviewed with the regulators and with the public.

Comment

4. Contingency Issues
   a. Prohibition of private drinking water wells in the area potentially influenced by the T-25 ground water contamination may not be sufficient to protect public health. The institutional controls at the site should include prohibition of all ground water withdrawal, including for irrigation and lawn sprinkler systems. People have been known to drink from irrigation wells, or to use

water from these wells to fill swimming pools, etc. There is no way to prevent people from drinking from a ground water source once a well is installed. We strongly urge the ROD to require prohibition of all wells as part of the remedial response.

b. The ROD should provide for planning in the event that ground water concentrations of primary COCs level off above the PRGs. If pumping is to be discontinued, there needs to be a contingency plan to evaluate alternative technologies that may be available.
c. The ROD should address response actions that will be implemented if concentrations of COCs are detected above the PRGs in the POC wells.
d. The ROD should include contingencies planning in the event that primary or secondary COCs are detected in the treatment plant effluent.
e. The ROD should address contingency planning in the event that the primary contaminant plumes split, and there is evidence of failure to capture the off-site contamination. The possibility of adding an extraction well to extend the capture zone should be addressed.
f. The ROD should include contingency plans for addressing disposal problems that could arise if elevated metals are detected in waste materials derived from the remediation process, including sludge and carbon.
g. The ROD should address concerns about potential aerator fouling from iron.

Response

4a. The Natick Board of Health ordinance promulgated on February 19, 1999 states that:

1. Private wells for drinking water are not allowed where a public water supply is available
2. Private wells for drinking water shall not be allowed in an area bounded by North Main Street, Lake Cochituate, West Central Street, and the Massachusetts Turnpike, and
3. Installation of wells for irrigation or industrial purposes may not occur without a permit from the Board of Health

4b. As stated in the Proposed Plan (page 12), reviews of the remedy will occur at least every five years. If concentrations of primary COCs level off above the cleanup goals, some components of the remedy may be modified to meet remedial action objectives, and/or new remedial technologies may be evaluated to determine applicability. The Army would propose any alternative viable technologies to the U.S. EPA. These provisions for review of the remedial action results and review of alternative technologies will be incorporated in the Long-Term Monitoring Plan, which will be developed after the ROD has been signed. In addition, the monitored natural attenuation (MNA) part of the remedy will be reviewed regularly. One or more of the following observations could lead to re-consideration of the MNA portion of the remedy, if confirmed by three or more rounds of sampling:

- Increase in levels of parent contaminants, indicating that other sources may be present.
- Concentration levels of parent contaminants and/or daughter products differ significantly from modeling predictions.
- Contaminant plume for parent contaminant and daughter products increases significantly in areal or vertical extent and/or volume from that predicted by modeling estimates.

These stipulations ensure that the effectiveness of the MNA portion of the selected remedial alternative will be evaluated on a regular basis, and will be described in detail in an MNA Evaluation Plan after the ROD is signed.

4c. If concentrations of COCs are detected above the remedial action goals in the protective POC wells, the Army will notify the U.S. EPA, MADEP, and town of Natick officials. Regular ground water monitoring reports will also be issued to the regulators and made available to the public in the information repositories at SSC, the Morse Institute, and the MADEP. The Long-Term Monitoring Plan, to be developed after the ROD is signed, will describe in detail the procedures for notification and evaluation if an exceedance in protective POC wells has occurred (Proposed Plan, page 10). Options to refine the treatment system, if necessary, could include:

- Adjusting the rate of pumping from the extraction wells
- Discontinuing pumping at individual extraction wells, where cleanup goals have been attained
- Installing additional ground water extraction wells to facilitate or accelerate cleanup of the contaminant plume
- Installing additional ground water monitoring wells to evaluate the effectiveness of remedial action
- Utilizing pulsed pumping during ground water extraction
- Modifying treatment system for more cost-effective treatment; e.g., eliminate granulated activated carbon for the aqueous or gaseous stream, install inorganic removal processes, or incorporate new innovative technologies

4d. Treatment effluent will continue to be analyzed on a regular basis, as will be specified in the Operations and Maintenance Plan. If there is an exceedance, the Army will notify the U.S. EPA, MADEP, and the Town of Natick. The notification procedures in case of an exceedance of discharge limits will be specified in the Operations and Maintenance Plan. It should be noted that, in addition to analysis immediately prior discharge, the effluent is analyzed several times along the treatment train as part of the standard operation of the treatment system, for example, after leaving the air stripper and after the first carbon canister. Options in case of an exceedance of discharge limits could include:

- Resampling to check for sampling or laboratory error
- Evaluating current process technology steps
- Evaluating and installing a new process technology
- Shutting off the system

4e. The event discussed in the comment would be covered by the five-year review process. If there is evidence of failure to capture the off-site contamination, modification of the remedy and/or new remedial alternatives may be considered, which could include the possibility of adding an extraction well. These items will be discussed in detail in the Long-Term Monitoring Plan. The effectiveness of the extraction wells will continue to be evaluated using the data generated as part of the procedures and data requirements, which will be given in the Long-Term Monitoring Plan and Operations and Maintenance Plan. The chemical and hydrogeological data will be evaluated to assess the effectiveness of the extraction wells. As a result of the continued evaluation (including modeling), the Army may consider adjusting the number and location of the extraction wells and/or the rate of extraction from some or all the wells to increase the efficiency of the system and decrease the overall remedial costs.

4f. The spent carbon, particulate filters, backwash water, and settled solids are waste streams that are managed according to federal and state regulations concerning hazardous waste. To date, all backwash water, settled solids, carbon, and used particulate filters generated during the treatment process have been tested and classified as nonhazardous wastes, and handled accordingly. The solvents trapped by the carbon would be recycled/disposed at a permitted off-site facility (Proposed Plan, page 10). The methods of treatment will be specified in the Operations and Maintenance Plan to be completed when the ROD is signed. After air stripping, any remaining volatile organic compounds (VOCs) in the ground water are treated with activated carbon, which is regenerated. The regeneration process destroys contamination from the carbon. Safe handling practices are followed during removal and regeneration by a vendor. Backwash water is put into storage tanks, the settled solids from the equalization tanks are stored in drums, tested, and treated as a non-hazardous waste, based on Resource, Conservation and Recovery Act (RCRA) characterization methods. If data indicated that any wastes demonstrated RCRA characteristics, then it would be managed appropriately as a hazardous waste.

4g. The treatability study found that slight system changes were necessary to improve the way the system filters out oxidized metals, (Proposed Plan page 4). The system will be continuously monitored and operating procedures reviewed to ensure that aerator fouling from iron will not be a concern. These procedures will be described in the Operations and Maintenance Plan, to be completed after the ROD is signed. Options to address issues associated with iron and other metals will continue to be evaluated.

Comments of Marco Kaltofen, Submitted September 3, 1999

Comment 1:

The groundwater model on which the Army bases its projections of its impact on the Town of Natick water supply assumes that no continuing source of chlorinated solvents exists, that all chlorinated solvents are dissolved in groundwater. This results in the extreme minimization of the source strength (the concentration of contaminants in the source area).

As the March 1999 Lawrence Livermore Historical Case Analysis of Chlorinated Volatile Organic Compounds report (Also called the “Plumathon study” at http://www.erd.llnl.gov/library/AR-133361.pdf) states, source strength and groundwater velocity are the key determinants of plume length.

In other words, this assumption of no undissolved PCE or TCE yields the minimum possible plume length and strength. No evidence has ever been presented that this source area exists only as a dissolved groundwater plume. No evidence has ever been presented that the original spill of TCE and PCE came as a dissolved aqueous source. No attempt has been made to locate the exact source area other than to examine dissolved contaminants in groundwater. Undissolved sources can include free product, PCE/TCE adsorbed onto soils or organic matter, and any other nonaqueous phase system.

By completely avoiding the issue of locating the nondissolved source area or identifying the original TCE/PCE source, the entire remedial investigation program yields the minimum possible plume length, strength, and time to reduce groundwater levels to required cleanup standards.

Unless direct evidence of the original nature of the TCE/PCE source as a dissolved aqueous waste stream or direct physical evidence that no undissolved TCE/PCE exists on the T-25 site is presented, any remediation method based on the groundwater model presented is doomed to failure.

Response 1:

There has been an extensive effort made to locate the exact source area. The plans for these investigations, as well of the results of these investigations have been presented and provided to the public and government officials. This is, in fact, some of the most heavily scientifically peer-reviewed work in the environmental field. There are three to four drafts of each document. There are many checks and balances, including reviews from the Army, U.S. EPA New England Region, MADEP, the Town of Natick, the Agency for Toxic Substance and Disease Registry, the Center for Health Promotion and Preventative Medicine, and the Restoration Advisory Board. Any comments and/or suggestions made by any reviewer, including the public, were taken seriously and incorporated into the approach and procedures used to try to locate the source. It would have been in the Army's best interest to locate a source, since its elimination would shorten the cleanup time, reduce costs, and increase the cleanup's effectiveness. It is unclear what the commentor means by stating that "No attempt has been made to locate the exact source area....", particularly since the commentor has been one of the reviewers, since 1995, of the presentations, plans, and documents prepared in support of investigating the T-25 Area ground water.

The FFS/TS and other previous reports available to the public describe the exhaustive number of soil and ground water samples collected at the site over the past 10 years, including at locations of suspected source areas. Despite the large number of samples collected and analyses done, the previous investigations have not conclusively identified the source(s) of contamination to the ground water at the T-25 Area. There has been little to no PCE or TCE detected in the soil or ground water in the intervals above the contaminated zone (B-interval), which would be expected if an active source were present.

Interpretation of the large volumes of available T-25 Area data indicate that the presence of PCE and/or TCE in the DNAPL form is unlikely. PCE has never been detected in the numerous surface and subsurface soil samples collected throughout the T-25 Area, including in soil samples collected from the screened intervals of some monitoring wells with the highest ground water PCE concentrations (e.g., MW-18B-HP2, MW-83B-2). TCE has only been detected sporadically in soil samples at very low concentrations (below detection limits and below MCP S-1/GW-1 soil criteria). If DNAPL were present in the soils, high soil concentrations of PCE and TCE would be expected. No direct data suggest that DNAPL exists, and no reviewer (including the commentor) has ever actually produced any direct evidence suggesting that DNAPL exists at the site.

In addition, numerous quarterly monitoring and field screening ground water samples collected over the past eight years have never had PCE or TCE concentrations approaching several percent of the saturation limit for PCE (150,000 μg/L) or TCE (1,100,000 μg/L), which would suggest the presence of DNAPL. Many of the field screening soil and ground water samples were collected at and below the interface of the clayey silt layer and the overlying higher conductivity materials, where, if present, DNAPL would tend to accumulate. It is believed that if there were a release of DNAPL, the volume of product would have to have been sufficiently large to penetrate 65 feet of overburden soils, and then pool at depth. If a release of this size did occur, there would be evidence (such as the presence of residual or higher dissolved concentrations) in ground water from the overburden and upper portions (A-interval) of the aquifer. Based on the voluminous number of soil and ground water samples collected from the aquifer, and the lack of any significant PCE or TCE concentrations present in the A-interval, it is unlikely that this scenario occurred. There is no direct evidence from this sampling that DNAPL exists, and it would be erroneous to interpret that there is DNAPL at this site.

The ground water model is not, as the comment indicates, the basis for the selected remediation method. This is a misunderstanding of the use of ground water models and the criteria used for selecting a remedial alternative. The cleanup time period estimated by the ground water computer model (27 years) is used only for cost criteria comparisons presented in the Focused Feasibility Study/Treatability Study (FFS/TS). No specific time for ceasing pumping or the remedial alternative is stipulated in the Proposed Plan. The estimated cleanup times do not indicate when an alternative would be "shut off." ***A remedial alternative is discontinued only when the actual chemical monitoring data meet the established cleanup goals.*** During continued long-term monitoring, if there is evidence that indicates the selected remedial action is no longer effective, modification of the remedy and/or new remedial alternatives may be considered.

The criteria for evaluating remedial alternatives are described in detail in the Final FFS/TS report and summarized in Figure 5-1, which is given on page 5-63 of the FFS/TS.

Comment 2:

Monitoring well coverage between Army Labs and Natick Town wells is grossly inadequate to measure the true potential for transmission of toxic chlorinated solvents into the Town's drinking water supply.

The well coverage in the area Northwest of the T-25 Site is inadequate to determine the true extent of the plume which is moving toward the Springvale well fields. The current model uses an initial condition where the plume movement in the downgradient direction is identical in magnitude to plume movement in the crossgradient direction. The assumption that plume movement in the downgradient direction moves no faster than plume movement in the crossgradient direction is obviously false. The result of this error is that the initial conditions of the model bias the model to produce less contaminant movement toward the Town of Natick water supply than actually occurs in reality.

In addition to correcting this conceptual flaw in the groundwater model, more monitoring wells need to be placed in this critical direction where the human health impact of contaminated groundwater flow is greatest, and where testing shows that TCE/PCE originating at the Army labs is headed toward drinking water wells in current use.

Response 2:

Well coverage is not considered “grossly inadequate”; as information became available from the Treatability Study, the type and number of wells to monitor the selected remedy has been continuously and carefully evaluated. There are currently four off-site wells to the north, three off-site wells to the west. In addition, there are eight wells on-site near the northern and western borders of the T-25 Area. In addition, the Town of Natick has installed two permanent monitoring wells at the end of Arcadia Road to the north. Most of these are screened at the same depth as the Springvale Well system. These wells ring the plume both on and off site to monitor contaminant levels and act as a sentinel system. The Army intends to install additional off-site wells to monitor the effectiveness of the selected remedy; specifically, an additional water table (A-interval) monitoring well in the area to the north of the T-25 Area on Fisher Street and a deep overburden monitoring well to the north of the T-25 Area. Other monitoring wells are also planned, however the exact location and depth of these wells is currently under discussion with the regulators. The specific details regarding the additional wells the Army will install will be described in the Long-Term Monitoring Plan, which will be developed after the signing of the ROD.

There is a misunderstanding about the results of the current model. The initial plume shape used in the model is based on actual chemical data compiled from more than eight years of quarterly ground water monitoring and numerous field-screening samples. The initial plume shape does not assume anything about plume movement in the downgradient versus crossgradient directions. Only when the model is set into motion, do assumptions of longitudinal versus transverse flow magnitudes come into play. And, as illustrated in the model simulations, flow in the downgradient (longitudinal) direction is greater (faster) than flow in the transverse (crossgradient) direction, as expected. This is in direct contradiction to the comment that there is an “assumption that plume movement in the downgradient direction moves no faster than the plume movement in the crossgradient direction”.

Comment 3:

The Army Lab’s model underestimates the flow and drawdown at the Springvale well field, thus underestimating the true magnitude of contamination of the Town’s water supply by chlorinated solvents which originate at the Army Labs.

Using a lower pump rate in the model results in a lower estimate of Army Labs’ contribution to Natick’s drinking water contamination. Actual pump rates (source: Jack Perideau, Natick DPW 9/2/99) are approximately 6 million gallons per day. In these high-use periods the 2.2 MGD contribution of Elm Bank wells is lost due to the requirement that no water be drawn from the Elm Bank wells when Charles River flows drop to their reduced summer levels. The bulk of this 6 MGD pump rate comes from the

Springvale and Evergreen wells, which are directly in the path of the Army Labs contaminant plume.

Response 3:

The ground water model is draft and is constantly being updated, as new data become available. As part of the continued development of the model, a sensitivity analysis will be conducted. A range of representative pumping rates at the Springvale wells will be modeled, and the flow and contaminant transport results will be evaluated to determine the influence of varying pumping rates on contaminant transport rates.

The Army is aware that pumping rates may increase in the future as water demand increases (due to development). However, the current Springvale wells can only pump up to a certain rate, because of their physical size (depth, diameter, screen length) and hydraulic conditions of the aquifer. If water usage in Natick increases beyond the current capacity of all of the town's wells, the Town would likely have to explore alternative sources.

The ground water flow and contaminant transport model developed in support of the T-25 Area remedial action currently uses average pumping rates and drawdown measurements for the Springvale and Evergreen wells. These averages were computed from town data available from the past couple years of actual recorded pumping data. While it is conceivable that the pumping rates at the town wells may be greater during times of drought or high use periods, these events are relatively short-term occurrences (relative to the model run time), and are not expected to impact the overall results of the ground water model. For example, if one assumes that a drought could last an entire summer, that would be a time frame of 90 days. The model scenarios are typically run for a period of 50 years or 18,250 days. The period of drought (90 days) in this example represents only about 0.5 percent of the total model run time. Due to this relatively low percentage, drought conditions are not expected to influence the overall results of the model significantly.

Comment 4:

This summer the Springvale aquifer is at record low levels. As the aquifer level lowers, the draw of contaminated groundwater from the Army Labs to the drinking water supply increases.

No mention of such low aquifer levels is included in the groundwater model. It is unlikely that the phenominal growth of housing in Natick, and the water usage the construction of 500 to 800 thousand dollar homes entails, will reverse itself. Water usage will increase. The proposed golf course alone will require 100,000 gallons per day of additional town-supplied water for irrigation (Source: Fred Conley, Town Manager).

Response 4:

The Army is unclear what the relationship is between $500,000 and $800,000 homes and water usage. As stated above in Response 3, the Army is aware that pumping rates may increase in the future as water demand increases (due to development). However, Superfund utilizes a process that is blind to housing costs, with the exception that recent Brownfields legislation is attempting to address past inequities. Regardless, the ground water model is draft and is constantly being updated, as new data become available. In addition, as part of the continued development of the model, a sensitivity analysis will be conducted. A range of representative aquifer levels (during wet, dry, and average conditions) will be modeled, and the flow and contaminant transport results will be evaluated to determine the influence of these varying levels on contaminant transport rates.

The ground water model currently uses average ground water elevations (i.e., aquifer levels), collected from more than eight years of quarterly ground water monitoring. The Army is aware that during the summer of 1999, aquifer levels were low. However, low aquifer levels/drought events are relatively short-term occurrences (relative to the model run time), and are not expected to impact the overall results of the ground water model.

Comment 5:

There is no evidence that the institutional controls required in the proposed plan have actually been imposed, or that they have the force of law, or that they have been or are enforceable, or that they will survive a lawsuit by any affected property owner who is subject to these institutional controls, or that they will; as a practical or legal matter, be enforceable on any future holder of the lands currently under the control of the Army labs.

No examples have been provided showing that legal or covert attempts to circumvent institutional controls prohibiting groundwater use or impact have been thwarted by any other federal facility located in a dense urban environment. For instance, what happens if the new owners of the Continental bakery property downgradient of the Army Labs decide to install large scale groundwater withdrawl wells? How will institutional controls prevent such a potential exacerbation of the T-25 plume problem? How can such a downgradient land use be guaranteed not to be undertaken?

Thus the institutional controls proposed are currently unable to be a part of the remedial approach which is designed to prevent human exposure to contaminated groundwater.

Response 5:

The proposed institutional controls have been imposed by the Town of Natick’s Board of Health (February, 1999) in a document that is legally enforceable. The ordinance will not apply to Army property (as the comment states regarding holders of lands currently under the control of the Army Labs), but will apply to the area surrounding the Army Labs in the Town of Natick. Institutional controls would be implemented as part of this alternative to restrict use of/access to the ground water both on site and off site throughout the remedial action. On-site use is restricted through the Army’s Master Plan for SSC and these use/access restrictions would be implemented through appropriate real estate transfer documents if the site property was ever transferred from Army ownership. At that point, land not in federal ownership would be subject to the Town of Natick Board of Health ordinance. Off site, the use restriction would be the local Town of Natick Board of Health ordinance (a legal restriction) in the study area where contaminated ground water has been found. The ordinance prohibits the installation of private drinking water wells in the area, and requires a permit for any other use, such as industrial or irrigation, thus giving the Board of Health the right to decide whether that use of the ground water in the area would be acceptable. The Town of Natick would have primary responsibility for monitoring and enforcing the ordinance, while the Army would be ultimately responsible to ensure that the institutional control remains in place and is effective and protective of human health and the environment. As stated in the Final FFS/TS, September 1999 (page 5-38), “The Army does not anticipate any problems with monitoring the effectiveness of the town ordinance on the basis of the current discussion with the town of Natick. As with any control, its reliability is subject to citizen’s adherence to the law. The Army believes these institutional controls will be as reliable as any town ordinance. The procedures for monitoring the effectiveness of the institutional controls (e.g., making observations during field work) will be described in detail in the Long-Term Monitoring Plan, which will be developed after the ROD.”

Summary Comment

All of these errors and omissions in the proposed plan to model groundwater flows underestimate the true danger to residents of the growing plume from the T-25 area contamination.

The following added measures are required.

Any Record of Decision must put in place specific plans to construct additional control measures such as extraction wells located off site between the Army Labs and the Springvale wellfield to prevent added contamination from reaching the Town water supply.

If a reevaluation of the groundwater model based on the above comments shows that the Army Labs fails to meet state and federal cleanup standards in a timely fashion, more aggressive source cleanup and control measures must be put in place.

Any financial contribution made to the Town to jointly operate the Springvale Treatment Plant is inadequate if it is based upon the previously stated assumptions. The recent loss of water quality at the Pine Oaks wells, which is expected to become the new focus of the MADEP's NERO site investigation team, by itself demonstrates the vulnerability of the community to any added contamination risk.

Summary Response

The plume from the T-25 Area is decreasing, not growing, as stated in the summary comment. Ground water chemical data have shown significant decreases in PCE and TCE concentrations at wells within the T-25 Area and in off-site wells to the north (Fisher Street) and west (Lakewood Road) of the T-25 Area, since the beginning of the Treatability Study in November 1997.

The five-year review process will consider the results of the implemented remedy. If there is evidence of failure, to capture the off-site contamination, or if cleanup standards are not being met in a timely fashion, modification of the remedy and/or new remedial alternatives may be considered, which could include the possibility of adding an extraction well. It is in the Army's best interest to clean up the contamination as fast as possible; lengthy cleanups result in higher costs and sometimes in decreased effectiveness. These items will be discussed in detail in the Long-Term Monitoring Plan. The effectiveness of the extraction wells will continue to be evaluated using the data generated as part of the procedures and data requirements, which will be given in the Long-Term Monitoring Plan and Operations and Maintenance Plan. The chemical and hydrogeological data will be evaluated to assess the effectiveness of the extraction wells. As a result of the continued evaluation (including modeling), the Army may consider adjusting the number and location of the extraction wells and/or the rate of extraction from some or all of the wells to increase the efficiency of the system and decrease the overall remedial costs.

To further protect the drinking water of the Town of Natick, the Army has committed to support a portion of the operation and maintenance of the air stripping system at the town's Springvale Treatment Plant. However, as stated in the Memorandum of Agreement between the Town and the Army, the Army does not agree that past SSC activities caused the contamination of the Natick drinking water supply. This conclusion is based on the time frame and concentrations of the contaminants in ground water, as found in analytical results and as modeled in the ground water model.

Written Comment, Larry Meile, Natick, Massachusetts, Received September 7, 1999

Comment 1:

1. Instead of simply discharging the purified water into Lake Cochituate, why not reinject it into the perimeter of the contaminated area to force the contamination inward?

Response 1:

1. Reinjection of treated ground water was considered during the identification and screening of discharge alternatives of the Focused Feasibility Study (page 4-36 of Final FFS/TS). However, due to certain technical and administrative concerns, reinjection was eliminated as a discharge alternative. The technical concerns were related to the potential for excessive groundwater mounding (or raising the water table close to the ground surface) in off-site and residential areas. The potential for excessive on-site ground water mounding could also impact other sites currently being investigated at SSC. Administrative implementation of reinjection wells off the property was also a concern, since it may have involved the installation of wells on private properties adjacent to SSC.

Comments Received During the Public Hearing, September 23, 1999

This section summarizes the comments received during the Public Hearing held on Tuesday, September 23, 1999, at the U.S. Army Soldier Systems Center (SSC) Officers' Club in Natick, and provides responses. A formal transcript of the Public Hearing will be available at the information repositories located at SSC, the Morse Institute, and the Massachusetts Department of Environmental Protection (MADEP). Comments are listed with the page number corresponding to the page where the comment begins in the formal transcript. Summaries of comments are used in this section, rather than direct quotes from the transcript. The following list of individuals provided comments during the Public Hearing:

1. A. Richard Miller
2. James Fitzgerald
3. Charles Czeisler
4. Anthony Doheny
5. Brian Hurly
6. Cindy Hurly
7. Peter Burke
8. Bea McCormick
9. Harlee Strauss
10. Nicholas Arthur
11. Jill Miller
12. Seth Green
13. Mel Willins

1. A. Richard Miller:

Comment 1 (page 5):

Mr. Miller noted that a stack of comments from RAB co-chair Marco Kaltofen was available. He mentioned that it contained a considerable number of issues that some RAB members feel are still unresolved.

Response 1:

It was agreed at the Public Hearing that anybody interested could look at the comments and then bring questions up later on in the meeting.

Comment 2 (page 9):

Mr. Miller had a question regarding the use of ground water at the AMVETS post 79 in Natick, although there was no representative of the AMVETS in attendance. The post is just north of the Springvale drinking wells, and private ground water drinking wells supply the post. That drinking water supply has not been studied at this time. It's close enough so Mr. Miller thinks that it should be, and hopes they will be connected into this process.

Response 2:

Due to its location, the area to the north of the Springvale Well Field, including the AMVETs post, was not part of the scope of the SSC T-25 Area study. However, this area does not fall within the limits of the recently (February 1999) imposed Town of Natick Board of Health ordinance that restricts private wells for drinking water. If concerned, the commentor may suggest that the AMVETs contact the Town of Natick and the MADEP to express any concerns they may have regarding their private water well.

Comment 3 (page 20):

In follow up to an earlier question, Mr. Miller referred to the final bullet on Page 9 of the Proposed Plan, regarding the Army's participation in Natick's Springvale Treatment Plant, and the one-time payment of $3.1 million. In the RAB, he and several others had asked much earlier how they could be included early enough to comment on any draft wording of such an agreement, and Mr. Miller noted that they were told that they could not. He would like to see the wording of the agreement. He would like to know if Natick is relieving the Army of further involvement. He believes it may be a good long-range solution, but he believes that additional help may be needed in the future. He would like to know if the $3.1 million is planned for now, but the door is not closed on further steps. Does it say that it can go beyond the $3.1 million if latter there is an apparent need for that?

Response 3:

The agreement between the Army and the Town of Natick was finalized within the last couple of weeks. It was signed off by Army representatives and Town of Natick selectmen, and the commentor has a copy of it. The agreement was developed through negotiations between the Town and the Army, with the involvement of the regulators. The Army believes that the agreement was fair, and that it will benefit both parties involved. The agreement includes several provisions including:

- The Army will provide the Town with a one-time payment of $3.1 million, representing the present value of operation and maintenance of the Springvale Treatment Facility
- Agreements by the Town to continue operation of the Springvale facility, and the Army to continue operation of source area containment of contaminated ground water at the SSC site
- Agreements by both parties that, upon fulfillment of all obligations and covenants, the parties will not sue each other
- Agreements that upon fulfillment of all obligations and covenants, both parties are released from past and future response costs incurred or to be incurred and claims for response costs and damages related to PCE, TCE, or breakdown compounds in Town drinking water supplies

Comment 4 (page 33):

Mr. Miller added a comment, regarding citizen participation, to one provided by Bea McCormick (page 30). He noted discussions at the latest RAB meeting about the need for greater citizen participation. He believes that September is a bad time for meetings.

Response 4:

In regard to the timing of the Public Information Meeting and the Public Hearing, after many years of study and extensive discussions with both the public and the regulators, the Army was ready to move forward with the Proposed Plan, and the regulators were ready to move forward with the ROD. The Town of Natick was also ready to move ahead with the Memorandum of Agreement regarding the Army's participation in the operation of the Springvale Treatment Plant. The public has had ample opportunity in the past to comment on the entire process, including the FFS/TS and the Proposed Plan. The Army has had a number of environmental open houses at SSC over the last couple of years to talk about the approach to cleaning up the ground water, as well as other issues on the installation. All of the monthly RAB meetings were open to the public. In regard to this Public Hearing, the Army sent out 2,500 notices to the general public. The meeting date and time was published twice in the local newspapers (e.g., *Metro West Daily News* and the *Natick TAB*), with a circulation of at least 2,500, and all of the bulletin announcements were posted throughout the Town at the library, fire station, and other public facilities.

Comment 5 (page 50):

Mr. Miller asked a question to follow up on Mr. Seth Green's comment (page 48) regarding the length of time projected for cleanup (27 years). Is it possible to see costing for different alternatives, for example, what if the goal is achieved in 10 years instead of 27? Can the facility be expanded, for example, if more needs to be cleaned up later, or if the goal has actually become more stringent, because there is a change in the law? Mr. Miller understands the facility selected is capable of that kind of expansion.

Response 5:

As stated in the Proposed Plan (page 9), “A remedial alternative is discontinued when actual chemical monitoring data meet the goals of the cleanup.” No specific time for ceasing pumping or the remedial alternative is stipulated in the Proposed Plan. The time period of 27 years was estimated based on a ground water computer model, only for use in the cost criteria comparisons presented in the Focused Feasibility Study/Treatability Study (FFS/TS). This was done to provide a consistent basis and known assumptions for estimating the cost of the various remedial alternatives. These estimated cleanup times do not indicate when an alternative would be “shut off.” ***A remedial alternative is discontinued only when the actual chemical monitoring data meet the established cleanup goals.***

Mr. Manning stated at the Public Hearing that the Army did not just randomly arrive at the current design of the treatment system. The Army has already looked at varying the pumping rates of the extraction wells. A number of pretests were done and the design of the optimum pumping rates were decided after a lot of review and studies. The Army could have installed larger pumps and pumped more ground water to try to clean it quicker, but the effectiveness of the system would not have increased. By pumping at higher rates, the system would draw in a larger volume of clean, uncontaminated water than it would draw in at lower pumping rates, thus reducing the efficiency of the system.

The Army is aware that the potential exists for cleanup standards (e.g., EPA MCLs) to become more stringent in the future. The Army is also aware that cleanup standards may become less stringent in the future. The water discharge from treatment system meets the current drinking water standards (MCLs) of 5 ug/L for PCE and TCE (the primary contaminants). In fact, PCE and TCE in samples of the discharge have consistently been not detected (less than 2 ug/L) since the system began operation in 1997. The treatment system is also constructed so that another line of carbon filters or air filters may be installed, if the Army feels that it is necessary in the future.

Comment 6 (page 56):

Mr. Miller commented on the question of the safety of the treatment system facility. He wanted to find out what happened during a failure—would the system keep pumping, or would the system lose continuity? He had asked the Army during RAB meetings what the effects would be on the lake water if the system were discharging too much inadequately treated material. He noted that the answers indicated it was not very serious and further noted that those calculations can be made available.

Response 6:

As noted in the comment, calculations were done under the theoretical situation that untreated ground water reached the lake. These calculations are presented in Appendix I of the Final FFS/TS report.

In addition to these calculations, numerous safety-related design features and emergency shutdown conditions have been included in the treatment system. Many of these safety features overlap in purpose and therefore provide multiple, redundant treatment processes and safety shutdowns to prevent the release of untreated water to the lake. The safety-related design features are as follows:

1. The untreated ground water passes, through three treatment process units: an air stripper, a primary liquid-phase carbon tank, and a secondary liquid-phase carbon tank. Each of these tanks is individually capable of successfully cleaning the water to meet state and federal requirements. The Army has included three treatment processes in a row to ensure that all contamination is successfully removed from water that is released back to the environment.

2. A floor sump water sensor has been installed in the sump in the building floor near the equalization tank. The entire floor of the building slopes toward this sump. Also, the edges of the floor all have a sealed curbing to contain any spilled waters within the building. If the sensor in the sump detects water, the entire system is shut down, including the extraction well pumps. The system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition from the sump water sensor.

3. High water-pressure switches are included for all bag filters and liquid-phase carbon tanks. If water pressure increases past a set point for a filter pressure switch, the other filter in the pair is enabled, the previously operating filter is closed, and the autodialler contacts up to four equipment operators to change out the spare filter. If the pressure in both filters of a pair increase past a set point, the entire system is shut down and the system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition. The pressure switches prevent overworking the pumps and reduce the possibility for leaks caused by too much pressure in the system.

4. Water level switches are located in the equalization tank and the air stripper. Emergency high-level switches are set in the equalization tank and air stripper tank to prevent overflow and spillage of untreated water in the building. The emergency low-level switch in the equalization tank is set to detect leaks in the

equalization tank and to prevent continued pumping in the event of a catastrophic failure of the tank or a malfunction of the operational low-level switch. If an emergency water level switch is tripped, the entire system is shut down and the system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition.

5. Conductivity probes have been installed in the extraction wells to detect free product (DNAPL – dense, nonaqueous phase liquid) and to regulate the operation of the extraction well pumps. If the conductance differs from the conductance of the ground water or if the probes fail, the extraction well pump is shut down. Although free product and high concentrations associated with free product have never been observed near these wells, the Army has installed these probes as an additional safety feature to prevent free product from entering the system and overloading the equipment. In addition, the conductivity probes will sense if the water level in the extraction well drops too low, and will shut the extraction well pumps off to prevent the well from dewatering and causing potential damage to the well pump.

6. A low air-pressure switch has been installed in the air stripper. If the air stripper blower fails, then air pressure in the air stripper sump tank will drop and cause the alarm switch to shut down the entire system.

7. The control system is programmed to require manual reset of the system if any alarm condition occurs. The system will not automatically restart once water levels, for example, return to operational ranges. The on-call operator must physically inspect the system, determine the cause for the alarm condition, and correct the problem before restarting the system manually.

8. Water is sampled from the treatment system regularly to ensure that the contamination is successfully removed and that the system is operating correctly. Samples of water are collected before and after each stage of the treatment system. These water samples allow the Army to monitor how the amounts of chemicals are decreasing in the untreated water as more and more water is removed, and demonstrate that only successfully treated water is being released from the building. Analyses of the treatment system water being discharged to the lake to date have shown no detectable concentrations of PCE and TCE (at a detection limit of 2 ug/L). Calculations associated with the hypothetical discharge of PCE and TCE in untreated effluent and at concentrations at/below the detection limits are presented in Appendix I of the Final FFS/TS.

9. Treatment system inspection and maintenance activities are performed at least weekly, with more extensive inspection and maintenance performed during

quarterly shutdowns that coincide with the long-term ground water monitoring program across SSC.

2. James Fitzgerald:

Comment 1 (page 7):

Mr. Fitzgerald had a question regarding the long-term plan - how is it addressed if the Labs has to move out of its current location? He noted that this is a long-term plan, perhaps 30 to 40 years. How is that handled if the Army has to move out in five years?

Response 1:

Jerry Keefe from EPA New England Region answered at the Public Hearing that even if the Labs were closed or the property changed hands, this site would remain a Department of Defense responsibility until it is cleaned up.

Comment 2 (page 10):

Mr. Fitzgerald's questions had to do with the last two bullets on the first page of the Proposed Plan handout (August 1999). He asked why is it five years for a review? Is it reviewed more frequently in the early years and then up to a maximum of five years?

Response 2:

Five years is the statutorily required review period for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup actions. In the intervening time, there will be quarterly ground water monitoring reports submitted to the regulators. If there is an exceedance of the cleanup goals, it will have to be addressed immediately. However, the Army is going to review the technology processes at more frequent intervals, because if there is a better process that can achieve the same goals in a shorter time, it's in the Army's best interest to consider other options that may result in a faster, more efficient, and more effective system.

Comment 3 (page 12):

Mr. Fitzgerald had a question on the last bullet on the first page of the Proposed Plan (August 1999). He asked about the details concerning the extent that the Army is going to work with the Town on the Springvale Treatment Plant. He asked if this involves a financial commitment?

Response 3:

As part of the ROD, the Army and the Town have signed an agreement in which the Army will support a portion of the operation and maintenance of the Springvale Treatment Plant by providing the Town with a one-time payment of $3.1 million, in order to further protect the drinking water of the Town of Natick. It's most cost-effective for the Amy to participate in wellhead treatment that is already existing in the Town of Natick. This is a one-time financial commitment by the Army, in addition to the Army's regular payment of its Town water bill, as the town's largest user of water.

Comment 4 (page 40):

Mr. Fitzgerald had two questions. First, he asked if a risk analysis on the various failures that can occur within the building had been done, and second, if there is training for personnel on the base in terms of controlling the facility, for example, on a weekend, or an evening, if something should go wrong? If the automatic shutoff fails, or should something happen, what is the process for controlling the activity in that building?

Response 4:

A risk analysis for the treatment system was completed in 1997, prior to the construction of the system. After the equipment vendor was selected and preliminary equipment specifications were prepared, a hazards analysis was completed to review the safety and operability of the design and equipment. The design documents, including specification sheets for each separate piece of equipment, were reviewed and the equipment vendor's facility was inspected. Based on this hazards analysis, slight modifications were incorporated into the final design. After equipment installation was completed, the equipment was tested piece by piece and then together, with all treated water contained in a temporary holding tank until testing showed that the system was operating as designed. Regular health and safety monitoring inspections are performed to ensure operator safety. All water and air discharged from the system are monitored regularly to show that all environmental requirements are met.

A trained equipment operator is always on call during the operation of the treatment system. If an alarm condition is triggered (as described below), the on-call operator and up to three backup operators are beeped by the systems' autodialler, and the operator will respond to the alarm. In addition to the continuous monitoring by the equipment operator, numerous safety-related design features and emergency shutdown conditions have been included in the treatment system. Many of these safety features overlap in purpose and therefore provide multiple, redundant treatment processes and safety shutdowns to prevent the release of untreated water to the lake. These safety-related design features are as follows:

1. The untreated ground water passes through three treatment process units: an air stripper, a primary liquid-phase carbon tank, and a secondary liquid-phase carbon tank. Each of these tanks is individually capable of successfully cleaning the water to meet state and federal requirements. The Army has included three treatment processes in a row to ensure that all contamination is successfully removed from water that is released back to the environment.

2. A floor sump water sensor has been installed in the sump in the building floor near the equalization tank. The entire floor of the building slopes toward this sump. Also, the edges of the floor all have a sealed curbing to contain any spilled waters within the building. If the sensor in the sump detects water, the entire system is shut down, including the extraction well pumps. The system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition from the sump water sensor.

3. High water-pressure switches are included for all bag filters and liquid-phase carbon tanks. If water pressure increases past a set point for a filter pressure switch, the other filter in the pair is enabled, the previously operating filter is closed, and the autodialler contacts up to four equipment operators to change out the spare filter. If the pressure in both filters of a pair increase past a set point, the entire system is shut down and the system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition. The pressure switches prevent overworking the pumps and reduce the possibility for leaks caused by too much pressure in the system.

4. Water level switches are located in the equalization tank and the air stripper. Emergency high-level switches are set in the equalization tank and air stripper tank to prevent overflow and spillage of untreated water in the building. The emergency low-level switch in the equalization tank is set to detect leaks in the equalization tank and to prevent continued pumping in the event of a catastrophic failure of the tank or a malfunction of the operational low-level switch. If an emergency water level switch is tripped, the entire system is shut down and the system's autodialler contacts up to four equipment operators. The system will not restart until the on-call operator visits the building and determines the cause of the alarm condition.

5. Conductivity probes have been installed in the extraction wells to detect free product (DNAPL – dense, nonaqueous phase liquid) and to regulate the operation of the extraction well pumps. If the conductance differs from the conductance of the ground water or if the probes fail, the extraction well pump is shut down. Although free product and high concentrations associated with free product have never been observed near these wells, the Army has installed

these probes as an additional safety feature to prevent free product from entering the system and overloading the equipment. In addition, the conductivity probes will sense if the water level in the extraction well drops too low, and will shut the extraction well pumps off to prevent the well from dewatering and causing potential damage to the well pump.

6. A low air-pressure switch has been installed in the air stripper. If the air stripper blower fails, then air pressure in the air stripper sump tank will drop and cause the alarm switch to shut down the entire system.

7. The control system is programmed to require manual reset of the system if any alarm condition occurs. The system will not automatically restart once water levels, for example, return to operational ranges. The on-call operator must physically inspect the system, determine the cause for the alarm condition, and correct the problem before restarting the system manually.

8. Water is sampled from the treatment system regularly to ensure that the contamination is successfully removed and that the system is operating correctly. Samples of water are collected before and after each stage of the treatment system. These water samples allow the Army to monitor how the amounts of chemicals are decreasing in the untreated water as more and more water is removed, and demonstrate that only successfully treated water is being released from the building. Analyses of the treatment system water being discharged to the lake to date have shown no detectable concentrations of PCE and TCE (at a detection limit of 2 ug/L). Calculations associated with the hypothetical discharge of PCE and TCE in untreated effluent and at concentrations at/below the detection limits are presented in Appendix I of the Final FFS/TS.

9. Treatment system inspection and maintenance activities are performed at least weekly, with more extensive inspection and maintenance performed during quarterly shutdowns that coincide with the long-term ground water monitoring program across SSC.

Comment 5 (page 41):

Mr. Fitzgerald’s second question was addressed to the MADEP and the U.S. EPA. He asked if they could comment on their organizations’ opinion of the proposed cleanup plan.

Response 5:

Mr. Campbell of the MADEP answered at the Public Hearing that as far as the cleanup goals are concerned, the most stringent cleanup goals are already in place. The cleanup goals are the Massachusetts drinking water standards for ground water. The goals for the contaminants of concern, PCE and TCE, are both 5 parts per billion, because this is what is considered a Groundwater 1 (GW-1) area. Thus, these goals would comply with the Massachusetts Contingency Plan in terms of reaching cleanup standards. So those are the most stringent standards that we have, and those are the cleanup goals. I don't know how we could improve on them. Although it's conceivable at some point in time that those standards might drop to a lower level, at the present time, the technology that is being employed here would take into consideration any drop in that standard of cleanup. Right now, the concentrations of contaminants in the effluent of the treatment system are at/below the detection limit, which is 2 parts per billion, and I stress that the concentrations are less than that - the only reason we can't say it's not detected at all is because we have the limitations of the analytical instruments to work with.

Mr. Keefe of the U.S. EPA answered at the Public Hearing that the U.S. EPA is applying the most stringent standards available here in New England and across the country. EPA has established drinking water standards, and the Army has agreed to clean up to those drinking water standards, using this pump-and-treat system with the granular activated carbon treatment system along with air strippers, one of the advanced technologies that can treat contaminants of this type. So the U.S. EPA believes it's the most protective plan today.

3. Dr. Charles Cziesler:

Comment 1 (page 14):

Dr. Cziesler represents the Lakewood Association, and is a member of the RAB. Dr. Cziesler stated that Environmental Insight, the consultant hired through a technical assistance grant that the Lakewood Association received from the U.S. EPA to monitor the cleanup, presented some concerns at the informational meeting two weeks ago. Some of those concerns have been summarized in a sheet of paper, which was available at the hearing.

Response 1:

Comments received by Environmental Insight have been responded to and subsequent comments by Dr. Cziesler are included below.

Comment 2 (page 15):

Dr. Cziesler had a comment about the estimated time to reach the cleanup goal of 27 years, under Alternative 3. On page 9 of the Proposed Plan, a footnote says estimated groundwater model cleanup time includes a 10-year pumping period and a 17-year monitored natural attenuation period. His understanding of a monitored natural attenuation period is that nothing is happening during monitored natural attenuation, except for watching whether it goes away by itself. His concern was about the estimated 10-year pumping period that he saw at the RAB, which used computerized simulations of the plume. Using sophisticated simulations that were carried out by an Army consultant, it indicated that if pumping was stopped at 10 years, the contamination spread like an ink blot throughout the neighboring areas. His concern, therefore, is that the computer simulation model indicated that it took 25 to 30 years of pumping to really get rid of the contamination. And given the concern that Mr. Fitzgerald raised about what happens if the Army were to for some reason have to close this base, then the new owners might be under the misimpression that it would take less time to clean up. So even though he knows that the actual target goals are the time that it takes to reach the PRGs, he thinks it's important that the record of decision reflect the actual time that is estimated, which is not 10 years of pumping, but 25 to 30 years of pumping.

Response 2:

As stated in the Proposed Plan (page 9), "A remedial alternative is discontinued when actual chemical monitoring data meet the goals of the cleanup." No specific time for ceasing pumping or the remedial alternative is stipulated in the Proposed Plan. The time period of 27 years was estimated based on a ground water computer model, only for use in the cost criteria comparisons presented in the Focused Feasibility Study/Treatability Study (FFS/TS). This was done to provide a consistent basis and known assumptions for estimating the cost of the various remedial alternatives. These estimated cleanup times do not indicate when an alternative would be "shut off." ***A remedial alternative is discontinued only when the actual chemical monitoring data meet the established cleanup goals.***

The cleanup goal for the facility is 5 parts per billion, both on and off the facility, and it's a continuing Army responsibility, whether they own the property or not, to reach that goal, no matter what length of time. As the Army moves toward that goal, it's going to be reviewed by the regulators at regular events, but also the whole process is going to be reviewed every five years by the Army and the regulators to determine whether the Army is making progress toward that goal. If there is evidence that the remedial action is no longer effective, the Army and EPA may consider modification of the current remedy and/or new remedial alternatives may be considered.

Comment 3 (page 18):

Dr. Cziesler followed up on the questions raised in Comment 2: A realistic estimate of how long it will take to pump needs to be used. Currently a 10-year estimate is being used to calculate the cost. This means that if the latest model that the Army has, the more sophisticated computerized ground water model, indicates it will take 25 to 30 years, then the amount budgeted here is insufficient to meet the cleanup goal. He said he was concerned that if a low estimate is used for the cost then five or ten years from now when it's discovered that the goal is not being reached, and it's going to cost more, it will be harder to acquire those funds, since they were initially underestimated. He believes, for budgeting purposes, that it's important to have the best estimate possible.

Response 3:

The times to complete overall cleanup are estimated only to provide a common basis for calculating costs across a range of remedial alternatives. It does not establish the budget for a cleanup.

Environmental restoration is covered by a line item separate from the rest of the Defense Department budget. This line item is known as the Defense Department Environmental Restoration Account (DERA). This line item is approved every year by Congress and the funding is split among the four branches of the armed services. As a part of this budgeting process, Congress requires that each site be tracked using the Defense Site Restoration Tracking System (DSERTS). The T-25 Area ground water is considered a site. To ensure that funds go to those sites with the highest priority, Congress requires that each site have a Relative Risk Site Evaluation ranking that considers what the chemical contaminant is, how the contaminant might migrate, and who the receptor of the contaminant could be. The Army ranks its sites using this evaluation, as well as other available site information. Those sites with the higher rankings are the sites that will receive funding. The T-25 Area is a high ranked site and has been well funded to ensure cleanup. The Army actually plans its budgets for 20 to 30 years; that budget is reviewed every year. Therefore, if something is discovered that requires additional funding, then it's rebudgeted within a year of discovery. The real chemical data collected during monitoring will be used to determine when the cleanup criteria are met. Additionally, hydrogeological data and operational and maintenance data are used for continuing evaluation of whether changes need to be made in a remedial alternative. If a change is necessary, rebudgeting occurs within the year of discovery.

Also, in the cost estimate model, a large majority of the annual operating cost of an alternative is associated with ground water monitoring, which will occur whether the treatment system is pumping or not. The addition of continuing operating costs from pumping does not significantly affect the analysis of total remedial alternative costs.

Comment 4 (page 38):

Dr. Cziesler was concerned about how drought conditions could affect the treatability and treatment plan. He had asked at a RAB meeting whether or not the system had been modeled during drought conditions, such as the condition a few years ago, when the lake was down two to three feet. The response at that time was that this would happen only once every 50 or 100 years; and yet it happened again this summer, because of the lack of rain. The ground water model indicates that 55 percent of the water that is drawn into the Springvale wells that goes into the Natick drinking water is actually coming from Lake Cochituate. Given that 55 percent of the water is coming from the lake, when the lake goes down several feet, the ground water presumably is also going down. As Marco Kaltofen indicated in his question, that may draw more contaminants from the Army Labs, which may spread into an area that is not currently being monitored because of insufficient wells. Dr. Czeisler requested that the ground water model be run under drought conditions to determine what effect that has on the Proposed Plan and to do simulations before the plan is finalized.

Response 4:

The ground water model is draft and is constantly being updated, as new data become available. As part of the continued development of the model, a sensitivity analysis will be conducted. A range of representative aquifer levels (during wet, dry, and average conditions) will be modeled, and the flow and contaminant transport results will be evaluated to determine the influence of these varying levels on contaminant transport rates. The results of these additional modeling efforts will be presented at a future RAB meeting.

The ground water flow and contaminant transport model developed in support of the T-25 Area remedial action currently uses average ground water elevations (i.e., aquifer levels), collected from more than eight years of quarterly ground water monitoring. The Army is aware that during the summer of 1999, aquifer levels were low. However, low aquifer levels/drought events are relatively short-term occurrences (relative to the model run time), and are not expected to impact the overall results of the ground water model. For example, if one assumes that a drought could last an entire summer, that would be a time frame of 90 days. The model scenarios are typically run for a period of 50 years or 18,250 days. Therefore, the period of drought (90 days) in this example represents only about 0.5 percent of the total model run time. Due to this relatively low percentage, drought conditions are not expected to influence the overall results of the model significantly.

Comment 5:

Dr. Cziesler noted that he is still concerned about the question of the possibility of additional extraction wells. He was concerned by the statement Mr. Manning made that the Army wasn't considering, at this time, placing an extraction well offsite. Contaminant levels in the area under Fisher Street have not changed by nearly the same order of magnitude as, for example, by Lakewood Road, where there was a tenfold reduction in the contaminant levels and an even higher rate of reduction of the contaminant levels directly under SSC where the pumping is taking place. Under Fisher Street, where the plume seems to be extending northwestward, the levels have only dropped in half. If the Army owned the whole area then it would be very logical and reasonable to install a pipe that could pull water to the pumping station from the area beneath Fisher Street. He commented that it appeared that ownership of the property is determining the plan rather than the health of the Town and the people in the Town.

Response 5:

Mr. McHugh stated at the Public Hearing that the Army will consider the installation of additional pumping wells, but first there is a need to see what occurs with the operation of the current pumping wells over time. If the continued evaluation of the selected remedy during the long-term monitoring program indicates that the cleanup goals are not being attained in the off-site portions of the plume, contingencies would be developed. Contingencies could possibly involve the installation of an additional adequately yielding extraction well to the north of the current treatment building. This possibility was discussed on page 5-16 of the Final FFS/TS report. The cleanup goals in the Proposed Plan are for both on- and off-site areas. Property ownership does not dictate any portion of the cleanup. It is in the Army's best interest to clean up the contamination as fast as possible; lengthy cleanups result in higher costs and sometimes in decreased effectiveness. If an additional extraction well would decrease the time to clean up or improve the effectiveness of the cleanup, the Army would certainly implement that modification.

4. Anthony Doheny:

Comment 1 (page 18):

Mr. Doheny, a RAB member, commented on the footnote on page 9 of the Proposed Plan, which he noted is only one possible scenario. Other ground water models or more extended ground water models may indicate that pumping is necessary for a longer period of time, depending on whether the attenuation levels are reached. The footnote in that report was a little bit optimistic, and it might be modified to say that it is an optimistic estimate.

Response 1:

A remedial alternative is discontinued when actual chemical monitoring data meet the goals of the cleanup, as noted in the Proposed Plan. No specific time for ceasing pumping or any other portion of the remedial alternative is stipulated in the Proposed Plan. The time period of 27 years was estimated based on a ground water computer model, only for use in the cost criteria comparisons presented in the Proposed Plan and the Focused Feasibility Study/Treatability Study report (FFS/TS). This was done to provide a consistent basis and known assumptions for estimating the cost of the various remedial alternatives. These estimated cleanup times do not indicate when an alternative would be "shut off." ***A remedial alternative is discontinued only when actual chemical monitoring data meet the established cleanup goals.***

Comment 2 (page 44):

Mr. Doheny referred to Mr. Fitzgerald's earlier quote of Marco Kaltofen's request for the most stringent plan [refers to Mr. Fitzgerald's Comment 5], not the most stringent goals. He noted that he thinks that the plan is somewhat different from the goals. He further noted that, you can set goals, and if it takes 100 years to meet them, they are still stringent goals. He believes that one of the issues that has to be addressed is the installation of additional monitoring wells between the T-25 Area and the Springvale well field. He also suggested setting some action levels, and developing an action plan if those action levels are not met.

Response 2:

Mr. Keefe of the U.S. EPA answered at the Public Hearing that the goals are part of the plan and EPA thinks that the plan is the most effective plan to date. EPA agrees that there could be more monitoring wells off site and that they be included as part of this plan.

The Army will install additional off-site wells to monitor the effectiveness of the selected remedy. The Army will install an additional water table (A-interval) monitoring well in the area to the north of the T-25 Area on Fisher Street. A deep overburden monitoring well will also be installed to the north of the T-25 Area. Other monitoring wells are also planned, however the exact location and depth of these wells is currently under discussion with the regulators. The specific details regarding the additional wells the Army will install will be described in the Long-Term Monitoring Plan, which will be developed after the signing of the ROD.

The protective POC wells will be a series of wells off site and downgradient of the T-25 Area that currently show primary contaminant concentrations below MCLs. The specific wells that will be designated as POC wells will be selected and monitored as will be described in detail in the Long-Term Monitoring Plan. If the levels in these protective POC wells exceed the PRGs, notification will occur, following procedures to be described in the Long-Term Monitoring Plan. The “action levels” for POC wells are the cleanup goals (or PRGs), and the “action levels” for the treatment system effluent are the legal discharge limits. If these concentrations are exceeded, the Army will notify U.S. EPA New England Region, MADEP, and Town of Natick officials. Notification procedures for treatment system effluent exceedances will be described in the Operation and Maintenance Plan to be completed after the ROD has been signed.

Comment 3:

Mr. Doheny wished to draw the audience’s attention to one of the first bullet points in Marco Kaltofen’s summary, that is, the actual source of contamination has never been located. He noted that this is important, because the ground water permeation model includes a partition factor between soluble and mobile contaminants and those that are adsorbed on the various strata. The rebound effect that was such a source of concern in the initial pumping is caused by the change in the partitioning between the adsorbed and the mobile phases. Are there any plans to actually examine the soils rather than the waters to see if there are any large concentrations of adsorbed and immobile contaminants?

Response 3:

The T-25 Area Remedial Investigation (RI) Report and the FFS/TS describe the exhaustive number of soil and ground water samples that have been collected at the site over the past 10 years, including at locations of suspected source areas. Despite the large number of wells installed and samples collected and analyzed, the previous investigations have not conclusively identified the source(s) of contamination to the ground water at the T-25 Area. However, interpretation of the large volumes of available T-25 Area data indicate that the presence of PCE and/or TCE in the DNAPL form is unlikely. PCE has never been detected in the numerous surface and subsurface soil samples collected throughout the T-25 Area, including in soil samples collected from the screened intervals of some monitoring wells with the highest ground water PCE concentrations (e.g., MW-18B-HP2, MW-83B-2). TCE has only been detected sporadically in soil samples at very low concentrations (below detection limits and below MCP S-1/GW-1 soil criteria). No direct data suggest that DNAPL exists, and no reviewer has ever actually produced any direct evidence suggesting that DNAPL exists at the site. In addition, numerous quarterly monitoring and field screening ground water samples collected over the past eight years, have never had PCE or TCE concentrations approaching several percent of the saturation limit for PCE (150,000 µg/L) or TCE (1,100,000 µg/L). In terms of undissolved TCE and PCE in ground water, the highest concentrations detected at the facility were at approximately 2,000 µg/L, concentrations that are no where near the levels expected if DNAPL were present. Many of the field screening samples were collected at and below the interface of the clayey silt layer and the overlying higher conductivity materials, where, if present, DNAPL would tend to accumulate. It is believed that if there were a release of DNAPL, the volume of product would have to have been sufficiently large to penetrate 65 feet of overburden soils, and then pool at depth. If a release of this size did occur, there would be evidence (the presence of residual or higher dissolved concentrations) in the overburden and upper portions (A-interval) of the aquifer. Based on the voluminous number of soil and ground water samples collected from the aquifer, and the lack of any significant PCE or TCE concentrations present in the A-interval, it is unlikely that this scenario occurred. The Army has no evidence that any undissolved TCE or PCE exists.

During the initial operation of the treatment system, rebound effects were observed. However, during continued operation and sampling of the system over the past two years, the rebound conditions initially observed were not as marked and in some cases were not present.

The rebound/tailing condition observed at the site is common to many pump-and-treat remedial systems, and is due to rate-limited mass transfer processes. Rebound and tailing conditions are not necessarily an indication of the presence of DNAPL. The rebound/tailing effect results from contaminants (either dissolved, residual, and/or free-phase) either being stored on and released from solid surfaces through sorption/desorption processes, or from contaminants migrating into the pore spaces of low permeability aquifer inclusions (e.g., silts and clays) and then slowly being released. Based on the interbedding of the heterogeneous mixture of fine- and course-grained deposits at the T-25 Area, matrix diffusion is the most likely explanation for the rebound effect observed. Matrix diffusion accounts for the contaminant migration via diffusion between adjacent aquifer deposits with different concentrations. At the T-25 Area, concentration differences between adjacent aquifer deposits can be created during pumping. During pumping, contaminated ground water within the more conductive deposits moves at a higher velocity toward the pumping wells than the contaminated ground water within the less conductive deposits. After a few weeks of pumping, differences in concentrations will exist between the more conductive and less conductive deposits because of the different amount of flushing that has occurred in each deposit type. When pumping stops, any concentration differences between the deposits will diminish over time as the ground water system re-equilibrates. The re-equilibration process will cause the concentrations in the deposit with the lower concentrations to increase and thus produce a rebound effect. The current ground water model has been developed to incorporate matrix diffusion and produces the rebound effects that have been observed in the field.

5. Brian Hurly

Comment 1 (page 23):

Mr. Hurley asked whether the water and air discharges from the treatment system building might contain solvents, or are they filtered?

Response 1:

Contaminants in both the air and the water are filtered out in the treatment system prior to their discharge to the environment. Both air and water discharges are emitted at concentrations below available analytical detection limits available. So while no one can say that it’s zero, it is beneath the minimum detection limits available for detecting solvents in the laboratory. In water, for instance, the detection limit for PCE and TCE is 2 parts per billion. The drinking water limit is 5 parts per billion. So the concentrations of solvents in the water effluent are beneath 2 parts per billion. Both the air and water discharges are regularly monitored, and will continue to be throughout the remedial action. Mr. Keefe of the EPA stated that at this point in time, we don’t believe that contaminants are being discharged into the air, based on analytical testing, and the results of not detected, using the specific techniques available, which have very low detection limits. Discharges meet all applicable air standards and water standards.

The treatment plant has been designed by consultants for the Army that regularly do this throughout the country. Also the Lakewood Association consultants have been overseeing the project, and have also reviewed this technology. The air is filtered through two carbon canisters, so it is clean as it comes out of the facility, as best as we can detect with available detection limits. Also the water is below safe drinking water standards. So it’s the same as if you opened up your own tap water and put it into the lake. Thus, both air and water emissions are regularly monitored and are treated with the best available technology.

Comment 2 (page 55):

Mr. Hurley commented on the safety of treatment building. He asked if it were possible to start pumping contaminants into the local neighborhood.

Response 2:

No, it is not possible to start pumping contaminants into the local neighborhood. The treatment system has been designed and constructed with numerous safety-related features and emergency shutdown conditions. Many of these safety features overlap in purpose and therefore provide multiple, redundant treatment processes and safety shutdowns to prevent the release of untreated water or air into the surrounding environment.

In regards to air emissions, the Army has selected the most protective option described in the Massachusetts Department of Environmental Protection (MADEP) “Remedial Air Emissions” requirements. The MADEP requirements state that applicable treatment systems may elect to apply off-gas treatment that ensures 95 percent removal of volatile emissions. The treatment system at SSC exceeds this 95 percent limit for volatile emissions. The treatment system removes the volatile emissions in air, and provides safety features as follows:

1. The air stripper unit of the water treatment process cleans the water by transferring the volatile contaminants from the water to the air. This air is contained within a sealed system that passes the stripper air through two vapor-phase carbon units. Each of the carbon units can successfully treat this air to meet federal and state requirements. The Army has included two treatment processes in a row to ensure that all contamination is successfully removed from air that is released back to the environment.

2. Air pressure is monitored and air samples are collected regularly from the air treatment portion of the system. Samples and pressure are monitored after the air stripper, and in between and after the carbon units. Sample and pressure information ensure that the carbon units are operated correctly.

3. A low air pressure switch has been installed in the air stripper. If the air stripper blower fails, then air pressure in the air stripper sump tank will drop and cause the alarm switch to shut down the entire system.

4. The control system is programmed to require manual reset of the system if any alarm condition occurs. The system will not automatically restart. The on-call operator must physically inspect the system, determine the cause for the alarm condition, and correct the problem before restarting the system manually.

Mr. McHugh of SSC stated at the Public Hearing that he would be happy to take Mr. Hurley on a tour of the building at any time.

6. Cindy Hurley

Comment 1 (page 26):

Mrs. Hurley stated that she was very concerned about the air coming out of the filter systems. She wanted to know whether the Army checked the neighborhoods to find out if people are having respiratory problems from these emissions. She asked if there had ever been a survey through the neighborhoods to find out who is having respiratory problems.

Response 1:

The Army carefully evaluated the potential air emissions from the treatment system, then designed and constructed the treatment system with numerous safety-related features and emergency shutdown conditions. Many of these safety features overlap in purpose and therefore provide multiple, redundant treatment processes and safety shutdowns to prevent the release of untreated air into the surrounding environment.

In regards to air emissions, the Army has selected the most protective option described in the Massachusetts Department of Environmental Protection (MADEP) “Remedial Air Emissions” requirements. The MADEP requirements state that applicable treatment systems may elect to apply off-gas treatment that ensures 95 percent removal of volatile emissions. The treatment system at SSC exceeds this 95 percent limit for volatile emissions. The treatment system removes the volatile emissions in air, and provides safety features as follows:

1. The air stripper unit of the water treatment process cleans the water by transferring the volatile contaminants from the water to the air. This air is contained within a sealed system that passes the stripper air through two vapor-phase carbon units. Each of the carbon units can successfully treat this air to meet federal and state requirements. The Army has included two treatment processes in a row to ensure that all contamination is successfully removed from air that is released back to the environment.

2. Air pressure is monitored and air samples are collected regularly from the air treatment portion of the system. Samples and pressure are monitored after the air stripper, and in between and after the carbon units. Sample and pressure information ensure that the carbon units are operating correctly.

The analyses of the treatment system air discharge show nondetectable to infrequent, very low concentrations of TCE and PCE (page 7-18, FFS/TS). The maximum detected concentrations of both TCE and PCE in the air effluent were well below the MADEP regulations for emission rates of TCE and PCE. The concentrations of TCE and PCE emitted from the system are about 4,000 times lower than MADEP regulations for TCE emissions and about 1,000 time lower than the MADEP regulations for PCE.

The Army has not surveyed the neighbors to see if there are any effects from this air discharge, but given the typical nondetectable levels of emissions, the compliance with the State’s requirements, and the mixing of these emissions with ambient air, respiratory effects due to these emissions are unlikely.

7. Peter Burke

Comment 1 (page 28):

Mr. Burke asked a question concerning the TCE plume that extends across the north side of Fisher Street. Does the cleanup plan have a provision in it for future extraction off site? He said that he understood that the extraction points now have been effective, but as that plume continues to migrate north and to the west, would the Army be prepared to go off site and extract more water as part of the cleanup?

Response 1:

In order to modify the existing system, it is necessary to evaluate the chemical and hydrogeological data resulting from that system. The Army has been operating the treatment system for about a year and a half; it takes time for the system to fully develop, e.g., affect areas beyond the immediate extraction wells. The Army has to reach the cleanup goal of drinking water standards (5 parts per billion) for PCE and TCE, both on site and off site. The effectiveness of the current extraction wells will continue to be evaluated using the data generated as part of the procedures and data requirements, which will be given in the Long-Term Monitoring Plan and Operations and Maintenance Plan. If the evaluation of the data indicates that cleanup goals are not being attained in the off-site and/or on-site portions of the plume, contingencies are developed. Those contingencies have already included the additional monitoring wells noted above. As a result of the continued evaluation (including modeling), the Army may consider adjusting the number and location of the extraction wells and/or the rate of extraction from some or all of the wells to increase the efficiency of the system and/or decrease the overall remedial costs. It is in the Army's best interest to clean up the contamination as fast as possible; lengthy cleanups result in higher costs and sometimes in decreased effectiveness. If an additional extraction well would decrease the time to cleanup or improve the effectiveness of the cleanup, the Army would certainly implement that modification.

8. Bea McCormick

Comment 1 (page 30):

Ms. McCormick commented on the location of the Public Hearing and the low attendance. Several neighbors, friends, acquaintances, people, were very upset and disappointed about the meeting not being in the library where it is accessible to that part of town. She added that many people simply don't want to come to Natick Labs for meetings.

Response 1:

The Informational Meeting, which was the kickoff to the Public Hearing, was held at the fire station in downtown Natick. The original Public Hearing was scheduled for last Thursday in the basement of the library, but due to weather conditions, the hearing was changed to tonight and the library meeting room was booked. The Army sent out 2,500 notices about this meeting to the general public. The meeting notice was published twice in the local newspapers, including the *MetroWest Daily News* and the *Natick TAB.* Announcements were posted throughout the Town, including at the library, fire station, and other public facilities. The Army has had a number of environmental open houses at SSC over the last couple of years to talk about the proposed cleanup, as well as other issues. All of the monthly RAB meetings were open to the public.

9. Harlee Strauss

Comment 1 (page 34):

Ms. Strauss, a RAB member, voiced technical concerns about the lack of definition of the plume on the northern boundary. She believes that there is some move to petition the state for the Springvale well to pump harder, based on the information in local newspapers. If that is the case, that makes the concern even larger about the definition of that northern boundary and whether it's going to move or not and has some implications with the intensity of the monitoring, how many new monitoring wells you need to put in, and how far north they need to go. Therefore she wanted to note this potential change in the pumping rate of the Springvale well.

Response 1:

Robert Campbel, of the MADEP responded at the Public Hearing that he didn't know what the plan is for any additional pumping out of the Springvale well. However, he will provide Ms. Strauss with additional information, once he gets it from the appropriate department. If there is an appreciable increase in the volume of water pumped out of the Springvale well, it may very well have some effect, but he doesn't know what those plans are. In addition, the Army has committed to installing additional off-site monitoring wells to the north of the facility to monitor the effectiveness of the selected remedy.

The ground water flow and contaminant transport model developed in support of the T-25 Area remedial action currently uses average pumping rates and drawdown measurements for the Springvale and Evergreen wells. These averages were computed from town data available over the past couple years of actual recorded pumping data. The Army is aware that pumping rates may increase in the future as water demand increases. However, the current Springvale wells can only pump up to a certain rate, because of their physical size (depth, diameter, screen length) and hydraulic conditions of the aquifer. If water usage in Natick increases beyond the current capacity of all of the town's wells, the town would likely have to explore alternative sources.

The ground water model is constantly being updated, as new data become available. As part of the continued development of the model, a sensitivity analysis will be conducted. A range of representative pumping rates at the Springvale wells will be modeled, and the flow and contaminant transport results will be evaluated to determine the influence of varying pumping rates on contaminant transport rates.

10. Nicholas Arthur

Comment 1 (page 36):

Mr. Arthur stated that at the selectmen's meeting, one of the selectmen brought up the issue of the water shortage. They said they would have to get approval from the state to pump any more from the well, but they were going to look into it. Nothing has been finalized, as far as the Town is concerned.

Response 1:

Robert Campbell of MADEP stated at the Public Hearing that the pump rates at the Springvale well system are permitted by the Bureau of Resource Protection, which is a part of the DEP. The overall Springvale Well Field pumping rate can not be exceeded unless the Town petitions the Bureau of Resource Protection for an increase, and they may not allow that with the existing configuration of the wells. His understanding is that there has been a new well installation in Springvale or one is planned; and if so, before that well can come on-line, it has to have approval from the Bureau of Resource Protection, and I don't know what the status of that is.

11. Jill Miller

Comment 1 (page 45):

Ms. Miller stated: She noted that the plume extends considerably past the edge of the Army property. She asked if there are any contingency plans for putting off-site drawing wells for pulling water out from off-site as opposed to only on site to go into the treatment plant.

Response 1:

The Army will evaluate what is happening currently with the extended running of the system, but is prepared to refine the treatment system, if necessary, which could include installation of additional wells. The TCE concentrations off site, for instance to the north on Fisher Street, has dropped by approximately one-half in one year. The Army will continue to evaluate the data and see if the decrease continues. As the plume moves north and west, through natural processes (e.g., dilution, dispersion) it is cleaning itself as it runs through the underground soils. The Army believes that by cutting off the source on the Army property side, that the plume will eventually disappear. The computer models and the actual sampling data show that this is happening. Also, the Town of Natick's Springvale well field filters for the contaminants; that is one of the main goals of that filtration system—to clean the water if contamination does come toward the drinking water supply from other sources besides the Army.

The Army will install additional off-site wells to monitor the effectiveness of the selected remedy. The Army will install an additional water table (A-interval) monitoring well in the area to the north of the T-25 Area on Fisher Street. A deep overburden monitoring well will also be installed to the north of the T-25 Area. Other monitoring wells are also planned, however the exact location and depth of these wells is currently under discussion with the regulators. The specific details regarding the additional wells the Army will install will be described in the Long-Term Monitoring Plan, which will be developed after the signing of the ROD.

12. Seth Green

Comment 1 (page 48):

Mr. Green questioned the basis of the economic analysis and the selection of the most effective method, and stated that 27 years to clean up is excessive. He mentioned other factors such as children in the neighborhood and property values.

Response 1:

The evaluation of the remedial alternatives was accomplished as outlined in the chart on page 9 of the Proposed Plan. The specific evaluation criteria in the left column are required by the EPA under the guidance for CERCLA, and include overall protection of human health and the environment. The option selected will protect human health, and will not result in any exposures to individuals in the neighborhood surrounding SSC. All of the options were extensively evaluated; the details of this evaluation are documented in the FFS/TS. The selected option, air stripping with carbon adsorption, is the best available technology at present, as stated not only by the Army, but by regulators and others. The Army is committed to evaluating other technology processes if they will clean the ground water faster. The time frame of 27 years is not necessarily the time it will take to clean up the ground water. As stated in the Proposed Plan (page 9), "A remedial alternative is discontinued when actual chemical monitoring data meet the goals of the cleanup." No specific time for ceasing pumping or the remedial alternative is stipulated in the Proposed Plan. These estimated cleanup times do not indicate when an alternative would be "shut off." ***A remedial alternative is discontinued only when the actual chemical monitoring data meet the established cleanup goals.***

13. Mel Willens

Comment 1 (page 53):

Mr. Willens commented on the amount of people that attended the hearing, because this is such an important subject and is relevant to all Natick citizens. He stated that he found nothing wrong with the location of the hearing.

Response 1:

As previously discussed, the informational meeting, which was the kickoff to this Public Hearing, was held at the fire station in downtown Natick. The original Public Hearing was scheduled for Thursday in the basement of the library, but due to weather conditions, the hearing was changed to tonight and the library meeting room was booked. The Army sent out 2,500 notices about this meeting to the general public. The meeting notice was published twice in the local newspapers, including the *MetroWest Daily News* and the *Natick TAB*. Announcements were posted throughout the Town, including the library, fire station, and other public facilities. The Army has had a number of environmental open houses at SSC over the last couple of years to talk about the proposed cleanup, as well as other issues. All of the monthly RAB meetings have been held at SSCOM and are open to the public.

PART 4: REFERENCES

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Appendix A: Administrative Record Index

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Wk Plan	5	Draft Final QA Project Plan for T-25 - THAMA	3/17/93	
Correspond	6	Review of Draft Wk Plan for T-25	3/17/93	
Corresp.	7	Draft Letter Report of HRS Score for NRDEC	5/3/93	
Corresp.	8	Public Affairs Announcement from EPA to Natick	5/7/93	
Newspaper	9	Tab: "Army Labs may make Superfund List"	5/93	
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Corresp	42	To: David LaRusso - DEP, Woburn - Purge H2O	9/20/93	Sharon [illegible]
Corresp.	43	To: David [illegible] / Don [illegible], EPA Re: NPDES Permit	9/20/93	Sharon [illegible]
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Corresp	48	EPA. Permit Exclusion for Purgewater & Pumptests	1/10/3	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Corresp?	[illegible]	[illegible]	[illegible]	[illegible]
Corresp?	[illegible]	[illegible] - EPA?	[illegible]	[illegible]
Corresp?	[illegible]	[illegible] - EPA?	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Memo	[illegible]	[illegible]	[illegible]	[illegible]
Memo	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Newspaper	101	News: Stoba holding env. open houses	4/10/95	[illegible]
Newspaper	102	News: Public Announcement for open House	4/11/95	[illegible]
Corresp	103	Ltr. from Cody State Park Advisory Committee	4/11/95	[illegible]
Corresp	104	EPA notification of TAG grant Approval	4/11/95	[illegible]
Newspaper	105	TAB: Natick Stoba opens up to residents	4/19/95	[illegible]
Newspaper	106	TAB: On the contamination trail	4/27/95	[illegible]
Corresp	107	Ltr. to Mr Carr - Resident of Natick	5/5/95	[illegible]
Corresp	108	Ltr. to C. Murphy - Resident of Natick	5/11/95	[illegible]
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Corresp	113	Ltr. to Mr + Mrs Williams III - Resident	5/[illegible]/95	[illegible]
Corresp	114	Ltr. to Dr [illegible] - Resident of Natick	5/[illegible]/95	[illegible]
Corresp	115	Community Selection Panel	5/30/95	[illegible]
Corresp	116	Ltr. to Ms Tutuny: Re: RAB Volunteer	5/30/95	[illegible]
Corresp	117	Ltr. to Potential RAB Members	5/30/95	[illegible]
Corresp	118	Community Interest Survey Form	5/30/95	[illegible]
Corresp	119	Volunteering for RAB as of 15 May 95	5/30/95	[illegible]
Corresp	120	E-mail from Barry Cole - Resident	5/30/95	[illegible]

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Corresp	143	Ltr. to RAB Members Forwarding Package for First RAB Meeting	8/9/95	[illegible]
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Newspaper	149	News: Groundwater testing comes up empty at Natick Labs site	8/17/95	[illegible]
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Newspaper	151	News: Correction to News Articles 149 + 150	8/21/95	[illegible]
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Corresp	154	Agreement Statements for RAB Members	8/31/95	[illegible]

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Corresp	155	Ltr. to RAB Members Forwarding Package for Second RAB Meeting	9/16/95	[illegible]
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Corresp.	181	Ltr to Mr. Keele Re: Draft Phase II Comments + Response to RAB Comments + Draft Community Relations Plan for SSCOM	3/11/96	[illegible]

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Newspaper	183	News: Continued Natick Gibbs Cleanup Takes Shape	3/19/96	[illegible]
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Corresp	185	Ltr. from Hollowood Assoc., Inc. Re: Discharge of Water from the Proposed Groundwater Decontamination + Cleanup System into Lake Cochituate Residential Swimming Area	5/7/96	[illegible]
Newspaper	186	Natick Bulletin: Gibbs Celebrate Earth Day	5/7/96	[illegible]
Newspaper	187	Natick Bulletin: Action Starting in Gibbs Cleanup	5/17/96	[illegible]
Newspaper	188	Cancer Study Still Under Wraps: NB	5/17/96	[illegible]
Corresp	189	Media Advisory on Seventh RAB Mtg.	5/28/96	[illegible]
Corresp	190	Ltr. to RAB Members, EPA + MDEP Re: Review of Ground Water Model for SSCOM	5/30/96	[illegible]
Corresp	191	Ltr. to RAB Members Re: May RAB Mtg Minutes + Draft Agenda for June RAB Mtg.	6/14/96	[illegible]

IN

FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Newspaper	192	News: Legal Notice - RAB Mtg - 6/27/96	6/19/96	[signature]
Corresp	193	Ltr to Mr Fitzgerald Re: Response to Comments on the Draft Treatability Study Work Plan - dtd Oct 95	6/26/96	[signature]
Corresp	194	Media Advisory on Eighth RAB Meeting	6/27/96	[signature]
Corresp	195	8th RAB Sign In Sheet	6/28/96	[signature]
Corresp	196	Ltr to Mr McHugh from Mr Keefe EPA Re: Draft Community Relations Plan - Revision 1	6/28/96	[signature]
Corresp	197	Ltr to Mr McHugh from Mr Keefe EPA Re: Draft Steam Injection [illegible] Test Design March 1996	6/28/96	[signature]
Corresp	198	Ltr to Mr Campbell MADEP and Mr Keefe EPA Re: Draft Action Memorandum [illegible] Process Area	7/2/96	[signature]
Work Plan	199	Addendum to Work Plan Phase II	7/3/96	[signature]
Work Plan	200	Addendum Work Plan Phase II - [illegible] Area of the US Army Soldier Systems Command (SSCOM) Natick, MA	7/12/96	[signature]

IN

FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Workplan	2001	ADS Final Quality Assurance Project Plan Phase II RI [illegible] Area at [illegible] Annex, MA Vol. I of II	[illegible]	[illegible]
Workplan	2002	ADS Final Quality Assurance Project Plan Phase II RI [illegible] Area at [illegible] Annex, MA Vol. II of II	[illegible]	[illegible]
Corresp.	2003	Ltr. to Mr. Campbell MDEP and Mr. [illegible] EPA re: Final [illegible] Phase II RI Work Plan, Final [illegible] Phase II RI Quality Assurance Project Plan	[illegible]	[illegible]
Corresp.	2004	8th RAB Meeting Minutes	[illegible]	[illegible]
Workplan	2005	ADS Final Health and Safety Plan [illegible] Area at [illegible] [illegible], MA	[illegible]	[illegible]
Workplan	2006	ADS Final Quality Assurance Project Plan [illegible] [illegible] Area at [illegible] [illegible], MA	[illegible]	[illegible]

IN

FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	207	Ltr to Mr Campbell, MDE and		
		Mr Keck, EPA Re: Draft Shelter Report		
		Survey of Special Properties - Final		
		Model [illegible] Final [illegible]		
		[illegible]		
		[illegible] Draft Final Community		
		Relations Plan Draft Final		
		[illegible]		
		Monitoring Report Summer [illegible]		
		[illegible]	8/14/96	[illegible]
Corresp	208	2nd Greenhouse Surveys	8/14/96	[illegible]
Wk Plan	209	ADD - Phase I Final Work Plan -		
		[illegible] Investigation Feasibility		
		[illegible]		
		[illegible]		
		[illegible] Area at [illegible]	9/13/96	[illegible]
Wk Plan	210	ADD - Phase [illegible]		
		[illegible]		
		[illegible]		
		[illegible] Area at [illegible]	9/13/96	[illegible]

IN

FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	207	Ltr to Mr Campbell, MDE and Mr Nesky EPA Re: Draft Shelter Report, Survey of Special Properties Final, Phase I [illegible] Final Phase [illegible] Quality [illegible] Draft Final Community Relations [illegible] Draft Final [illegible] Ground Water Monitoring Report Comments [illegible]	8/14/96	[illegible]
Corresp	208	2nd Goat House Surveys	8/14/96	[illegible]
Wk Plan	209	ADD [illegible] Final Work Plan [illegible] Investigation [illegible] [illegible] Area [illegible]	9/13/96	[illegible]
Wk Plan	210	ADD [illegible] [illegible] [illegible]	9/13/96	[illegible]

IN

FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	221	Ltr to M. Jackson [illegible] Research [illegible] [illegible] [illegible] Smith	[illegible]	[illegible]
Corresp	222	Letter to Dr Glyn Request RAB Rep from schools	10/29/96	C. Fitzgerald
Newspaper	223	TAB Article "Water Faucet"	11/14/96	C. Fitzgerald
E-Mail	224	Mr. Kaltofen: Comments Regarding SSCOH Rpt	12/3/96	C. Fitzgerald
Newspaper	225	Suit Against Labs - Middlesex News	12/10/96	C. Fitzgerald
News	226	Add for RAB Member	12/25/96	C. Fitzgerald
Newspaper	227	Letters to the Editor: Some Clarification by the Labs TAB	12/27/96	K. Alves
Newspaper	228	"Natick Lab Eyed Over Hike in Cancer" Boston Globe	3/3/97	K. Alves
Newspaper	229	"Cancer Cluster Seen in Natick" Middlesex News	3/3/97	K. Alves
Newspaper	230	"Natick cancer cluster worries state officials" Middlesex	3/3/97	K. Alves
Newspaper	231	"Cause of high cancer rate sought" Patriot Ledger	3/3/97	K. Alves
Newspaper	232	"Cancer Scare" Middlesex News	3/3/97	K. Alves
Newspaper	233	"Cancer Concern" Middlesex News	3/3/97	K. Alves
Newspaper	234	"Natick's water safe now". Middlesex News	3/3/97	K. Alves
Newspaper	235	"More money sought to study Natick Cancer rates" Middlesex News	3/3/97	K. Alves
Corresp	236	Ltr from Martha Steele to Mr Manning: Mr. Kaltofen	3/3/97	K. Alves

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	237	Ltr to Mr. Campbell Ammend #1 to final SSCOM Work Plan	3/3/97	K Alves
Corresp	238	Ltr to Mr. Keck Ammend #1 to final SSCOM Work Plan	3/3/97	K Alves
Corresp	239	Questions/Comments received from the Feb. 25, 1997 RAB	3/4/97	K Alves
Newspaper	240	"Officials seek cause of elevated cancer incidence" Morning Sentinel	3/7/97	K Alves
Newspaper	241	"Costly Exposure" TAB	3/7/97	K Alves
Corresp	242	Ltr from Michael Berkman certifying Dr. Czeisler to be Lakewood Association Inc. representative to RAB	3/18/97	K Alves
Newspaper	243	"Water is OK" Milford Daily News	3/18/97	K Alves
Newspaper	244	"Natick's Water Safe Now" Middlesex News	3/24/97	K Alves
Newspaper	245	"State will address Surge in local Cancer" Middlesex news	3/24/97	K Alves
Newspaper	246	"Residents to Conduct Town's Own Cancer Survey" Natick Bulletin	3/24/97	K Alves
Newspaper	247	'Task force needed to Study Cancer data' Ltr to Editor Natick Bulletin	3/24/97	K Alves
Newspaper	248	"Natick must get its own answers on Cancer findings" Middlesex News	3/24/97	K Alves

IN

FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Newspaper	249	"Markey asks EPA to find cause of cancer"	3/24/97	K Alves
		Middlesex News		
Newspaper	250	"EPA cancer probe urged" Middlesex News	3/24/97	K Alves
Corresp	251	Ltr to Mr. Keefe, EPA Mr Cambell		
		MDEP, and Mr. Tate Tate & Howard Inc.		
		Re: Response to comments Ground Water		
		Model	3/25/97	K Alves
Newspaper	252	"Unanswered questions' lead to formation		
		of cancer task force" Middlesex News	3/25/97	K Alves
Newspaper	253	"Dubious Devices" Middlesex News	3/25/97	K Alves
Newspaper	254	"Test shows high chemical levels" Middlesex News	3/31/97	K Alves
Corresp	255	Ltr to Mr. Keefe, EPA and Mr Campbell,		
		DEP Re: Draft Quality Assurance Quality,		
		Control Plan for Gypsy Site	4/29/97	K Alves
Newspaper	256	"Environment on hold" TAB	4/29/97	K Alves
Corresp	257	Ltr. to RAB members FY98 Budgeting Survey	5/1/97	K Alves
Corresp	258	Ltr. to Mr. Cunniff from PAO	5/1/97	K Alves
Newspaper	259	"Army Lab focus of Cancer Dispute" Union News	5/5/97	K Alves
Newspaper	260	"Town to form Cancer task force" TAB	5/5/97	K Alves
Newspaper	261	"Cancer task force to start own study" Natick Bulletin	5/5/97	K Alves

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Newspaper	262	RAB mtg. advertisement" PAO News release	5/5/97	[signature]
Newspaper	263	"Natick to probe cancers" Boston Globe	5/5/97	[signature]
Newspaper	264	"Contingent goes to State House for Cancer Study		
		Funds" TAB.	5/5/97	[signature]
Newspaper	265	"Dow plant studied as Natick cancer source"		
		Middlesex news	5/5/97	[signature]
Corresp	266	Ltr to Lucas Meagan (Middlesex news) From		
		Susan Anninger PAO in response to article	5/5/97	[signature]
Corresp	267	Ltr. to Mr. Keefe, EPA and Mr. Campbell		
		DEP Re: Health and Safety Plan Addendum		
		For SSCOM proposed Gym Site	5/14/97	[signature]
Newspaper	268	"Natick Cancer Study funds in state budget proposal"		
		Middlesex news	5/22/97	[signature]
Corresp	269	Ltr. to RAB members FY98 budgeting survey #2	5/29/97	[signature]
Newspaper	270	"Water Study breaks little new ground"		
		Middlesex news	5/28/97	[signature]
Newspaper	271	"Federal Study Shows Labs not likely cancer		
		Source" Natick Bulletin	5/30/97	[signature]
Newspaper	272	"Federal health report on Natick Labs is		
		released" Natick Tab	5/30/97	[signature]

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	273	Ltr to Jerome Keefe, EPA: Robert		
		Campbell, DEP Re: Draft Work Plan		
		for Proposed Gymnasium Site	5/30/97	[signature]
Corresp	274	Ltr to Martha Steele, DPH Re: Draft		
		Proposed Sampling Plan	6/5/97	[signature]
Newspaper	275	"Cochituate Park prepares for summer season"		
		Natick Bulletin	6/9/97	[signature]
Newspaper	276	"Public health report on Natick Labs", "Water		
		Sewer rates to increase in coming year"		
		Natick Bulletin	6/9/97	[signature]
Newspaper	277	"Natick water, sewer rates jump"		
		Middlesex News	6/20/97	[signature]
Newspaper	278	"Water rates jump up to 32 percent in		
		Natick" Middlesex News	6/20/97	[signature]
Newspaper	279	"Questions Remain on Natick Labs" TAB	6/23/97	[signature]
Newspaper	280	"Federal health assessment of Natick Labs site		
		released" TAB	6/23/97	[signature]
Newspaper	281	PAO news release for 24 June 1997 RAB		
		meeting	6/24/97	[signature]
Corresp.	282	Ltr. to RAB members Re: Draft		

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
		Work Plan for Proposed Gym Site	6/24/97	K. Allen
Corresp	283	Ltr to Jerome Keefe, EPA & Robert		
		Campbell, DEP Re: Draft Removal		
		Work Plan and Draft Site Safety and		
		Health Plan	6/25/97	K. Allen
Corresp	284	Ltr to Max Howie, ATSDR Re: Forwarding		
		Comments on ATSDR Public Health Assessment	6/27/97	K. Allen
Corresp	285	Ltr to Jerome Keefe, EPA; Robert		
		Campbell, DEP Re: Storm Water		
		screening of 1-25; Main Outfall	8/8/97	K. Allen
Corresp	286	Ltr to Jerome Keefe, EPA; Robert Campbell,		
		DEP Re: Final Removal Action Work Plan		
		for Storage Area (1-25 Area)	9/3/97	K. Allen
~~Newspaper~~	~~287~~			
Newspaper	287	PAO News release for 23 September 1997		
		RAB meeting	9/24/97	K. Allen
Newspaper	288	"Labs to remove contaminated soil"		
		Middlesex News	10/2/97	K. Allen
Corresp	289	Ltr. to community re: Soil excavation		
		at the Storage area	10/7/97	K. Allen

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	290	Ltr. to Jerome Keck, EPA; Robert Campbell, DEP; and Forest Lyford, USGS re: Final Treatability Study Work Plan	10/28/97	[signature]
Corresp	291	Ltr. to Donald Stoddard, DEM re: Request for Authority to Complete Installation of Ground Water Monitoring Wells on property owned by DEM.	10/28/97	[signature]
Corresp	292	Ltr. to Jerome Keck, EPA and Robert Campbell, DEP re: Draft Phase II T-25 Remedial Investigation Report	10/28/97	[signature]
Newspaper	293	"Tiny critters could clean Lake Cochituate." Middlesex News	10/28/97	[signature]
Newspaper	294	"Cancer study outlook brightens" Middlesex News	10/28/97	[signature]
Newspaper	295	"Cancer group looks at town history" Middlesex News	10/28/97	[signature]
Newspaper	296	"Natick to debate school construction" Middlesex News	10/29/97	[signature]
Newspaper	297	"Preliminary report from Cancer Study Task Force expected soon" Middlesex News	10/29/97	[signature]
Newspaper	298	"Army lab cleanup on track" Natick Bulletin	10/29/97	[signature]

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Newspaper	299	"Cancer map editorial position is harmful"		
		The Natick TAB	10/29/97	K Allen
Newspaper	300	"Cancer levels now normal" Natick Bulletin	11/21/97	K Allen
Newspaper	301	"Cancer study allays concerns" The Natick TAB	11/21/97	K Allen
Corresp.	302	Special Use Permit from DEM/Division		
		of Forest and Parks for Pegan Cove	11/21/97	K Allen
Newspaper	303	"Natick Labs testing clean-up system"		
		Middlesex News	12/5/97	K Allen
Newspaper	304	"New Employee Representative Needed for		
		RAB" SSCOM Bulletin	2/4/98	K Allen
Corresp	305	Ltr. to Jerome Keefe, EPA and Robert		
		Campbell, DEP re: Installation Action Plan	2/4/98	K Allen
Newspaper	306	"Lake overrun by ~~pop~~ pollution, development		
		Middlesex news	2/9/98	K Allen
Corresp	307	Ltr. to RAB members re: Draft Phase II		
		Remedial Investigation Sections 5-9	3/3/98	K Allen
Corresp	308	Ltr. to Jessica Graham re: Draft		
		Phase II Remedial Investigation Sections 5-9	3/3/98	K Allen
Corresp	309	Ltr. to Dr. Campbell ATSDR re: maps for		
		public health assessment	3/3/98	K Allen

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Newspaper	310	"Status report on Superfund Sites" Boston Globe	3/17/98	K Alves
Corresp	311	Ltr. to Jerome Keefe, EPA and Robert Campbell, DEP re: Draft Final Quarterly Groundwater Sampling report	3/23/98	K Alves
Newspaper	312	"Army Labs an unlikely suspect Study Says" Natick Bulletin	4/6/98	K Alves
Corresp	313	Ltr. to Jerome Keefe, EPA and Robert Campbell, MaDEP re: Environmental Open House Poster	4/15/98	K Alves
Corresp	314	Ltr to Community from BG Floyd re: invitation to Environmental Open House	4/15/98	K Alves
Corresp	315	Ltr to neighbors (mailing list) from BG Floyd re: Invitation to Environmental Open House	4/15/98	K Alves
Corresp	316	Ltr to Laurie Haines, AEC, Steven Young, HydroGeoLogic, and Donald Koch, ETA re: Comments on Groundwater Modeling Draft Technical Work Plan Comments	4/15/98	K Alves
Corresp	317	Ltr from Scott Pellgrin re: NPDES permit exclusion for groundwater remediation	4/30/98	K Alves

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	318	Ltr. to Scott Pellerin, EPA re: NPDES Permit Exclusion Reference #98-004	4/30/98	K. Alves
Corresp	319	Ltr. w/enclosure from Jerome Keefe, EPA re: Phase II RI, T-25 Area Comments	4/30/98	K. Alves
Corresp	320	Ltr. w/comments from Forest Lyford, USGS re: Comments on Phase II RI, T-25 Area	4/30/98	K. Alves
Corresp	321	Ltr to Kathleen Thrun, ADL re: Comments from EPA & USGS for Phase II RI, T-25 Area	4/30/98	K. Alves
Corresp	322	Ltr to Jeffrey Pickett, ABB re: EPA & USGS Comments on the Phase II RI, T-25 Area	4/30/98	K. Alves
Corresp	323	Ltr. to Laurie Haines, AEC, Steve Young, HGL, Donald Koch, EPA re: EPA & USGS Comments on the Phase II RI T-25 Area	4/30/98	K. Alves
Corresp	324	Ltr. to Robert Campbell, DEP, Jerome Keefe, EPA and Forest Lyford, USGS re: Draft Technical Work Plan for Groundwater Modeling	5/8/98	K. Alves

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	325	Ltr. to Bob Campbell, DEP and Jerome		
		Keefe, EPA re: Installation Action Plan	5/8/98	KAlves
Newspaper	326	"Army to pay for Labs cleanup"		
		Middlesex News	5/12/98	KAlves
Corresp	327	Ltr. to Robert Campbell, DEP and Jerome		
		~~Keffe~~ Keefe, EPA re: Draft Removal		
		Action report for Storage Area, T-25 Area	5/12/98	KAlves
Corresp	328	E-mail from Forest Lyford, USGS		
		Subject: Review of Modeling Plan	5/26/98	KAlves
Newspaper	329	"Labs give $2.6 million to town for		
		water treatment" Natick Bulletin	5/28/98	KAlves
Newspaper	330	"Some clarification by the Labs"		
		The Natick TAB	6/9/98	KAlves
Newspaper	331	"Environmental Scene". Worcester		
		Business Journal	6/17/98	KAlves
Corresp	332	Ltr. to Laurie Haines, AEC, Steven		
		Young, HGL, Donald Koch, ETA re:		
		EPA, DEP & USGS Comments for		
		Draft Technical Work Plan, Groundwater		
		Modeling at SSCOM	6/17/98	KAlves

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	333	Ltr. to Todd Frederick, DEM re: Quarterly Groundwater Sampling Report Event 15	6/26/98	K Allen
Corresp	334	Ltr. to Jerome Keck, EPA and Robert Campbell, DEP re: Draft Work Plan for Site Investigation, Boiler Plant	6/29/98	K Allen
Corresp	335	Ltr. to Kate Lewis, DEM re: Quarterly Groundwater Sampling Report Event 15	7/14/98	K Allen
Corresp	336	Ltr. to Terrance Whalen, Natick Conservation Commission re: Quarterly Groundwater Sampling Report Event 15.	7/19/98	K Allen
Corresp	337	Ltr. to Kerry Van Acker, Cochituate State Park re: Quarterly Groundwater Sampling Report Event 15	7/19/98	K Allen
Corresp	338	Ltr. to Michael Plumb, ANEPTEK re: Draft Removal Action Report, Draft Final Quarterly Groundwater Sampling Report Events 14 & 15, Draft Work Plan for Site Investigation Boiler Plant Area	8/11/98	K Allen
Corresp	339	Ltr to Scott Pellerin, EPA re: NPDES Permit Exclusion Reference #98-004	8/11/98	K Allen

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Corresp	340	Ltr. to Robert Campbell, DEP and Jerome Keefe, EPA re: Draft Comment and Response Package on Phase II T-25 Area Remedial Investigation	8/11/98	[signature]
Corresp	341	Ltr. to Robert Campbell, DEP and Jerome Keefe, EPA re: T-25 Area Schedule	8/11/98	[signature]
Corresp	342	Ltr. to Robert Campbell DEP, Jerome Keefe, EPA and Forest Lyford, USGS re: Response to Comments, Draft Technical Work Plan, Groundwater Modeling	8/11/98	[signature]
Corresp	343	Memorandum for Peter Tuttle re: T-25 Area Current Revised Schedule	8/11/98	[signature]
Response Card	344	From May 1998 Newsletter	1/28/99	R. Boutin
Response Card	345	From October 1997 Newsletter	1/28/99	R. Boutin
WK PLAN	346	Tier II Ecological Risk Assessment Work Plan	2/1/99	R. Boutin
WK PLAN	347	Site Investigation Work Plan Report for Boiler Plant Area, Former Haz. Mat. Storage Building, Former Piggery & Building T-23	2/1/99	R. Boutin
Newspaper	348	TAB Article: Residents sought to monitor cleanup	3/2/99	R. Boutin

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
R.I. Report	349	Final Phase II Remedial Investigation Report.	2/2/99	R. Boutin
		Vol. I, Sect. 1-4, T-25 Area at U.S. Army SSCOM		
R.I. Report	350	Final Phase II, R.I. Report, Vol. II, Sect. 5-9	2/2/99	R. Boutin
		with Comment & Response Packages.		
Correspondence	351	Cover Letter - Final Phase II RI Report	2/11/99	R. Boutin
Correspondence	352	Caitlin Fitzgerald - Earth Science Student - Replied to	2/11/99	R. Boutin
Correspondence	353	Maria Walman - Earth Science Student - Replied to	2/11/99	R. Boutin
Corresp.	354	Groundwater Use & Value Determination	2/23/99	R. Boutin
Newspaper	355	Contamination threatens town's backup well TAB 3/5	3/4/99	R. Boutin
Newspaper	356	Long Road to Remediation - Natick Tab 3/2/99	3/4/99	R. Boutin
Correspondence	357	Request for visit to SSC - Caitlin Fitzgerald	3/29/99	R. Boutin
Correspondence	358	Request & Response to Info about Pegan Cove	3/29/99	R. Boutin
Newspaper	359	Public Notices for RAB Meeting 3/4/99 - BAH	4/22/99	R. Boutin
Correspondence	360	Ltr. to New RAB Members - Intro Packet	5/6/99	R. Boutin
Response Card	361	From Winter 1999 Newsletter	5/17/99	R. Boutin
Corresp.	362	Applications for RAB membership	5/20/99	R. Boutin
Corresp.	363	Comments on FFS/Treatability Study for T-25 Area	5/21/99	R. Boutin
~~Corresp.~~	~~364~~	- Environmental Insight		
Corresp.	364	Comments on FFS/Treatability Study - C. Greisler	5/28/99	R. Boutin
Corresp.	365	Response to C. Greisler / Oakwood Assn.	6/2/99	R. Boutin

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Newspaper	366	Boston Sunday Globe, Army, Natick talk on tainted wells	6/13/99	R. Boutin
Corresp	367	Dept. Public Health - Health Consultation on	6/30/99	R. Boutin
		T-25 Outfall Area		
Contacts	368	Original Members of the Restoration Advisory Bd	7/8/99	R. Boutin
Corresp.	369	Ltr. to Chief Fredette requesting meeting room	8/12/99	R. Boutin
Corresp.	370	Ltr. from Tom E Howard on T-25 FFS/TS	8/12/99	R. Boutin
Corresp.	371	Ltr. to Bob Campbell, Jerry Keefe, Kathy Thrun	8/12/99	R. Boutin
		@ Draft FFS for T-25		
Corresp.	372	Comments on Draft Proposed Plan of T-25 Area from	8/13/99	R. Boutin
		Environmental Insight		
Newspaper	373	T-25 Proposed Plan Public Hearing Ad - Metrowest Daily 8-25-99	8/26/99	R. Boutin
Corresp.	374	Attendance List for Informational Meeting on	9/13/99	R. Boutin
		T-25 Proposed Plan on 9/9		
Newspaper	375	Natick Bulletin $3.1M to keep drinking H2O safe	9/22/99	R. Boutin
Newspaper	376	Boston Globe, Army set to pay $3.1M for cleanup	9/28/99	R. Boutin
Newspaper	377	MetroWest Daily, Army Plans Big Cleanup 9/23/99	9/29/99	R. Boutin
Correspondence	378	T-25 GW Proposed Plan Comment, Larry Meile, Citizen of Natick	10/1/99	R. Boutin
Corresp.	379	T-25 GW Proposed Plan Comment, Marco Kaltofen	10/1/99	R. Boutin
Corresp.	380	T-25 GW P.P. Comment, Environmental Insight	10/1/99	R. Boutin
Corresp.	381	P.A.O. Press Release - 10-5-99 RAB Meeting	10/5/99	R. Boutin

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FILE	FILE #	DESCRIPTION	DATE	SIGNATURE
Report	382	FFS/TS T-25 Area at SSC Final	9/99	R. Bautin
Newspaper	383	Globe Article • Army-Natick agreement to depend on EPA	10/18/99	R. Peret
Corresp	384	T-25 Groundwater Responsiveness Summary	11/15/99	R. Peret
Newspaper	385	Herald Article - Gvt. agencies on list of worst polluters in State	12/1/99	R. Peret
Newspaper	386	Metrowest Daily News - Natick Labs makes 'Dirty Dozen' List	12/4/99	R. Peret
Report	387	Public Hearing Transcript: T-25 Proposed Plan	12/7/99	R. Peret
Newspaper	388	Metrowest Daily News - Natick Settlement may not be for the best	12/9/99	R. Peret
Correspondence	389	Environmental Insight: Responses to Proposed Plan Comments	12/13/99	R. Peret
Correspondence	390	Adam Losi's Letter of Resignation from RAB	1/12/00	R. Peret
Correspondence	391	Response Cards from Newsletter # 8	5/10/00	R. Peret
Newspaper	392	Framingham TAB - Natick Legal Woes	9/12/00	J. McHugh
Newspaper	393	Metrowest Daily News - Labs Cleanup Plan leads debate	11/03/00	J. McHugh
Newspaper	394	Boston Globe - "Swallowing a Bitter pill"	11/06/00	J. McHugh
Newspaper	395	Boston Globe - "A two year wait"	02/05/01	J. McHugh

Appendix B: Memorandum of Agreement Between and Among the Town of Natick, Massachusetts and the United States Army Materiel Command, Soldier and Biological Chemical Command

MEMORANDUM OF AGREEMENT
BETWEEN AND AMONG
THE TOWN OF NATICK, MASSACHUSETTS
AND
THE UNITED STATES ARMY MATERIEL COMMAND,
SOLDIER AND BIOLOGICAL CHEMICAL COMMAND

THIS MEMORANDUM OF AGREEMENT ("Agreement") is entered into this 10th day of September 1999, by and among the Town of Natick, Massachusetts ("Town"or "Natick") and the United States Army Materiel Command, Soldier and Biological Chemical Command ("SBCCOM"or "Army), collectively the "Parties."

WHEREAS, the Town of Natick is a municipal corporation chartered under Massachusetts law. Natick operates water well systems including the Springvale, Elm Bank, and Evergreen Well Fields, which draw water for consumption and uses by the Town and its residents ("Natick drinking water supply"). In May of 1992, the Town entered into a Consent Decree with the Commonwealth of Massachusetts to construct a treatment plant to filter town water.

After engineering and design analysis, and with the approval of the Commonwealth pursuant to the Consent Decree, the Town constructed the treatment facility at its Springvale well field, located .41 miles north-northwest of SBCCOM ("Springvale Treatment Facility"). To satisfy the Consent Decree, water is pumped from the Evergreen walls to the Springvale Treatment Facility for treatment prior to entering the drinking water supply.

WHEREAS SBCCOM operates the U.S. Army Soldier Systems Center in Natick Massachusetts. The SBCCOM facility is located approximately .41 miles south-southeast of the Springvale well field and approximately 1.16 miles south of the Evergreen well field. The SBCCOM facility was placed on the National Priorities List ("NPL") pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), Public Law 96-510, as amended, in May of 1994, primarily as a result of groundwater contamination under the T-25 area of the facility. The T-25 area is hereinafter referred to as the "SBCCOM Site". The U.S. Army Environmental Center commenced a Phase I Remedial Investigation/Feasibility Study ("RI/FS") of the SBCCOM Site in 1992, prior to the NPL listing. The Phase I Final Report was issued in 1996. A Phase II RI/FS has built upon that effort through additional monitoring wells, groundwater modeling, and construction of a pilot scale treatment plant ("the T-25 Pilot Plant").

Based upon current pump and groundwater drawn-down testing, the T-25 Pilot Plant is proving capable of containing and remediating groundwater contaminated with tetrachlorethylene ("PCE") and trichloroethylene ("TCE"), as well as the compounds associated with the chemical decomposition of PCE and TCE ("breakdown compounds"), that have been identified at the SBCCOM Site. As a result, SBCCOM's feasibility study has focused upon a remedial action that includes operation of the T-25 Pilot Plant, and/or other source area controls, in conjunction with continued operation of the Town's Springvale Treatment Facility, as the most desirable treatment alternative employing the nine evaluation criteria required by the Environmental Protection Agency and codified at 40 Code of Federal Regulations ("CFR") §300.430(e)(9)(iii).

With these two complementary treatment facilities as cornerstones, SBCCOM will propose a remedial action plan to the United States Environmental Protection Agency ("U.S. EPA"). A Record of Decision ("ROD") is expected during the second half of 1999.

WHEREAS, the Town believes that past SBCCOM facility operations caused contamination of the Natick drinking water supply. The Army disputes these allegations.

WHEREAS, with respect to contamination of the SBCCOM Site, and the alleged contamination of the Natick drinking water supply, the Town and the Army desire to avoid litigation and to compromise and settle all disputes and claims, as well as to define on-going rights and obligations between the Parties.

NOW THEREFORE, in consideration of the representations, mutual promises and covenants contained herein, the Parties do hereby agree as follows:

A. PROMISES and COVENANTS

1. NATICK

a. The Town agrees to continue its operation of the Springvale Treatment Facility for the removal of PCE and TCE, and all breakdown compounds, at least until remediation of the SBCCOM Site is completed as evidenced by approval of the Army's Remedial Action Completion Report by EPA or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the SBCCOM Site.

b. The Town's Board of Health has enacted a regulation to prohibit the development of any private drinking water wells within the Town in the area bounded by Evergreen Road to the north, Route 27 and Washington Avenue to the east, Route 135 to the south, and Speen Street to the west. The Town agrees that such regulation will remain in effect at least until remediation of the SBCCOM Site is completed as evidenced by approval of the Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the SBCCOM Site.

c. Upon fulfillment of all Army obligations and covenants, the Town hereby covenants not to sue, and to release the Army, as well as individual members of the uniformed service and its civilian employees, agents or assigns, for all liability, suits, formal claims, or causes of actions of any sort arising out of contamination or alleged contamination of the Natick municipal well fields by PCE, TCE, or breakdown compounds arising from or related to the SBCCOM Site, or resulting from actual or alleged errors in any design or construction of the Springvale Treatment Facility.

d. Upon fulfillment of all Army obligations and covenants, the Town waives and releases the Army from any and all claims the Town may have for past and future response costs incurred or to be incurred and claims for response costs and damages related to PCE, TCE, or breakdown compounds in Town drinking water supplies arising from or related to the SBCCOM Site.

2. ARMY and SBCCOM

a. The Army agrees to conduct continued source area containment of contaminated groundwater at the SBCCOM Site in accordance with the approved Record of Decision. Source area containment may be achieved through continued operation of the Army's pilot scale treatment plant or such other means as are acceptable to the Town and approved by EPA.

b. The Army will pay the Town the sum of $3,l00,000.00, representing the present value of operation and maintenance of the Springvale Treatment Facility, upon execution by the Chief of Staff of the Army Materiel Command or designee of a Record of Decision regarding the selected remediation plan for the SBCCOM Site. This payment is conditioned upon the execution of a Record of Decision by SBCCOM and EPA adopting the continued operation of the current pilot treatment plant – or other source area containment acceptable to the Town – in conjunction with the Springvale Treatment Facility as the appropriate remedial action for the SBCCOM Site.

c. Upon fulfillment of all Town obligations and covenants, the Army hereby covenants not to sue, and to release the Town, its employees, agents or assigns, for all liability, suits, formal claims, or causes of actions of any sort arising out of contamination or alleged contamination of the Natick municipal well fields by PCE, TCE, or breakdown compounds, or resulting from actual or alleged errors in any design or construction of Springvale Treatment Facility.

d. Upon fulfillment of Town obligations and covenants, the Army waives and releases the Town from any and all claims the Army may have for past and future response costs incurred or to be incurred and claims for response costs and damages related to PCE, TCE, or breakdown compounds in Town drinking water supplies.

e. The Army agrees to incorporate this Memorandum of Agreement into its proposed remediation plan and subsequent Record of Decision.

B. MUTUAL COVENANTS AND REPRESENTATIONS

1. This settlement and release shall be binding among and between the respective Parties upon execution by each Party. The Parties agree to thereafter cooperate with each other to further the purposes and goals of this Agreement. Each Party will bear its own costs, except as otherwise stated in ¶ B3 below.

2. This Agreement is made without admission of fact, liability or wrongdoing on the part of any Party and is entered into as a compromise of disputed claims and to avoid the time and expense of litigation.

3. Each party waives all claims against the other party for any compensation due to loss, damage, personal injury or death occurring as a result of the reasonable and non-negligent implementation of this Agreement. In the event that any party to this Agreement shall fail to perform any of the covenants or obligations as described herein, then, in addition to any and all other rights and remedies the non-defaulting Party shall have against the defaulting Party, the defaulting Party shall pay to the non-defaulting Party all costs and expenses, including but not limited to reasonable attorneys' fees incurred by the non-defaulting Party to enforce its rights hereunder.

4. Nothing in this Agreement shall be construed to create any rights in, or grant any cause of action to, any person not a party to this Agreement. The Parties expressly reserve any and all rights, defenses, claims, demands, and causes of action which they may have with respect to any matter, transaction, or occurrence relating in any way to the SBCCOM Site and Natick drinking water supply against any person not a Party hereto.

5. The Parties hereby agree to waive, upon fulfillment of all single and mutual obligations and covenants, any right to contribution under CERCLA § 113(f)(1) to which the Parties might otherwise be entitled under CERCLA §§ 106 and 107(a) for recoverable costs and damages associated with the SBCCOM Site.

6. The Parties warrant and represent to each other that they have read this Agreement, that each has had the benefit of advice and consultation with the counsel of their choosing with regard to the nature, force and effect of its terms, promises, and covenants, and that each understands this Agreement and that neither has been coerced nor placed under any duress in any manner.

7. The provisions contained herein constitute the entire agreement between the Parties and may only be modified in a writing executed by the authorized representatives of each Party.

8. The Parties agree that this Agreement constitutes complete satisfaction of all costs associated with implementing the terms and conditions of this Agreement.

9. The Parties to this Agreement warrant and represent to each other that they are under no legal disability and have appropriate authority to execute this Agreement.

10. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same Agreement.

11. This Agreement shall be controlled, construed, and interpreted in accordance with the laws of the Commonwealth of Massachusetts.

12. This Agreement shall be binding upon and inure to the benefit of the undersigned Parties and their respective successors and legal representatives.

Town of Natick

By: ______________________
Paul McKinley, Chair

By: ______________________
Jay Ball, Selectman

By: ______________________
Edward Carr, Selectman

By: ______________________
Charles Hughes, Selectman

By: ______________________
Mel Willens, Selectman

United States Army Materiel Command
Soldier and Biological Chemical Command

____
John C. Doesburg
Major General, USA
Deputy Chief of Staff for
Chemical and Biological Matters

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Appendix C: Town of Natick Board of Health Ordinance

Town of Natick

Massachusetts

February 19, 1999

AMENDMENTS TO CHAPTER 5,

NATICK BOARD OF HEALTH REGULATIONS

NEW SECTIONS

Section 31.1

Private wells for drinking water shall not be allowed where a public water supply is available in sufficient quantity and pressure so as to meet U.S. and Massachusetts safe drinking water standards.

Section 31.2

Private wells for drinking water shall not be allowed in any case in an area bounded by North Main Street, Lake Cochituate, West Central Street, and the Massachusetts Turnpike.

Section 31.3

Installation of wells for irrigation or industrial purposes must be performed by a Massachusetts registered well driller, after first obtaining a permit from the Board of Health. The fee for such permit shall be $50.00.

Adopted February 8, 1999
Published February 24, 1999

Natick Board of Health
Donald J. Breda P.E., Chairman
Peter A. Delli Colli, D.M.D., Vice Chairman
Arthur C. Taddeo, M. Ed., Clerk
Anthony G. Capobianco, M.D.
Physician to the Board

Office of the Board of Health • 13 East Central Street • Natick, Massachusetts 01760 • (508) 647-6460 • Fax (508) 647-6466

A public hearing as announced in said notice was held at the office of the Board of Health, Natick, at 8:00 p.m. on October 15, 1979.

Board of Health
Natick, Mass.

Richard N. Abbott, M.D.
Chairman

John E. Goodman, D.M.D.

James J. Mulligan, D.M.D.

Adopted October 22, 1979

Published - Natick Bulletin
October 31, 1979

Section 34. Penalty.

(a) Criminal Complaint - Whoever violates any provision of these rules and regulations may be penalized by indictment or on complaint brought in the District Court. Except as may otherwise be provided by law, and as the District Court may see fit to impose, the maximum penalty for any violation of these provisions shall be $300.00 for each offense.

(b) Non-Criminal Disposition - Whoever violates any provision of these rules and regulations may, in the discretion of the Health Agent, be penalized by a non-criminal complaint in the District Court pursuant to the provisions of the Massachusetts General Laws, Chapter 40, Section 21D. For the purpose of this provision the penalty to apply in the event of a violation shall be as follows: $25.00 for the first offense; $50.00 for the second offense; $100.00 for the third offense; and $200.00 for the fourth and each subsequent offense. Each day on which a violation exists shall be deemed to be a separate offense.

Amended December 6, 1988

Published December 20, 1988

BOARD OF HEALTH
Natick, Mass.

Arthur C. Taddeo, M.Ed.
Chairman
J. Cary Parsons, M.S.
Anthony G. Capobianco, M.D.

Appendix D: Preliminary Ground-Water Flow and Transport Modeling Results for the T-25 Area at Soldier Systems Command

PRELIMINARY GROUND-WATER FLOW AND

TRANSPORT MODELING RESULTS

FOR THE T-25 AREA

AT SOLIDER SYSTEMS COMMAND (SSC)

LETTER REPORT

Submitted to:
U.S. Army Environmental Center
(USAEC)
Aberdeen Proving Ground,
Maryland

Submitted by:
HydroGeoLogic, Inc
13740 Research Blvd, N-5
Austin, TX 78750

December 6, 1999

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1.0 Background

1.1 Site Description

The U.S. Army Solider Systems Command (SSC) is located approximately 17 miles west-southwest of Boston in Natick, Massachusetts. The research facility, which occupies a small peninsula extending from the eastern shoreline of Lake Cochituate, encompasses approximately 74 acres. Lake Cochituate consists of three connected ponds (North, Middle, and South Ponds). SSC is located on the shore of the South Pond. The land use surrounding SSC along the Eastern Shore of Lake Cochituate includes residential, commercial/retail, and light industrial areas. Approximately 2,500 feet northwest of SSC is the Springvale Municipal Well Field.

Field data from the Phase I and Phase II T-25 RI field screening programs, and from 16 rounds of ground-water monitoring, indicate that volatile organic compounds (VOCs) are present above their MCL limits at SSC. In May 1994, SSC was officially added to the Superfund National Priorities List (NPL), as a result of ground water contamination found in the T-25 Area. The VOCs of primary concern at SSC and the T-25 Area are Trichloroethylene (TCE) and Perchloroethylene (PCE). A detailed description of the nature and extent of contamination at SSC for all media is presented in Final Phase II Remedial Investigation Report: T-25 Area at the U.S. Army Soldier Systems Command, Natick Massachusetts (Arthur D. Little, 1998).

Based on a comprehensive survey of site hydrogeology, concentration data, potential exposure pathways, and human risks, Arthur D. Little began the design and operation of a Treatability Study involving two 4-inch diameter extraction wells in 1997. The two wells are designated as MW-15B and MW-90B-4 and are both located in the T-25 Area. Details concerning the design and selection of the pump-and-treat system are presented in the Final Treatability Study Work Plan (Arthur D. Little, 1997) and Final Focused Feasibility Study/Treatability Study (Arthur D. Little, 1999).

1.2 Development and Application of a Ground-water Model

In late 1997, the Army Environmental Center (AEC) hired HydroGeoLogic to develop a groundwater flow and transport model to help with evaluating: contaminant transport at SSC, the total costs of different remedial alternatives discussed in the FFS/TS, and the long-term effectiveness of the two-well extraction system at SSC. During the construction of the ground-water flow model, HydroGeoLogic applied newly developed data-fusion technology in order to match a large-number of calibration targets for several different water table conditions. Data-fusion technology is an advanced and robust inverse modeling approach that permits a wide-range of soft and hard data to be quickly and efficiently incorporated into the model calibration process. Among the benefits of using this approach is that the model's calibration can be rapidly updated as new data becomes available or existing data is modified.

The model results discussed in letter report are based on the calibrated ground-water flow model presented to the Resident Advisory Board (RAB) on June 3, 1999 at SSC except for a minor adjustment in the initial TCE distribution. Since the RAB meeting, a detailed statistical analysis has been performed on the pumping rates at the Springvale wells. Results of this analysis have been used to support a sensitivity analysis of different remediation options regarding drought/wet conditions and varied Springvale pumping conditions.

Future improvements are planned for the ground-water model, as additional site characterization data becomes available. Thus, the model and its predictions should be considered as preliminary and subject to change. Rigorous model calibration present in this letter report demonstrates that the model can accurately simulate aquifer flow response to different hydraulic stresses. Future model improvements are expected to focus primarily on the three-dimensional representation of the dissolved solvent plumes with particular emphasis on concentrations near the plumes' fringes. These improvements are pending the collection of additional concentration data and the completion of comprehensive data analysis tools and GIS for the concentration data at SSC. Possible changes to the plumes' representation are not anticipated to substantially affect any long-term model transport predictions presented in this letter report.

1.3 Ground-water Modeling Objectives

There are two primary modeling objectives associated with estimating the long-term solute transport at SSC. The first objective is to estimate the time at which contaminant concentrations are below MCLs at the Point of Compliance (POC) wells for no action and for pumping followed by monitored natural attenuation. The second objective is to support a cost comparison of different remedial alternatives presented in the Final FFS/TS Report. Currently, the most reliable tool for these long-range predictions is the calibrated ground-water flow model presented to the RAB on June 3, 1999. It should be noted that these clean-up time's predictions will not be used to determine when the selected remedial alternative will be modified or discontinued. Any major decision associated with the operation of the selected remedial alternative will be based on results from chemical data from routine ground-water sampling.

2.0 CONSTRUCTION OF THE GROUND-WATER MODEL

2.1 Code Selection

The most widely used code for ground-water flow is MODFLOW (McDonald and Harbaugh, 1988). MODFLOW was developed for the USGS, who has made the source code available to the general public. Within the last several years, several MODFLOW-based codes have been developed to provide options to more accurately model flow and to model transport. Among these MODFLOW-based codes, MODFLOW-SURFACT (HydroGeoLogic, 1998) has the best set of options to simulate the ground-water flow and transport in heterogeneous aquifers. MODFLOW-SURFACT is currently being used by over 170 different consulting companies and universities and was selected for application at SSC. MODFLOW-SURFACT supports several options including an advanced well package and dual-media transport that makes it a good choice for use at SSC.

2.2 Model Domain and Discretization

Figure 2-1 shows the area covered by the ground-water flow model. The model covers approximately 3.6 mi^2 and includes the Evergreen Well field, the Springvale Well field, Fisk Pond, the Middle and South Ponds of Lake Cochituate. The model extends vertically from land surface to a constant elevation of -55 ft MSL. The average depth to bedrock across the site is approximately 150 ft. At an elevation of -55 ft MSL, approximately 90% of the model domain is bedrock.

Figure 2.2 shows the numerical mesh that represents the area shown in Figure 2.1. The model consists of nine vertical layers. The layers thicken with depth. Near the surface, the model layers are approximately 10 ft thick but at the base of the model, the model layers are approximately 50 ft thick. The model's horizontal grid is non-uniform with the most refined mesh occurring in the vicinity of SSC where grid cells are 50 ft x 50-ft squares. The model has a total of 139680 grid cells.

Within the model, the different aquifer properties can be assigned to different grid cells, but within a grid cells, the aquifer properties are constant. Hence, the smaller the grid spacing the more accurately aquifer heterogeneity can be represented. Within SSC area, the size of the grid cell was selected to match the resolution of the field data.

2.3 Numerical Representation of Hydraulic Boundaries

The general ground-water flow across the model domain follows the trends in the topography: ground-water is flowing from relatively high land surface elevation near the model's perimeter toward the surface water bodies at the lower elevations in the middle of the model. These surface water bodies are a major control on ground-water flow near SSC and they should be accurately represented by any ground-water model. All of the lakes in the model are represented by the river package developed by the USGS for their MODFLOW code. This package permits the free exchange of water between the lake and the aquifer deposits based on fundamental hydraulic principals.

The MODFLOW river package calculates the direction and magnitude of ground-water flow based on two parameters. The first parameter is the head difference between the lake and the ground water. The lake elevation is entered as a constant value. The ground water uses an iterative process to solve for the ground-water flow. The second parameter is the lake conductance, which is a measure of the capability of the lake sediments to transmit water. Lake conductance is a spatially variable property that depends on the thickness and textural properties of the lake sediments.

The inputs required to set up the MODFLOW river package were based on field data. The lake and pond surface water elevations were measured with gauges installed near the water's edge and from the lake's location on topographic maps. The lake conductances were estimated from lake sediment maps constructed by the USGS using geophysical surveys. These maps show the distribution and thickness of sand, silt, and peat.

Besides the ponds, another hydraulic boundary that influences ground-water flow to the north of SSC are the Springvale wells. The Springvale well field consists of several wells with screened sections that intersect different model layers. In a heterogeneous aquifer, the ground-water flow will not enter uniformly into the well screen but vary spatially based on the vertical variability in the aquifer properties around the well. Because the Springvale wells are close to Lake Chochituate, this variability has an impact on whether the source of pumped water is shallow lake water or deeper ground water.

In order to properly represent the vertical distribution of water at the Springvale and other wells, the MODFLOW-SURFACT fracture-well package was used. The fracture well package requires two inputs -- the total pumping rate and the well screen location. These input parameters were obtained from well construction specifications and daily pumping logs.

A primary source of all ground water at SSC is recharge. Recharge represents the amount of rainfall that reaches the ground water table. Recharge occurs only at the top model layer and only at those grid cells that represent land. For model calibration purposes, the land surface was divided into two recharge zones. One zone covered more than 90% of the model domain and represented the region where the recharge should be between 14 and 18 inches per year based on regional water-budget analyses. The other zone represented areas of low recharge where bedrock outcrops occur.

3.0 SITE GEOLOGY

3.1 Geologic History

The geology of the Natick region consists of glacial and post-glacial sedimentary deposits underlain by metamorphic and igneous bedrock of Precambrian to Early Paleozoic Age. During the Pleistocene, continental ice sheets covered New England, the last being the Wisconsin glaciation, approximately10,000 to 20,000 years ago. Evidence of glaciation can be found on bedrock outcrops to the east of SSC (Nelson, 1975).

The glacial deposits consist of unconsolidated sediments ranging from clay to boulder sized particles. Glacial sediments in this region were deposited during the recession of the Wisconsin Age Laurentine Ice Sheet, approximately 10,000 years ago. Glacial movement was generally in a south to southeast direction.

Surficial deposits in this area are generally the result of glacial lake depositional environments. Glacial Lake Charles was formed during the glacial recession when meltwaters were dammed by hills to the south, east, and west; and by the ice sheet to the north (Nelson, 1975)

3.2 Bedrock

The bedrock underlying the glacial sediments consists of metamorphic and igneous rock of Precambrian to Lower Paleozic origin. Based on previous investigations, the Dedham Granodiorite is the dominant rock type with gabbro and diabase also found in some areas. The Dedham Granodiorite is principally a light-gray to pinkish-gray, medium to coarse-grained rock ranging in composition from granite to quartz diorite (Nelson, 1975).

There are no bedrock outcrops at SSC. However, two outcrops are located to the northeast of SSC and one outcrop to the southeast of SSC. Analysis of these outcrops indicates that the bedrock surface dips steeply to the west-northwest (A.D. Little, 1994a). Previous well installations and a geophysical survey conducted in January 1995 at SSC (Weston, 1995) confirm that the bedrock surface dip is generally to the west-northwest.

Many sources of information were used to construct a bedrock surface map for the vicinity near SSC. Approximately 100 borelogs with recorded bedrock were culled from USGS open file reports (Gay, 1981), state-led investigations, and from SSC borelogs completed by ABB-ES and A.D. Little. These elevations were used in conjunction with the USGS geologic bedrock (Nelson 1975), a USGS areomagnetic survey (Nelson 1969), and geophysical data prepared by Weston Geophysical (1995) were used to assemble the bedrock elevation map shown in Figure 3-1. The bedrock surface shows several undulations and steep dips. A prominent feature is an apparent valley, which trends from north to south.

3.3 Unconsolidated Deposits

The unconsolidated deposits near Natick are generally the result of glacial lake depositional environments. Glacial Lake Charles was formed during the glacial recession when meltwaters were dammed by hills to the south, east, and west; and by the ice sheet to the north (Nelson, 1975). The glacial deposits of the study area are Wisconsin in age and are composed of outwash and till.

Outwash consists of stratified sands and gravel deposited by meltwater streams and deltas at the terminus of the glacier, or it may consist of layered clay and silt deposited in a glaciolacustrine setting beyond the terminus of the glacier. Glacial till is unstratified glacial drift deposited directly by the glacier without reworking by meltwater. It consists of a mixture of clay, silt, sand, gravel, and boulders ranging widely in size and shape. At Natick, the glacial till is of variable thickness over much of the bedrock (Nelson, 1975). In general, till thickness declines with increases in the bedrock surface elevation.

Within the model domain shown in Figure 2.1a, 138 borings have been located with written descriptions of their lithology. Because the borelogs, were extracted from several different sources, the borelog descriptions were inconsistent with respect to terminology. In order to help evaluate possible large-scale trends, the borelog descriptions were assigned to one of the five hydraulic conductivity (K) groups shown in Table 3-1. The placement of each description is based on the assumption that hydraulic conductivity increases with grain-size and with increased sorting.

Table 3-1
Grouping of Borelog Descriptions into five Hydraulic Conductivity Groups

VERY LOW K (6)	LOW K (7)	MEDIUM K (15)	HIGH K (4)	VERY HIGH K (3)
Low Plastic Clay	Organics, Low Plasticity	Coarse Clayey Sand	Poorly Graded Sand	Medium - Coarse Poorly Graded Sand
High Plastic Clay	Fine Clayey Sand	Fine Silty Sand	Medium Poorly Graded Sand	Coarse Poorly Graded Sand
Silty Clay	Fine To Medium Clayey Sand	Fine To Medium Silty Sand	Well Graded Gravel	Poorly Graded Gravel
Low Plastic Silt	Fine To Coarse Silty Sand	Medium Silty Sand	Silty Gravel	
High Plastic Silt	Fine - Medium Well Graded Sand	Medium To Coarse Silty Sand		
Clayey Silt	Fine - Coarse Well Graded Sand	Coarse Silty Sand		
	Well Graded Fine Sand	Silty Sand		
		Fine - Medium Poorly Graded Sand		
		Fine - Coarse Poorly Graded Sand		
		Fine Poorly Graded Sand		
		Medium Well Graded Sand		
		Medium - Coarse Well Graded Sand		
		Coarse Well Graded Sand		
		Well Graded Sand (Not Silty)		
		Clayey Gravel		

Figure 3-2 shows a plot of the borelog data based on the hydraulic-conductivity groups shown in Table 3-1. In Figure 3-2, all borings that did not reach bedrock have been artificially extended vertically to the top of the bedrock surface. Based on examining several different visualization of the borelog data, the following generalizations become evident:

- the aquifer deposits are highly heterogeneous

- non-uniform flow conditions likely exist because of the interbedding of low-K and high-K deposits within a matrix of moderate-K deposits

- the high-K deposits exist near the bedrock in the southern portions of SSC but exist near the ground-surface in the vicinity of the Springvale wells

- multiple layers of very low-K deposits are common in the mid to lower regions of the aquifer except for the northern region near the Springvale wells

- the low-K and moderate-K deposits are most prevalent at the central and southern portions of SSC

4.0 FLOW MODEL CALIBRATION

4.1 Calibration Process

Model calibration is the process by which model-input parameters are adjusted within specified constraints until an acceptable match is obtained between the measured and predicted water table. In order to expedite model calibration at SSC, HydroGeoLogic used an advanced and robust inverse modeling approach that permits a wide-range of soft and hard data to be quickly and efficiently incorporated into the model calibration process. The approach is based on data fusion technology and is described in detail by Porter et al., (1998).

Application data fusion involves three major steps. The first step is the careful evaluation of all site data and the subsequent generation of as many calibration targets, with a measurement of uncertainty, as possible. An example of a measurement of uncertainty is that all initial recharge rates were assigned and uncertainty of 10% of their initial values. The second step is to construct the set of instructions to inform the data fusion program how best to match every calibration target given consideration to the different levels of uncertainty among all of the calibration targets. The third step is to continually run the data-fusion model while periodically adjusting the calibration instruction to achieve the most reasonable fit to all of the site data.

The initial calibration for the SSC ground water flow model was based on the November 1996 water table measurements. This set of measurements was selected because they appear to represent the average long-term ambient (e.g. non-pumping) flow conditions at SSC and the set has the greatest number of individual measurements. To verify the model calibration, the model was used to simulate ambient conditions in March 1998, as well as Treatability Study pumping conditions in November 1998 at SSC.

4.2 Calibration Targets

4.2.1 Water Table Measurements

In November 1996, seventy-four water table measurements were taken in the vicinity of SSC. For the model calibration, these measurements were augmented with a set of water table measurements taken in the late 90's at 10 wells in the vicinity of the Clean Corp site. These 10 well measurements were given to HydroGeoLogic by MADEP. The uncertainty assigned the SSC and the MADEP water table measurements were 0.2.and 1.0 ft, respectively.

4.2.2 Hydraulic Conductivity Values

The most extensive data set available at SSC related to aquifer heterogeneity are the borelogs discussed in Section 3.3. In order to quantify the trends in the borelogs, a mean value of hydraulic conductivity was determined for each of the five hydraulic conductivity groups shown in Table 3-1. By performing a detailed multi-variate regressional analyses with the transmissivity values calculated from four pumping tests at SSC and the geologic description of the aquifer deposits at the pumping test locations, the results in Table 4-1 were obtained. Using the values in Table 4-1, the difference between the predicted and measured transmissivity values at the four pumping locations ranged from 5% to 13%.

Table 4-1
Mean K Values Assigned to the Hydraulic Conductivity-base Lithologic Units.

Lithologic Unit	Mean Hydraulic Conductivity (ft/day)
Very Low K	0.2
Low K	2
Moderate K	45
High K	124
Very High K	419

Using the values provided in Table 4-1, continuous borelog descriptions were translated into a continuous vertical profile of hydraulic conductivity values that was used to constrain the hydraulic conductivity values assigned to the model layers at the borelog locations. The total number of grid cells with conductivity constraints were 685. The average uncertainty for each of these constrained K values was a factor of 3.

4.2.3 Recharge Rates

ETA (1996) summarizes several approaches for estimating the average long-term recharge rate at Natick. These approaches support annual rates between 16 and 20 inches/year. For the model calibration, the initial recharge estimate was presumed to be 18 inches/year with an uncertainty of about 2 inches/year.

4.3 Model Calibration Results for November 1996

When model calibration occurred in Spring 1999, a total pumping rate of 1.4 MGD was assumed to have been pumped by Springvale wells SV-1, SV-3, and SV-4. In addition, the Evergreen Well field was assumed to have been pumping 1.8 MGD.

Using these assumed pumping rates, data fusion was able to produce a model that could provided good fits to all of the calibration targets using an average recharge rate of 17.5 inches/year across the model domain.

Figures 4-1 a and 4-lb show the simulated hydraulic head field for Model Layers 2 and 5 and calculated residuals. Residuals represent the differences obtained by subtracting the predicted values from the measured values. Model layers 2 and 5 are shown because the majority of the wells are screened within one of these two layers. (Layers 2 and 5 generally correspond to the A and B intervals of the aquifer at SSC, respectively.) The plots show good agreement and that vertical hydraulic gradients are significant at SSC. Table 4-2 provides a statistical summary of the matches to the hydraulic head data.

Table 4-2
Summary of Water Table Calibration Points
for the Ambient Conditions

	SSCOM Wells	MADEP Wells
Number Points	69	10
Maximum Head (ft)	141	173.4
Minimum Head (ft)	136	137.7
Range (ft)	5	35.7
RMS (ft)	0.35	0.85
Bias (ft)	-0.09	-1.03

As part of the model calibration, the percentage of ground-water and surface water that comprise the water pumped out of the Springvale Well Field was determine. This analysis indicated that approximately 55% of the pumped water originates from Lake Cochituate. Recent calculation by the USGS using isotope data have estimated that approximately 60% of the pumped water originates from Lake Cochituate. Thus, the model simulates accurate conditions very well.

Detailed plots of hydraulic conductivity are beyond the scope of this letter report and will be presented in a later report. A summary of the calibration results is provided in Table 4-3. During the model calibration process, the hydraulic conductivity of the bedrock was constrained to decrease with depth based on the assumption that fracture frequency decreases with depth as a result of increased consolidation.

Table 4-3
Calibration Results for the Hydraulic Conductivity Values

Bedrock	Layer 1 & 2	1.9 ft/day
	Layer 3 & 4	1.2 ft/day
	Layer 5 & 6	0.85 ft/day
	Layer 7, 8, & 9	0.25 ft/day
Unconsolidated Deposits	Number of Points	685
	Minimum K	0.2 ft/day
	Maximum K	419 ft/day
	RMS	Factor of 4

4.4 Model Verification

4.4.1 SSC Ambient Conditions for November 1996 and March 1998

During November 1999, HydroGeoLogic obtained the daily pumping logs for the Springvale wells and was able to determine that the pumping rate for November 1996 was approximately 2.2 MGD. Using this correct value for pumping for November 1996, the model produced nearly identical head contours within the SSC area but differences were observed in the hydraulic head contours between the northern SSC boundary and the Springvale wells. As one should expect, higher pumping rates at Springvale introduced a slightly more northernly component to groundwater flow between the Springvale wells and the north boundary for SSC.

In addition to simulating the November 1996 water table data with the relatively high pumping rate of 2.2 MGD at Springvale, another model simulation was run with the March 1998 water table data with the relatively low pumping rate of 1.2 MGD at Springvale. The March 1998 data is of interest because it has was taken at a time when Lake Cochituate was at nearly the same water level of 137.5 ft MSL as it was in November 1996 but the Springvale pumping rates are only 1.2 MGD. The SSC water table data indicates that the model should predict nearly identical water tables within SSC for November 1996 and March 1998 and it did. These results confirm that the Springvale wells have a minor impact on ground-water flow direction and magnitude within the SSC boundaries.

4.4.2 SSC Pumping Conditions for November 1998

In order to evaluate the robustness of the calibrated model, the November 1998 water table conditions were simulated by imposing a constant combined pumping rate of 70 gpm at the T-25 Area Extraction Wells MW-90B-4 and MW-15B. Analysis of the trends in the water suggested that the water table had reached a quasi-steady state with pumping from the two extraction wells, which had started pumping in late March 1998. The simulated hydraulic head field, as well as the residuals for Model Layers 2 and 5 are shown in Figure 4-2. Except for two head measurements within less than 20 feet of a pumping well, the model accurately simulated the general shape and magnitude of the cone-of-drawdown. A significant feature captured by the model is the extremely high vertical hydraulic gradients in the vicinity of the well. Comparison of the model simulated contours with the hand-drawn contours provided in ADL (Final FFS/TS Report, 1999) are very favorable and strongly suggest that the model is reliable and credible.

5.0 BASELINE TRANSPORT SIMULATIONS

5.1 Construction of Trichloroethylene and Perchloroethylene Plumes

The primary contaminants of concern in the T-25 Area at SSC are trichloroethylene (TCE) and perchloroethylene (PCE). In order to construct initial three-dimensional plume configurations for these two contaminants, two sets of information were used. The first set of information was data from standard, permanent monitoring wells. The second was Phase 1 and Phase 2 Field screening data. The screening data consisted of ground-water samples taken with GeoProbes, Microwells, Hydropunch, and Soil Samples. Although these samples were taken between 1993 and 1996, they were used to help guide the construction of a 1998 plume to provide good areal and vertical coverage. Table 5-1 summaries the trends in the screening data.

Table 5-1
Summary of the TCE and PCE Concentration Measurements
Associated with Phase 1 and Phase 2 Field Screening Data

Elevation (ft)	# of Points	Maximum (ppb)		Average (ppb)	
		PCE	TCE	PCE	TCE
135	54	18	2.5	1.5	0.1
125	42	20	14	2.6	1.2
115	45	61	250	2.6	19
105	54	86	1000	7.6	109
95	58	1000	1000	43	115
85	21	4	53	0.6	13
75	28	0	0	0	0

Among the significant trends in the field data is that the maximum contamination values occur between the elevations of 105 and 95 ft MSL (which corresponds to a portion of the B interval of the aquifer) and that there is good reason to believe that very little, if any contamination exists at elevations below 75 ft MSL including the bedrock in the vicinity of the T-25 Area. The initial distributions used in the model simulations were based on a three-dimensional interpolation of the ground-water monitoring data, Phase 1, and Phase 2 data. The initial estimates of mass associated with the TCE and PCE plumes are 55 and 23 kilograms, respectively.

5.2 Development of Transport Model

One of the reasons for using MODFLOW-SURFACT for transport is that it can simulate matrix diffusion. The primary reason that matrix diffusion occurs in heterogeneous aquifers like the one at Natick is that large variations in K values exist in the aquifer deposits and dissolved contaminants have been in the aquifer long enough to have diffused into the low permeable deposits. As explained in several RAB meetings and response to regulatory comments, matrix diffusion appears to be the most probable reasons for the observed rebound and tailing effect initially observed at the two extraction wells following a break in pumping.

To model matrix diffusion, a transport model needs to have a portion of each grid cell assigned to the high-K deposits and to the low-K deposits so it can track the contaminant mass in the two deposits separately. The model solves the standard ground-water solute transport equation for the high-K deposits but includes an additional term that accounts for mass transfer to or from the low-K deposits. The mass transfer coefficient is considered to be constant through the entire aquifer and can be determined by analyzing the measured rebound effects in pumping wells.

Based on the analysis of the borelog descriptions, 30% and 70% of the aquifer at Natick is assumed to comprised the low-K and high-K deposits within each grid cell. Adsorption is assumed to occur at the same rate throughout the aquifer and to be represented by a linear isotherm. The retardation factor for TCE and PCE were set to values of 2.3 and 4.8, respectively, base on an average fraction of organic content of 0.18% and a porosity of 30%. The justifications for these numbers have been presented at several meetings with regulators and will be documented in a later report.

5.3 Simulation of the First Year of Pumping

To evaluate the reliability of the model's transport's capability, the model was used to simulate the impact of pumping the two-well extraction during from January 1998 to January 1999. The pumping schedule for both wells in the model simulation included the periods of non-pumping. Simulated model concentrations for the two pumping wells and nine monitoring wells were compared to measured field values. Figures 5-1 and 5-2 provide the comparison for the pumping wells. The results were very favorable and matches of similar quality were obtained for most of the observation wells. These favorable matches suggested that the model is a reliable tool for meeting the modeling objectives.

6.0 SENSITIVITY ANALYSIS OF GROUND-WATER TRANSPORT AT THE T-25 AREA

6.1 Modeling Approach

Because changes in lake levels and pumping rates at the Springvale Well Field could impact ground-water transport at SSC, a sensitivity analyses was performed to evaluate whether these changes could impact the effectiveness of the selected remedial action a the T-25 Area. The approach for evaluating possible impacts consisted of two phases. The first phase involved collecting data on the historical trends for the parameters of interest. The second phase involved simulating model scenarios based on permutations for the high and low estimates of lake levels and of Springvale Well Field pumping rates.

6.1.1 Springvale Pumping Rates and Lake Levels

Based on the historical monitoring results for Lake Cochituate’s South Pond, the lake level remains nearly constant at 137.5 ft MSL. Lake level fluctuations at South Pond appear to vary over the narrow range 137 to 138 ft MSL. The model simulations for calibration and verification are based on a lake level of 137.5-ft MSL. Based on discussions with ADL and a review of historical lake levels, HydroGeoLogic determined that a conservative estimate of the low and high lake elevations would be 136.5 ft MSL and 138.5 ft MSL, respectively.

The calibrated model is based on a pumping rate of 2.2 MGD and has been verified with 1.2 MGD pumping rate at the Springvale Well Field. In November 1999, the City of Natick provided the Army with electronic data of the daily Springvale pumping records from January 1996 to October 1999. The electronic data was processed by HydroGeoLogic to produce the monthly values shown in Figure 6-1. The 1994 values in Figure 6-1 were extracted from a table in ETA (1996). Based on the values in Figure 6-1, HydroGeoLogic selected the pumping rates of 2.8 MGD, 1.7 MGD, and 1.0 MGD to represent high, average, and low pumping conditions at the Springvale Well Field.

6.1.2 Modeling Scenarios

The two modeling scenarios selected for the sensitivity analysis were the case of no action and the case of pumping wells MW-15B and MW-90B-44. Both scenarios were simulated for a 30-year period. For the case of active pumping, the two SSC extraction wells were pumped for the first 10 years and then were off-line for the next 20 years for all of the stimulations; lake levels and Springvale pumping rates remained constant at their initial values.

For the sensitivity analysis, not all of the permutations were considered among three pumping rates (e.g. high, average, and low), the three lake levels (e.g. high, average, and low), and two contaminant species (PCE and TCE). In order to help reduce the number of simulations but still capture the full range of variability among the possible results, permutations were considered only for the extreme values for the pumping rates and lake levels. For each contaminant and for both modeling scenarios, the following five model runs were made using:

- average pumping rate and average lake levels (baseline conditions)
- high pumping rates and high lake levels
- high pumping rates and low lake level
- low pumping rates and high lake levels
- low pumping rates and low lake levels

6.2 Modeling Results

At 90-days intervals throughout the 30-yr simulations, the model provided concentrations at well-screen locations for the Point of Compliance (POC) wells. Figure 6-2 shows the POC locations. At some POC wells, the well screen covers two model layers. For these POC wells, the model

If the POC well screens intersected two-model layer, the model provided concentrations values for all of the model layers intersected by the well screen. Table 6-1 shows the locations of the POC wells screens and the model layers that the well screens vertically intersect.

Table 6-1
Locations of the Well Screens for the Point of Compliance (POC) Wells

POC Well	Easting	Northing	Top of Screen (ft, MSL)	Bottom of Screen (ft, MSL)	Model Layer(s) Intersected by Well Screen
MW-18B-HP2	636364.0	470643.8	100.3	90.3	4,5
MW-37B-HP2	636229.9	470923.0	99.5	89.5	4
MW-83B-2	636395.5	470754.8	100.5	90.5	4
MW-88B-HP2	636094.9	470631.9	75.6	85.6	4,5
MW-27B-HP2	636353.9	471081.2	110.2	100.2	4,5
MW-38B-HP2	636085.8	470830.4	98.1	88.1	4,5
MW-201B	635828.0	471163.8	100.6	80.6	4,5
MW-202B	635656.4	471933.9	101.7	81.7	4,5
MW-205B	636396.3	471451.5	113.0	103.0	4,5

For each of the POC wells, a breakthrough curve of concentration versus time was generated for the model layers shown in Table 6-1. The total number of break-through curves produced was 320 (e.g. 20 simulations x 16 model layers in Table 6-1). Based on the model results, the times required for the ground water concentration to remain below MCL was estimated for each POC well. For those well screens that had concentrations calculated at two model layers, a average time and a uncertainty range (about the average time) was calculated. The uncertainty range reflects the difference between the times required to achieve MCLS in the model's two layers.

In each Figure, the simulation column provides the model run name used for identifying a particular set of model parameters. For instance, Run 1 in Figure 6-3 represents the model run for TCE, 1.7

MDG pumping, and a lake level of 137.5 ft MSL. The estimated time for concentrations at MW-18B-HP2 to reach below MCL is 20 years with an uncertainty of 8 years. Thus, the possible range of for MCL to be reached is between 12 and 28. One of the objectives of future simulations is to improve the modeling and anlaysis methodology so that the range of uncertainty will be reduced, if not eliminated.

Figures 6-4 and 6-5 summarizes the times for TCE and PCE concentrations to drop below MCLs at the POC wells for the case of no action and the case of 10 years of pumping wells MW-15B and MW-90B-44. The first row in every table represents results for average Springvale pumping rates and lake elevation. Results in rows 2 to 5 in every table represents results for changes in the Springvale pumping rates and lake elevations from their average conditions.

For some of the POC wells, there is a wide range in the reported mean times to reach MCLs. The reader should understand that large differences in mean times do not indicated large differences in predicted concentration values. Many of the concentration values asymptotically approach a lower concentration limit over time. Thus, because of the very low slope of the time-concentation curve a difference of only 1 to 3 ppb in predicted concentration can change the predicted time to reach an MCL by 5 to 10 years.

Results for the no action case show that the MCLs were not reached for the PCE and TCE concentrations at two and six wells, respectively, after 30 years. For the case involving 10 years of pumping for the baseline simulation involving average conditions, the maximum mean time for any well to reach MCLs for PCE and TCE concentrations was 5 and 24 years, respectively.

7.0 SUMMARY

A calibrated ground-water model was used to simulate the impact of different lake levels and different Springvale pumping rates on the time to achieve MCLs for TCE and PCE concentrations in the T-15 Area for two remediation options. The calibrated model is identical to the one presented to the Resident Advisory Board (RAB) on June 3, 1999 except for minor adjustments in the initial TCE distribution. The model was calibrated for ambient ground-water flow (no pumping at SSC) conditions and for pumping conditions at SSC with the lake level at 137.5-ft MSL.

Since the RAB meeting, a statistical analysis was performed on the pumping rates at the Springvale Well Field and the lake levels in Lake Cochituate's South Pond. These results indicate that: 1) conservative estimates of the low and high lake elevations are 136.5 ft MSL and 138.5 ft MSL, respectively; and, 2) the pumping rates of 2.8 MGD, 1.7 MGD, and 1.0 MGD represent high, average, and low pumping conditions at the Springvale Well Field. Model predictions of concentration values over time were predicted at Point of Compliance (POC) wells for two remediation scenarios for the following five conditions:

- average pumping rate and average lake levels (baseline conditions)
- high pumping rates and high lake levels
- high pumping rates and low lake level
- low pumping rates and high lake levels
- low pumping rates and low lake levels

The two-remediation scenarios consisted of a no action case and the case of pumping wells MW-15B and MW-90B-44 at a total rate of 70 gpm. Both scenarios were simulated for a 30-year period. For the case of active pumping, the two SSC extraction wells were pumped for the first 10 years and then were off-line for 20 years.

With regard to predicted TCE and PCE concentrations, changes in the environmental conditions had relatively minor impacts. However, because the concentrations values asymptotically approach a lower concentrations limit over time, a difference of only 1 to 3 ppb in concentration did impact clean-up times of up to 5 to 10 years. Although clean-up times exceeded 30 years for the no action case, no clean-up times exceeded 30 years for the pumping case.

For the baseline simulation involving average conditions, the model results show that MCLs were not reached after 30 years for PCE and TCE concentrations at two and six wells, respectively. For the baseline simulation involving average conditions and 10 years of pumping, the maximum mean time for any well to reach MCLs for PCE and TCE concentrations was 5 and 24 years, respectively.

Future improvements are planned for the ground-water model, as additional site characterization data becomes available. Thus, the model and its predictions should be considered as preliminary and subject to change. Rigorous model calibration present in this letter report demonstrates that the model can accurately simulate aquifer flow response to different hydraulic stresses. Future model improvements are expected to focus primarily on the three-dimensional representation of the dissolved solvent plumes with particular emphasis on concentrations near the plumes' fringes.

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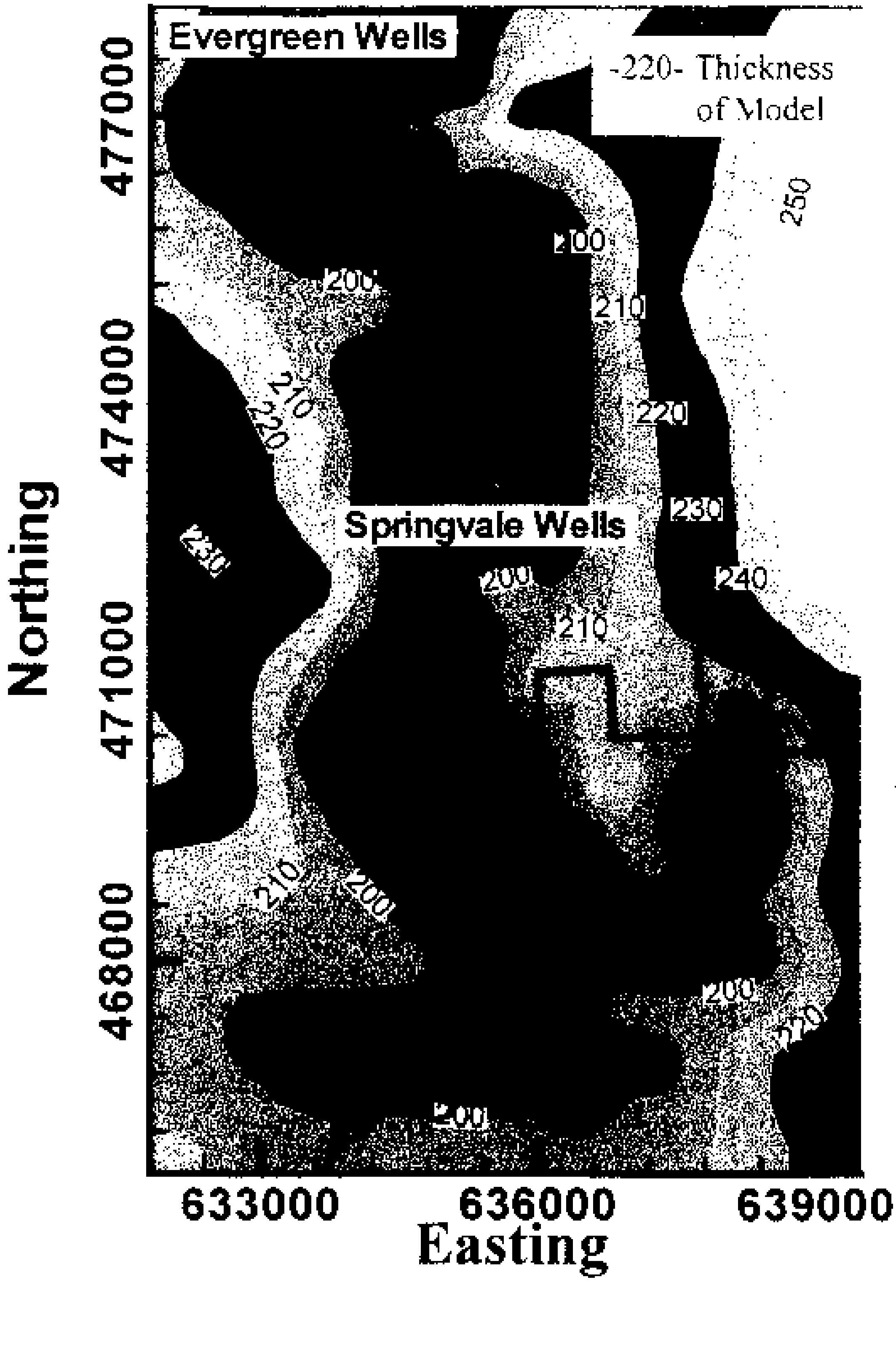


Figure 2-1 Ground Water Model Domain

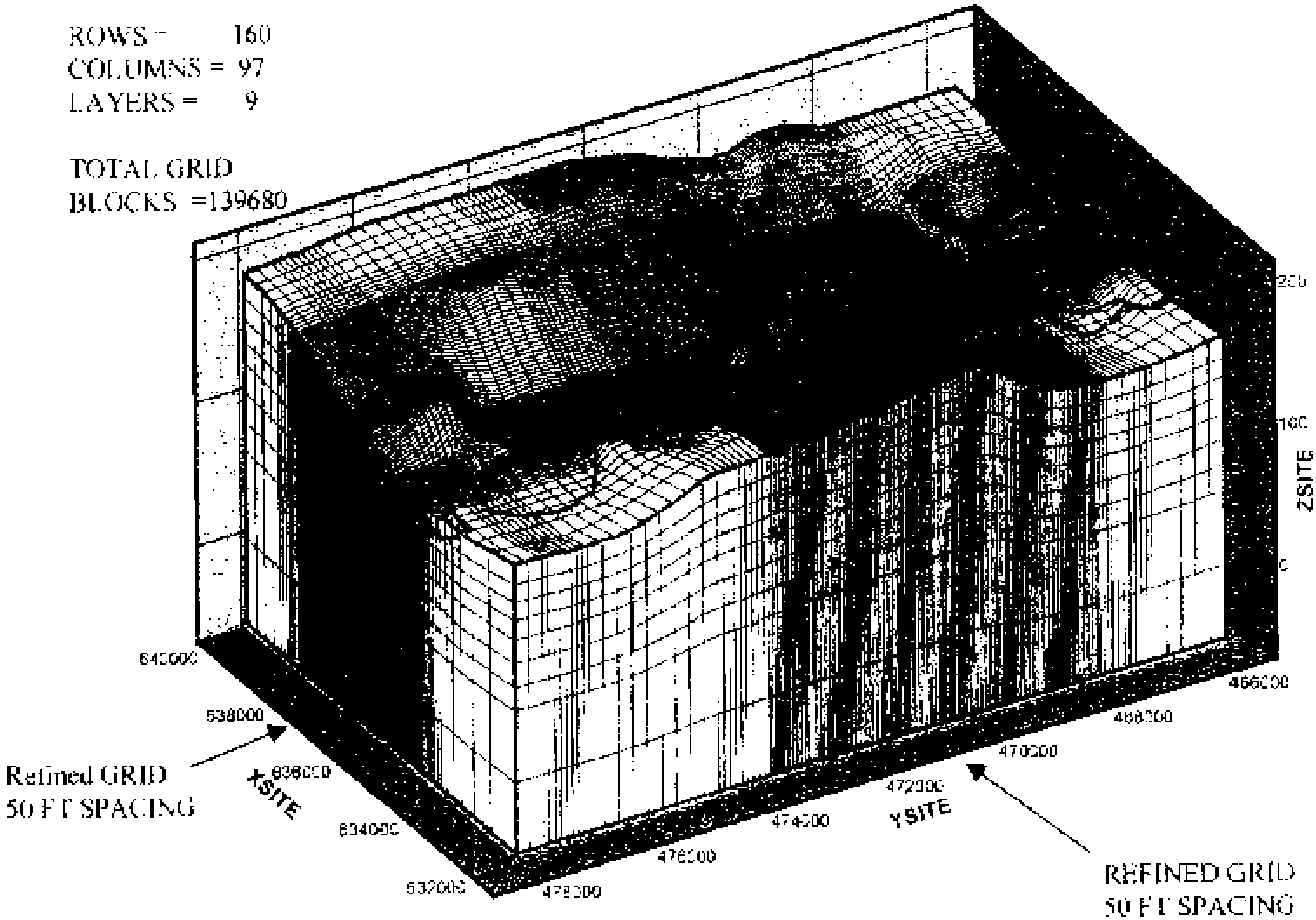


Figure 2.2 Numerical Grid Used to Represent the Ground-water System

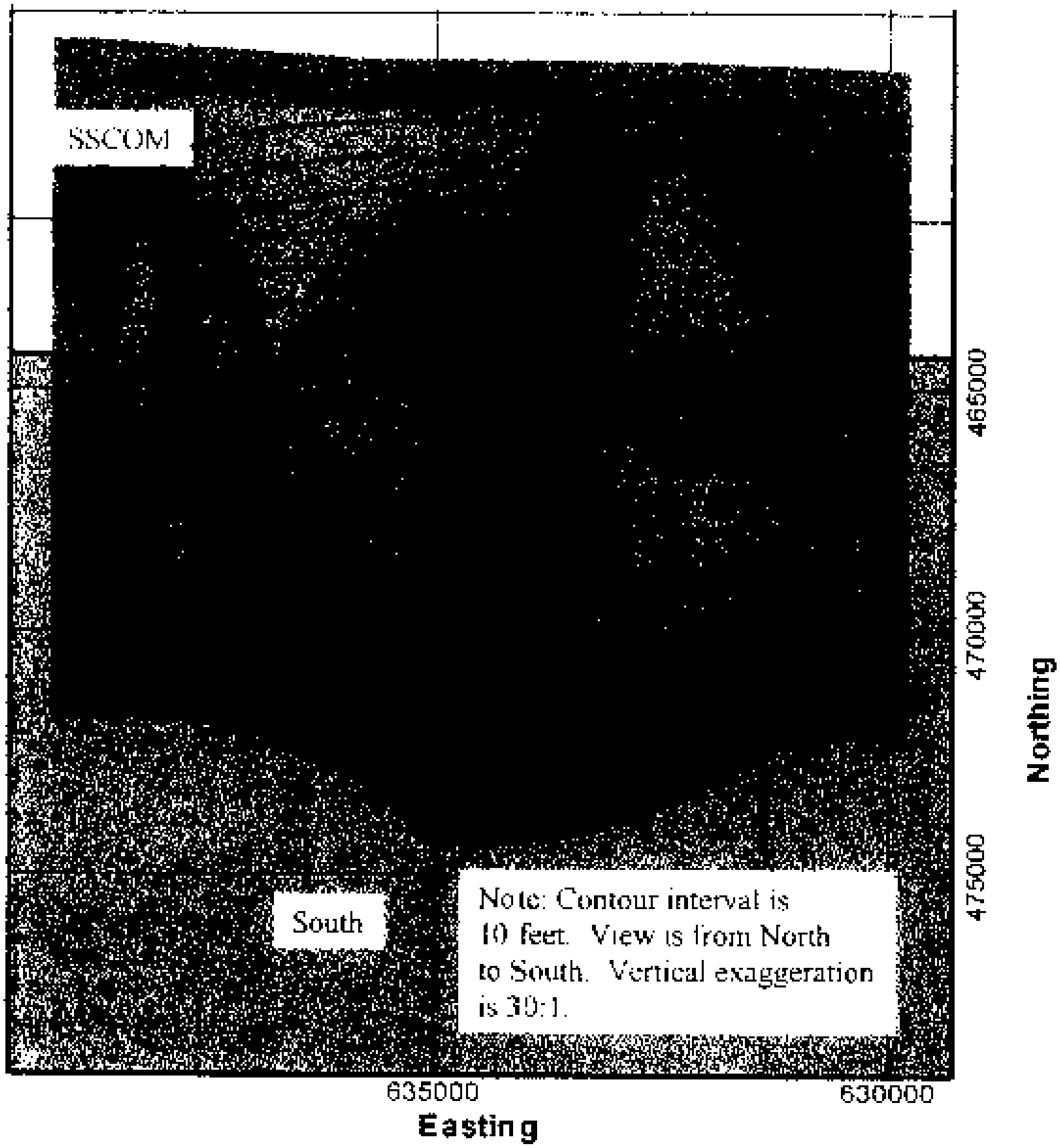


Figure 3-1 Relief Map of Top of Bedrock Elevations Across the Model Domain

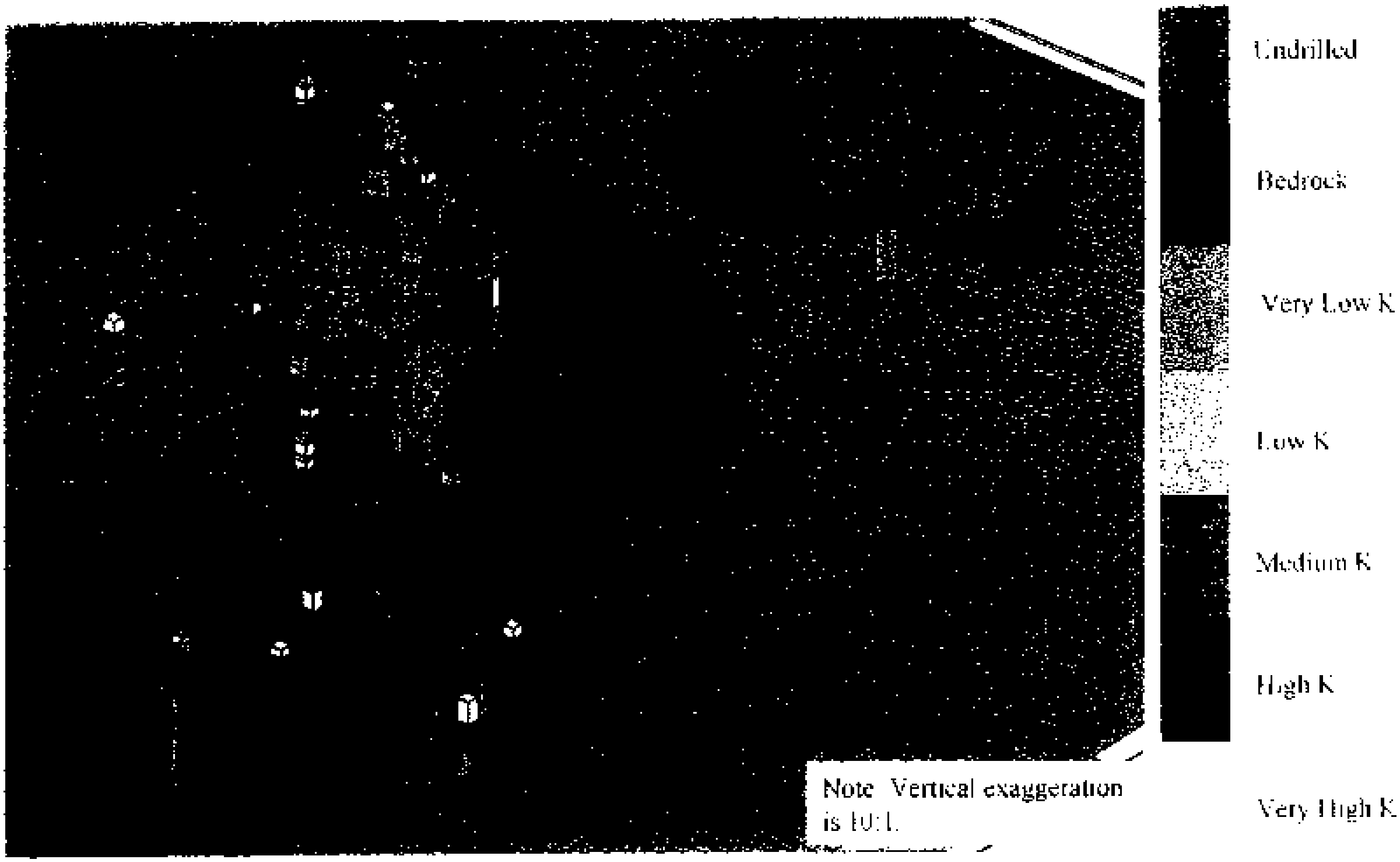


Figure 3.2 Illustration of Borelog Data in Terms of Hydraulic Conductivity Groups

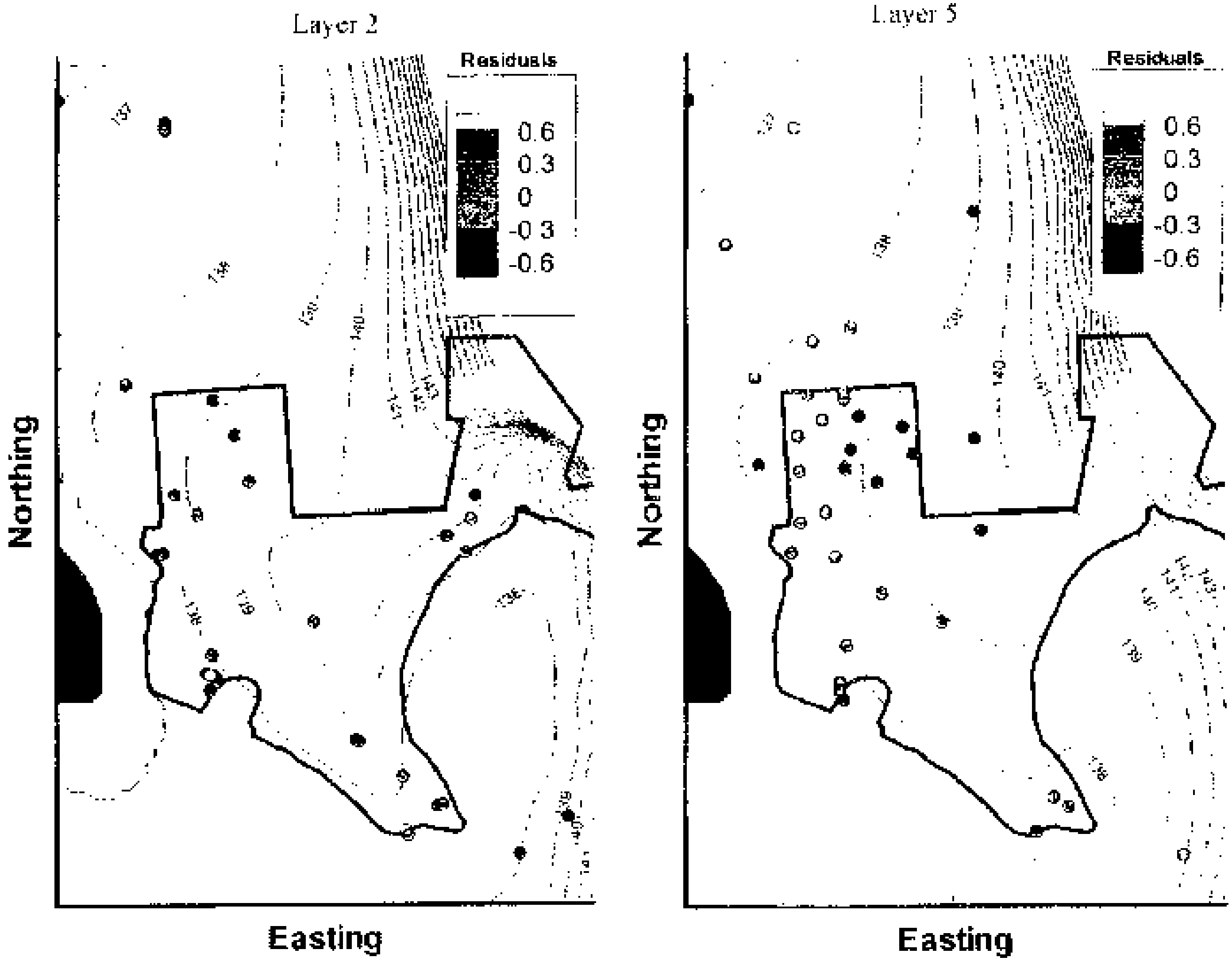


Figure 4-1   Hydraulic Head in Upper and Lower Aquifer During Ambient Conditions in November 1996

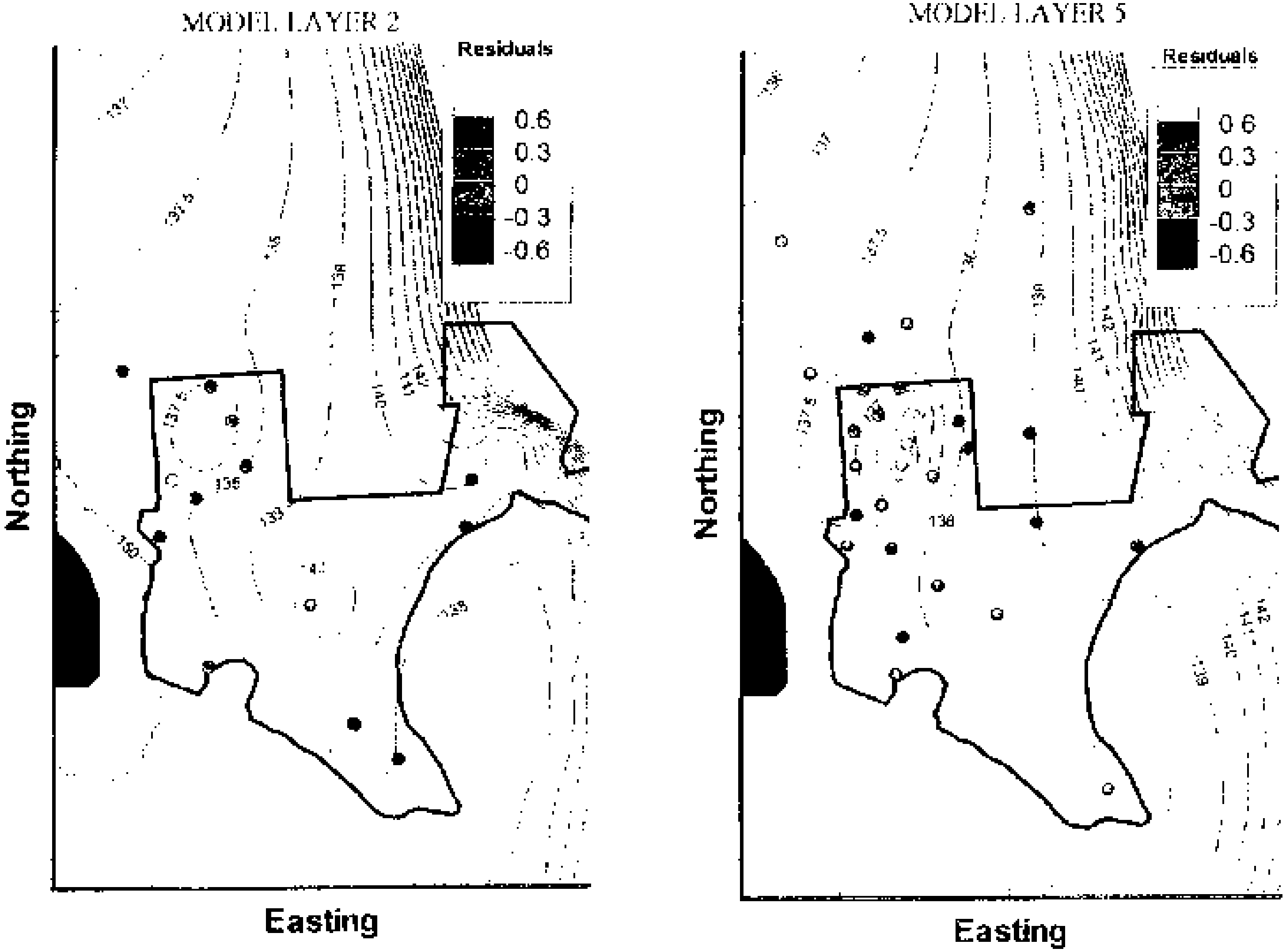


Figure 4-2 Hydraulic Head in Upper and Lower Aquifer During Pumping Conditions in November 1998

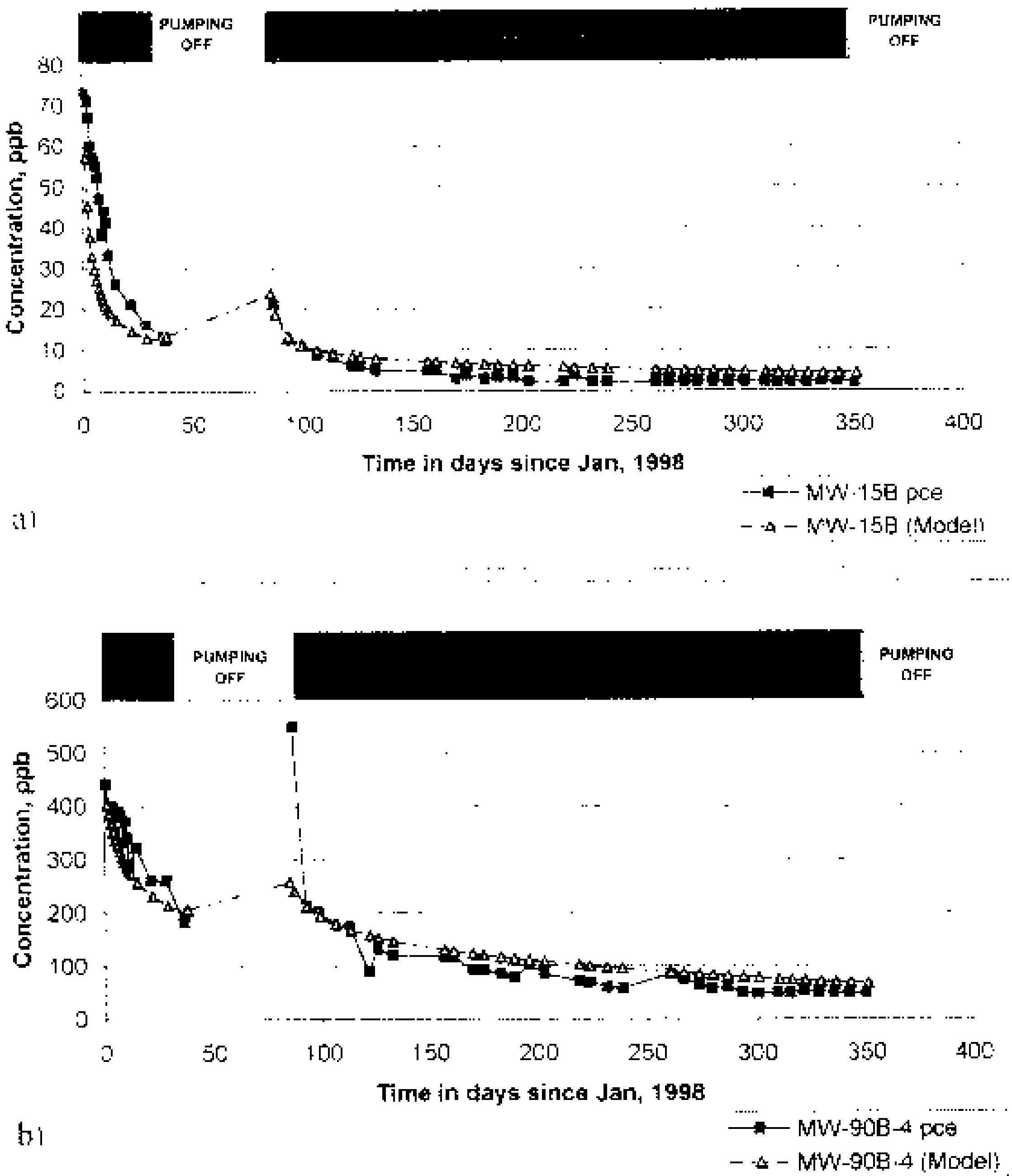
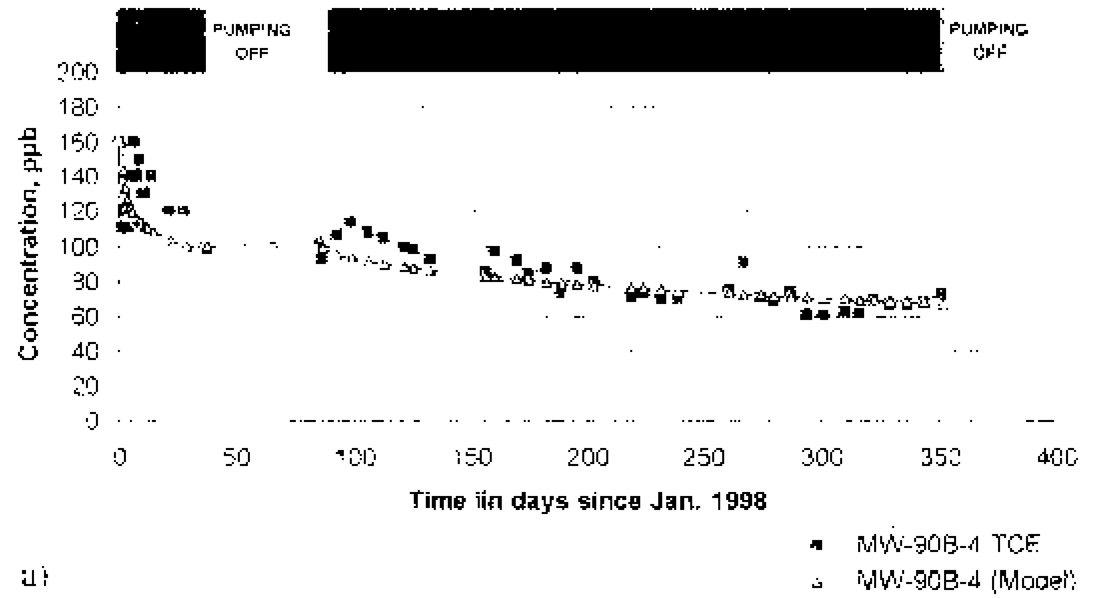


Figure 5-1 Comparison of Modeled and Measured PCE Concentrations at a) MW-15B and b) MW-90B-4



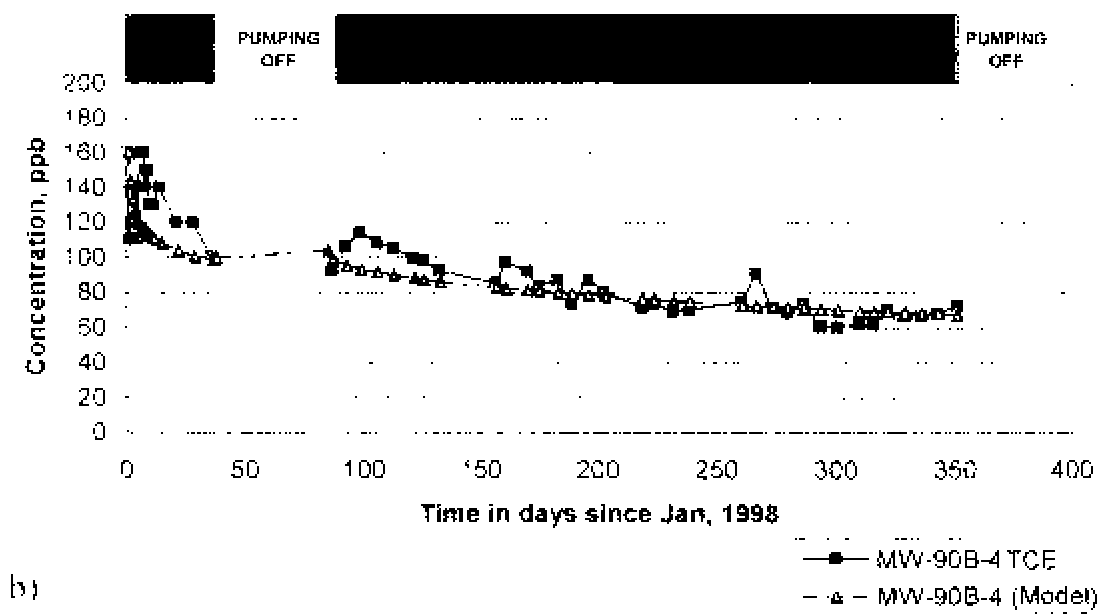


Figure 5-2 Comparison of Modeled and Measured TCE Concentratrions at a) MW-15B and b) MW-90B-4

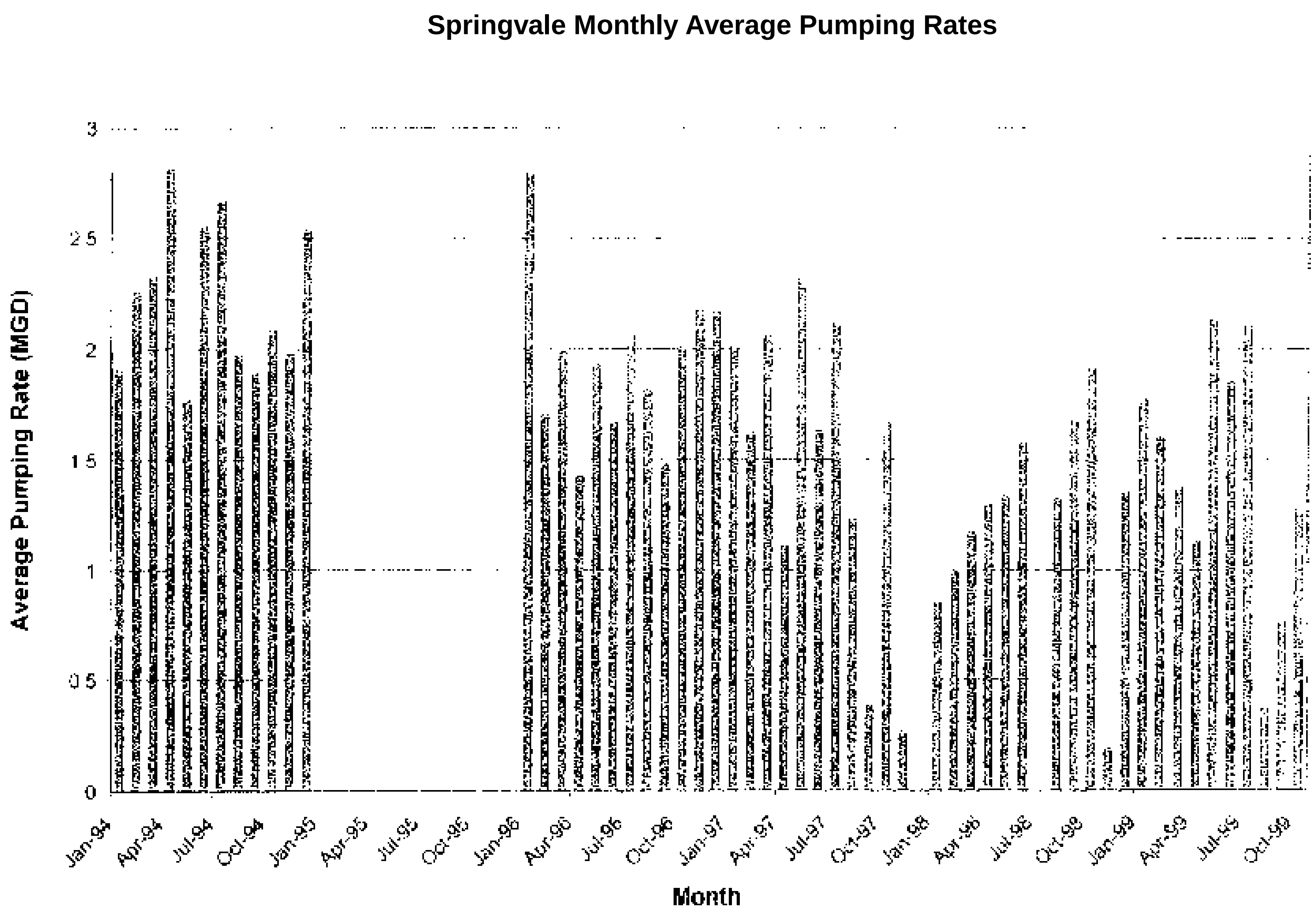


Figure 6-1 Monthly Average Pumping Rates for the Springvale Well Field for 1994 and 1996 to 1999

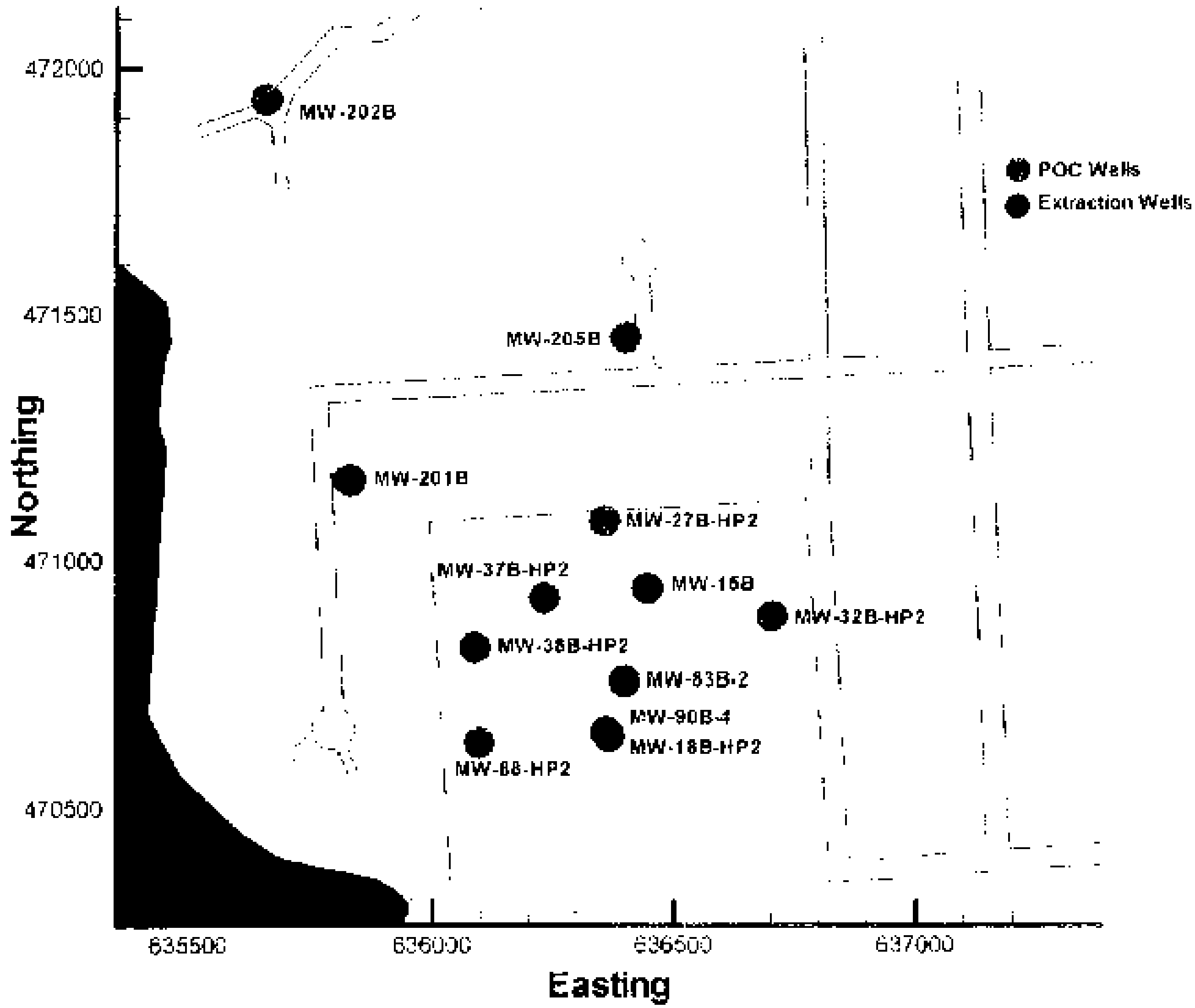


Figure 6-2 Location of Point of Compliance Wells in the T-25 Area

Simulation	Springval Well Pumping MGD	Average Lake Level (ft MSL)	Number of Years Required for PCE Concentration to Drop below MCL in POC wells (± Indicates a Uncertainty Range)								
			MW-18B-HP2 years	MW-37B-HP2 years	MW-83B-2 years	MW-88B-HP2 years	MW-27B-HP2 years	MW-38B-HP2 years	MW-201B years	MW-202B years	MW-205B years
Run 1	1.7	137.5	20 ± 8	>30	>30	9 ± 5	10 ± 5	16 ± 8	<1	<1	<1
Run 5	2.82	136.5	18 ± 8	>30	>30	12 ± 5	9 ± 4	15 ± 7	<1	<1	<1
Run 9	2.82	138.5	25 ± 8	25	>30	13 ± 5	<1	16 ± 8	<1	<1	<1
Run 13	1.13	138.5	18 ± 8	>30	>30	<1	<1	12 ± 5	<1	<1	<1
Run 17	1.13	136.5	>30	25	>30	<1	<1	16 ± 8	<1	<1	<1

Simulation	Springval Well Pumping MGD	Average Lake Level (ft MSL)	Number of Years Required for TCE Concentration to Drop below MCL in POC wells (± Indicates a Uncertainty Range)								
			MW-18B-HP2 years	MW-37B-HP2 years	MW-83B-2 years	MW-88B-HP2 years	MW-27B-HP2 years	MW-38B-HP2 years	MW-201B years	MW-202B years	MW-205B years
Run 2	1.7	137.5	>30	>30	>30	>30	>30	>30	12 ± 6	<1	<1
Run 6	2.82	136.5	>30	>30	>30	>30	>30	>30	14 ± 7	<1	<1
Run 10	2.82	138.5	>30	>30	>30	>30	>30	>30	18 ± 7	<1	<1
Run 14	1.13	138.5	>30	>30	>30	>30	>30	>30	12 ± 8	<1	<1
Run 18	1.13	136.5	>30	30	>30	25	25	>30	10 ± 6	<1	<1

Figure 6-3. Predicted Models Results for the Number of Years (along with Estimated Uncertainty) required for TCE and PCE Concentrations to Remain Below MCL at Point of Compliance Wells based on Different Values for Springvale Pumping and Lake Elevation for No Action

Simulation	Springval Well Pumping MGD	Average Lake Level (ft MSL)	Number of Years Required for PCE Concentration to Drop below MCL in POC wells (± Indicates a Uncertainty Range)								
			MW-18B-HP2 years	MW-37B-HP2 years	MW-83B-2 years	MW-88B-HP2 years	MW-27B-HP2 years	MW-38B-HP2 years	MW-201B years	MW-202B years	MW-205B years
Run 3	1.7	137.5	3 ± 1	<1	5 ± 2	<1	<1	<1	<1	<1	<1
Run 7	2.82	136.5	3 ± 1	<1	5 ± 3	<1	<1	<1	<1	<1	<1
Run 11	2.82	138.5	3 ± 1	<1	5 ± 2	<1	<1	<1	<1	<1	<1
Run 15	1.13	138.5	3 ± 1	<1	5 ± 2	<1	<1	<1	<1	<1	<1
Run 19	1.13	136.5	3 ± 1	<1	5 ± 2	<1	<1	<1	<1	<1	<1

Simulation	Springval Well Pumping MGD	Average Lake Level (ft MSL)	Number of Years Required for TCE Concentration to Drop below MCL in POC wells (± Indicates a Uncertainty Range)								
			MW-18B-HP2 years	MW-37B-HP2 years	MW-83B-2 years	MW-88B-HP2 years	MW-27B-HP2 years	MW-38B-HP2 years	MW-201B years	MW-202B years	MW-205B years
Run 4	1.7	137.5	17 ± 5	11.5	16 ± 6	22 ± 6	8 ± 3	24 ± 5	10 ± 5	<1	<1
Run 8	2.82	136.5	16.5 ± 5	14.0	18 ± 6	24 ± 6	9 ± 3	25 ± 4	<1	<1	<1
Run 12	2.82	138.5	17 ± 6	14.5	19 ± 6	23 ± 6	8 ± 3	22 ± 6	<1	<1	<1
Run 16	1.13	138.5	18 ± 6	11.0	15 ± 6	20 ± 3	7 ± 4	21 ± 6	11 ± 5	<1	<1
Run 20	1.13	136.5	18 ± 6	12.0	15 ± 6	19 ± 5	7 ± 5	23 ± 5	13 ± 5	<1	<1

Figure 6-4. Predicted Models Results for the Number of Years (along with Estimated Uncertainty) required for TCE and PCE Concentrations to Remain Below MCL at Point of Compliance Wells based on Different Values for Springvale Pumping and Lake Elevation for Pumping Ten Years Followed by Monitored Natural Attenuation.

Appendix E: Concurrence Letter from Massachusetts Department of Environmental Protection

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

ARGEO PAUL CELLUCCI
Governor

JANE SWIFT
Lieutenant Governor

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

December 29, 1999

Ms. Patricia Meaney, Director
Office of Site Remediation
U.S. EPA
JFK Federal Building
Boston, MA 02203

Re: State Concurrence with Record of Decision
Army Soldier Systems Command (Natick Lab)
T-25 Area Groundwater
Natick, MA

Dear Ms. Meaney:

The Department of Environmental Protection (the Department) has reviewed the selected remedy recommended by the U.S. Environmental Protection Agency (EPA) for the cleanup of the Army Soldier Systems Command (Natick Lab) T-25 Area Groundwater. The Department concurs with the selection of the remedy as presented in the Record of Decision.

The selected remedy addresses contamination of groundwater in the T-25 Area. The remedy will include the continued operation of an on-site groundwater extraction and treatment system; natural attenuation for groundwater in areas downgradient of the extraction wells; on-site and off-site groundwater monitoring to check the efficacy of the treatment system and to monitor natural attenuation; enforcement of institutional controls to restrict the use of groundwater for potable and non-potable use; and conveyance of supplemental funding for the operation and maintenance of the Town of Natick's Springvale Municipal Wellfield Treatment Facility.

EPA established the cleanup levels for groundwater by applying human health and ecological risk assessment methodologies, as well as state and federal standards. The selected remedy also meets applicable or relevant and appropriate state requirements for the selected remedy.

EPA will require that additional monitoring wells for shallow and deep groundwater monitoring will be installed as adjuncts to the existing groundwater monitoring system to improve its overall protectiveness, and as an added measure to assuage community concerns.

The Department looks forward to working with you in implementing the selected remedial alternative during the Remedial Design and Remedial Action process. If you have any questions regarding this letter, please contact Robert Campbell at 292-5732.

Very truly yours,

Deirdre C. Menoyo, Assistant Commissioner
Bureau of Waste Site Cleanup
Department of Environmental Protection

Copies to:

File RTN 3-2473
Anne Malewicz, MADEP
Jerome Keefe, EPA
Mary Sanderson, EPA
Elizabeth Mason, EPA
John McHugh, U.S. Army Soldier Systems Command

Appendix F: Cooperative Agreement Between the U.S. Army Soldier Systems Center and the Town of Natick

Modification P00002
to
Cooperative Agreement Number DAAD16-01-2-0003
between
The United States of America
Department of the Army
and
The Town of Natick, Massachusetts
Concerning: Remediation of Contaminated Groundwater at and near the Soldier Systems Center Facility in Natick Massachusetts

Agreement No:	DAAD16-01-2-0003
PR/ARPA Order No:	W13G0710749010
Total Amount of the Agreement:	$15,764,273.00
Government share:	$7,516,273.00
Recipient share:	$8,248,000.00
Authority:	10 U.S.C. § 2701(d)
Catalog of Federal Domestic Assistance number:	12-910

For the Town of Natick

Charles Hughes, Chair — Date: 8/20/01

Paul McKinley, Vice Chair — Date

Jeffrey Stern, Clerk — Date: 8/20/01

Jay Ball, Selectman — Date: 8/20/01

John Cicciariello, Selectman — Date: 8/20/01

For the United States of America
Department of the Army

Jerold J. Jeffrey
Grants Officer — Date: 01 AUG 21

1. Cooperative Agreement Number DAAD16-01-2-0003 between the Department of the Army and the Town of Natick Massachusetts, dated 28 March 2001 and modified August 9, 2001, is hereby modified as follows:

A. Delete Article 1, Scope (as previously amended by modification P00001 to this Agreement), in its entirety and replace with the following:

Article 1. Scope

A. BACKGROUND

This Cooperative Agreement reflects a joint commitment of the Department of the Army and the Town of Natick, Massachusetts to ensure the safety of the drinking water supply of the Town. The Town's Springvale aquifer is located partially beneath the Army's Soldier Systems Center (SSC), and 70% of the Town's drinking water is pumped from the aquifer at the Springvale well fields located .41 miles North-Northwest of the SSC facility's northern boundary. Although concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) at the Town's wells are below the Maximum Contaminant Limit (MCL) of five (5) parts per billion (PPB) for these two volatile organic compounds (VOCs), groundwater underneath the SSC facility was contaminated in concentrations as high as one thousand (1,000) PPB for these VOCs.

In 1992, the Town entered into a consent decree with the Commonwealth of Massachusetts to remove TCE and PCE from another well field located 1.1 miles from the SSC facility. The Town elected to install the treatment facility at its Springvale well field due to the relative size of the two fields and the potential that concentrations of contaminates at Springvale might rise above the MCL over time. The Town has incurred more than $4 million in capital costs associated with the construction of the Springvale Treatment Facility, and anticipates the expenditure of more than $6 million in operation and maintenance of the Springvale Treatment Facility during the life of this Agreement.

In 1993 and 1994, the Army first discovered, and then investigated, groundwater contamination at the SSC facility. In 1995, the facility was added to the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), principally as a result of the threat posed to the public water supply at the Springvale well field.

In 1997, in conjunction with the Army's Remedial Investigation/Feasibility Study under CERCLA, representatives of the Army and the Town first discussed the possibility of a coordinated action to optimize resources while providing the highest degree of protection to human health and the environment. Those initial discussions eventually included representatives of the Commonwealth of Massachusetts, the Environmental Protection Agency, and from a variety of internal organizations within the Department of the Army.

As a result of these discussions, the Army and Town are entering into this Cooperative Agreement. The coordinated action contemplated by this Cooperative Agreement has two principal benefits to the parties. The Town will recoup some past and future costs associated with the operation of the Springvale Treatment Facility without resort to costly litigation. The Army will reduce its environmental clean up costs by foregoing construction of the larger treatment facility originally contemplated in the Remedial Investigation. This results in a cost avoidance for the Army of approximately $3.500,000 (Capital costs saving - $2,000,000.00, total O&M cost saving - approximately $500,000, and additional site characterization cost avoidance - approximately $1,000,000).

In August of 1999, the Army proposed a Remedial Action involving the continued operation of the Army's pilot scale treatment plant. The Remedial Action was estimated to cost approximately $7,500,000 (On-site costs - $4,400,000 and Off-site payment - $3,100,000). The on-site costs include the past construction costs, future operation and maintenance of the treatment plant; periodic testing of the Springvale Aquifer; and other costs associated with remediation of the T-25 Site in accordance with the Record of Decision and Federal Facility Agreement. In addition, the Remedial Action includes the participation of the Town through operation of its Springvale Treatment Facility as well as the imposition of institutional controls by the Town to prohibit the installation of private drinking water wells within the vicinity of the SSC facility and the Springvale well field. The Town's participation accounts for the remaining $3,100,000 contemplated by the proposed Remedial Action Plan, implemented through this Cooperative Agreement.

The proposed plan was submitted for public comment and a public hearing was held in September of 1999. After completing the public comment process, a Record of Decision (ROD) for the T-25 Site selecting the proposed Remedial Action was forwarded to higher headquarters for approval in December of 1999. In addition, a Memorandum of Understanding was executed by representatives of the Army and the Town to pursue this coordinated Remedial Action upon approval of the ROD. The ROD for the T-25 Site has been conditionally approved by the Department of Army and will be executed by the Deputy Assistant Secretary of the Army, Environment, Safety and Health (DASA-ESH) after execution of this Cooperative Agreement by a warranted Grants Officer. Authority to enter into this agreement has been delegated by the Secretary of the Army pursuant to 10 U.S.C. § 2701(d).

B. RESPONSE ACTIONS

1. TOWN OF NATICK

The Town agrees to continue its operation of the Springvale Treatment Facility for the removal of PCE and TCE, and all breakdown compounds, at least until remediation of the T-25 Site is completed as evidenced by approval of the Army's Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the T-25 Site. Should the Army choose to operate its treatment facility to concurrently treat contaminated groundwater from areas of the SSC installation other than the T-25 Site, the Town's obligation to continue operation of the Springvale Treatment Facility will continue only until remediation of the T-25 Site is completed, as evidenced by approval of the Army's Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the T-25 Site.

Pursuant to a Memorandum of Understanding executed by the Parties to this Agreement in December of 1999, the Town's Board of Health has enacted a regulation to prohibit the development of any private drinking water wells within the Town in the area bounded by Evergreen Road to the north, State Route 27 and Washington Avenue to the east, State Route 135 to the south, and Speen Street to the west. The Town will ensure that such regulation will remain in effect at least until remediation of the T-25 Site is completed as evidenced by approval of the Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that such regulation is no longer required.

2. ARMY AND SOLDIER SYSTEMS CENTER

The Army will conduct continued source area containment of contaminated groundwater at the T-25 Site in accordance with the approved Record of Decision. Source area containment may be achieved through continued operation of the Army's pilot scale treatment plant or such other means as are acceptable to the Town and approved by EPA. The Army may use the pilot scale treatment plant or other means to treat contaminated groundwater from other areas of the SSC facility; provided however that the Army will not extend the period of obligation of the Town under this agreement or approved Record of Decision for the T-25 Site without the express written approval of the Town and EPA.

The Army will provide a one-time payment to the Town of $3,100,000.00 under this Cooperative Agreement, upon execution by the Secretary of the Army or designee of a Record of Decision regarding the selected remediation plan for the T-25 Site. This payment is conditioned upon the execution of a Record of Decision by the Secretary (or designee) and EPA adopting the continued operation of the current pilot treatment plant -- or other source area containment acceptable to the Town -- in conjunction with the Springvale Treatment Facility as the appropriate remedial action for the T-25 Site.

The $3,100,000 payment is provided to reimburse the Town for the past construction costs of the Springvale Treatment Facility and to provide a pro-rata share of the present value of the facility operation and maintenance costs (O&M) to address present and future VOC ground water contamination from the SSC facility. Costs associated with removal of compounds other than VOC ground water contamination from the SSC facility, or for subsequent improvements to the Springvale Treatment Facility to treat other compounds, are specifically excluded from this agreement.

C. MUTUAL COVENANTS AND REPRESENTATIONS

1. This Cooperative Agreement shall be binding among and between the respective Parties upon execution by each Party. The Parties agree to thereafter cooperate with each other to further the purposes and goals of this Agreement. Each Party will bear its own costs, except as otherwise stated in this Agreement.

2. This Cooperative Agreement is made without admission of fact, liability or wrongdoing on the part of any Party and is entered into as a compromise of disputed claims and to avoid the time and expense of litigation.

3. Nothing in this Cooperative Agreement shall be construed to create any rights in, or grant any cause of action to, any person not a party to this Agreement. The Parties expressly reserve any and all rights, defenses, claims, demands, and causes of action which they may have with respect to any matter, transaction, or occurrence relating in any way to the T-25 Site and Natick drinking water supply against any person not a Party hereto.

4. The Parties warrant and represent to each other that they have read this Cooperative Agreement, that each has had the benefit of advice and consultation with the counsel of their choosing with regard to the nature, force and effect of its terms, promises, and covenants, and that each understands this Agreement and that neither has been coerced nor placed under any duress in any manner.

5. The provisions contained herein constitute the entire agreement between the Parties and may only be modified in a writing executed by the authorized representatives of each Party.

6. The Parties agree that this Cooperative Agreement constitutes complete satisfaction of all costs associated with implementing the terms and conditions of this Agreement.

7. The Parties to this Agreement warrant and represent to each other that they are under no legal disability and have appropriate authority to execute this Agreement.

8. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same Agreement.

9. This Agreement shall be controlled, construed, and interpreted in accordance with the laws of the Commonwealth of Massachusetts.

10. This Agreement shall be binding upon and inure to the benefit of the undersigned Parties and their respective successors and legal representatives.

Modification P00001
to
Cooperative Agreement Number DAAD16-01-2-0003
between
The United States of America
Department of the Army
and
The Town of Natick, Massachusetts
Concerning: Remediation of Contaminated Groundwater at and near the Soldier Systems Center Facility in Natick Massachusetts

Agreement No:	DAAD16-01-2-0003
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Total Amount of the Agreement:	$15,764,273.00
Government share:	$7,516,273.00
Recipient share:	$8,248,000.00
Authority:	10 U.S.C. § 2701(d)
Catalog of Federal Domestic Assistance number:	12-910

For the Town of Natick

Charles Hughes, Chair — Date

Paul McKinley, Vice Chair — Date: 6 August 2001

Jeffrey Stern, Clerk — Date: 8/6/01

Jay Ball, Selectman — Date: 8/6/01

John Cicciariello, Selectman — Date: 8/6/2001

For the United States of America Department of the Army

Jerold J. Jeffrey
Grants Officer — Date: 8/9/01

1. Cooperative Agreement Number DAAD16-01-2-0003 between the Department of the Army and the Town of Natick Massachusetts, dated 28 March 2001, is hereby modified as follows:

A. Delete Article 1, Scope, in its entirety and replace with the following:

Article 1. Scope

A. BACKGROUND

This Cooperative Agreement reflects a joint commitment of the Department of the Army and the Town of Natick, Massachusetts to ensure the safety of the drinking water supply of the Town. The Town's Springvale aquifer is located partially beneath the Army's Soldier Systems Center (SSC), and 70% of the Town's drinking water is pumped from the aquifer at the Springvale well fields located .41 miles North-Northwest of the SSC facility's northern boundary. Although concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) at the Town's wells are below the Maximum Contaminant Limit (MCL) of five (5) parts per billion (PPB) for these two volatile organic compounds (VOCs), groundwater underneath the SSC facility was contaminated in concentrations as high as one thousand (1,000) PPB for these VOCs.

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In 1997, in conjunction with the Army's Remedial Investigation/Feasibility Study under CERCLA, representatives of the Army and the Town first discussed the possibility of a coordinated action to optimize resources while providing the highest degree of protection to human health and the environment. Those initial discussions eventually included representatives of the Commonwealth of Massachusetts, the Environmental Protection Agency, and from a variety of internal organizations within the Department of the Army.

As a result of these discussions, the Army and Town are entering into this Cooperative Agreement. The coordinated action contemplated by this Cooperative Agreement has two principal benefits to the parties. The Town will recoup some past and future costs associated with the operation of the Springvale Treatment Facility without resort to costly litigation. The Army will reduce its environmental clean up costs by foregoing construction of the larger treatment facility originally contemplated in the Remedial Investigation. This results in a cost avoidance for the Army of approximately $3.500,000. (Capital costs saving - $2,000,000.00, total O&M cost saving - approximately $500,000, and additional site characterization cost avoidance - approximately $1,000,000).

In August of 1999, the Army proposed a Remedial Action involving the continued operation of the Army's pilot scale treatment plant. The Remedial Action was estimated to cost approximately $7,500,000 (On-site costs - $4,400,000 and Off-site payment - $3,100,000). The on-site costs include the past construction costs, future operation and maintenance of the treatment plant; periodic testing of the Springvale Aquifer; and other costs associated with remediation of the T-25 Site in accordance with the Record of Decision and Federal Facility Agreement. In addition, the Remedial Action includes the participation of the Town through operation of its Springvale Treatment Facility as well as the imposition of institutional controls by the Town to prohibit the installation of private drinking water wells within the vicinity of the SSC facility and the Springvale well field. The Town's participation accounts for the remaining $3,100,000 contemplated by the proposed Remedial Action Plan, implemented through this Cooperative Agreement.

The proposed plan was submitted for public comment and a public hearing was held in September of 1999. After completing the public comment process, a Record of Decision (ROD) for the T-25 Site selecting the proposed Remedial Action was forwarded to higher headquarters for approval in December of 1999. In addition, a Memorandum of Understanding was executed by representatives of the Army and the Town to pursue this coordinated Remedial Action upon approval of the ROD. The ROD for the T-25 Site has been conditionally approved by the Department of Army and will be executed by the Deputy Assistant Secretary of the Army, Environment, Safety and Health (DASA-ESH) after execution of this Cooperative Agreement by a warranted Grants Officer. Authority to enter into this agreement has been delegated by the Secretary of the Army pursuant to 10 U.S.C. § 2701(d).

B. RESPONSE ACTIONS

1. TOWN OF NATICK

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2, This Cooperative Agreement is made without admission of fact, liability or wrongdoing on the part of any Party and is entered into as a compromise of disputed claims and to avoid the time and expense of litigation.

3. Nothing in this Cooperative Agreement shall be construed to create any rights in, or grant any cause of action to, any person not a party to this Agreement. The Parties expressly reserve any and all rights, defenses, claims, demands, and causes of action which they may have with respect to any matter, transaction, or occurrence relating in any way to the T-25 Site and Natick drinking water supply against any person not a Party hereto.

4. The Parties hereby agree to waive, upon fulfillment of all single and mutual obligations, any right to contribution from each other under CERCLA § 113(f)(1) to which the Parties might otherwise be entitled under CERCLA §§ 106 and 107(a) for recoverable costs and damages associated with the T-25 Site.

5. The Parties warrant and represent to each other that they have read this Cooperative Agreement, that each has had the benefit of advice and consultation with the counsel of their choosing with regard to the nature, force and effect of its terms, promises, and covenants, and that each understands this Agreement and that neither has been coerced nor placed under any duress in any manner.

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Catalog of Federal Domestic Assistance number:	12-910

For the Town of Natick

For the United States of America
Department of the Army

Jay Ball, Chair — Date: 3/23/01

Jerold J. Jeffrey, Grants Officer — Date: 01 MAR 28

Paul McKinley, Selectman — Date

Edward Carr, Selectman — Date: 3/22/01

Charles Hughes, Selectman — Date: 3/23/01

Mel Willens, Selectman — Date: 3/23/01

Table of Contents

PART I. SCOPE OF THE AGREEMENT

Article 1. Scope

A. BACKGROUND

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B. RESPONSE ACTIONS

1. TOWN OF NATICK

The Town agrees to continue its operation of the Springvale Treatment Facility for the removal of PCE and TCE, and all breakdown compounds, at least until remediation of the T-25 Site is completed as evidenced by approval of the Army's Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the T-25 Site. Should the Army choose to operate its treatment facility to concurrently treat contaminated groundwater from areas of the SSC installation other than the T-25 Site, the Town's obligation to continue operation of the Springvale Treatment Facility will continue only until remediation of the T-25 Site is completed, as evidenced by approval of the Army's Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the T-25 Site.

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Upon fulfillment of all Army obligations under this Cooperative Agreement, the Town hereby covenants not to sue, and to release the Army, as well as individual members of the uniformed service and its civilian employees, agents or assigns, for all liability, suits, formal claims, or causes of actions of any sort arising out of contamination or alleged contamination of the Natick municipal well fields by PCE, TCE, or breakdown compounds arising from or related to the T-25 Site, or resulting from actual or alleged errors in any design or construction of the Springvale Treatment Facility.

Upon fulfillment of all Army obligations and covenants, the Town waives and releases the Army from any and all claims the Town may have for past and future response costs incurred or to be incurred and claims for response costs and damages related to PCE, TCE, or breakdown compounds in Town drinking water supplies arising from or related to the T-25 Site.

2. ARMY AND SOLDIER SYSTEMS CENTER

The Army will conduct continued source area containment of contaminated groundwater at the T-25 Site in accordance with the approved Record of Decision. Source area containment may be achieved through continued operation of the Army's pilot scale treatment plant or such other means as are acceptable to the Town and approved by EPA. The Army may use the pilot scale treatment plant or other means to treat contaminated groundwater from other areas of the SSC facility; provided however that the Army will not extend the period of obligation of the Town under this agreement or approved Record of Decision for the T-25 Site without the express written approval of the Town and EPA.

The Army will provide a one-time payment to the Town of $3,100,000.00 under this Cooperative Agreement, upon execution by the Secretary of the Army or designee of a Record of Decision regarding the selected remediation plan for the T-25 Site. This payment is conditioned upon the execution of a Record of Decision by the Secretary (or designee) and EPA adopting the continued operation of the current pilot treatment plant - - or other source area containment acceptable to the Town – in conjunction with the Springvale Treatment Facility as the appropriate remedial action for the T-25 Site.

The $3,100,000 payment is provided to reimburse the Town for the past construction costs of the Springvale Treatment Facility and to provide a pro-rata share of the present value of the facility operation and maintenance costs (O&M) to address present and fixture VOC ground water contamination from the SSC facility. Costs associated with removal of compounds other than VOC ground water contamination from the SSC facility, or for subsequent improvements to the Springvale Treatment Facility to treat other compounds, are specifically excluded from this agreement.

Upon fulfillment of all Town obligations and covenants, the Army hereby covenants not to sue, and to release the Town, its employees, agents or assigns, for all liability, suits, formal claims, or causes of actions of any sort arising out of contamination or alleged contamination of the Natick municipal well fields by PCE, TCE, or breakdown compounds, or resulting from actual or alleged errors in any design or construction of the Springvale Treatment Facility.

Upon fulfillment of all Town obligations and covenants, the Army waives and releases the Town from any and all claims the Army may have for past and future response costs incurred or to be incurred and claims for response costs and damages related to PCE, TCE, or breakdown compounds in Town drinking water supplies.

C. MUTUAL COVENANTS AND REPRESENTATIONS

1. This Cooperative Agreement shall be binding among and between the respective Parties upon execution by each Party. The Parties agree to thereafter cooperate with each other to further the purposes and goals of this Agreement. Each Party will bear its own costs, except as otherwise stated in this Agreement.

2. This Cooperative Agreement is made without admission of fact, liability or wrongdoing on the part of any Party and is entered into as a compromise of disputed claims and to avoid the time and expense of litigation.

3. Nothing in this Cooperative Agreement shall be construed to create any rights in, or grant any cause of action to, any person not a party to this Agreement. The Parties expressly reserve any and all rights, defenses, claims, demands, and causes of action which they may have with respect to any matter, transaction, or occurrence relating in any way to the T-25 Site and Natick drinking water supply against any person not a Party hereto.

4. The Parties hereby agree to waive, upon fulfillment of all single and mutual obligations, any right to contribution from each other under CERCLA § 113(f)(1) to which the Parties might otherwise be entitled under CERCLA §§ 106 and 107(a) for recoverable costs and damages associated with the T-25 Site.

5. The Parties warrant and represent to each other that they have read this Cooperative Agreement, that each has had the benefit of advice and consultation with the counsel of their choosing with regard to the nature, force and effect of its terms, promises, and covenants, and that each understands this Agreement and that neither has been coerced nor placed under any duress in any manner.

6. The provisions contained herein constitute the entire agreement between the Parties and may only be modified in a writing executed by the authorized representatives of each Party.

7. The Parties agree that this Cooperative Agreement constitutes complete satisfaction of all costs associated with implementing the terms and conditions of this Agreement.

8. The Parties to this Agreement warrant and represent to each other that they are under no legal disability and have appropriate authority to execute this Agreement.

9. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same Agreement.

10. This Agreement shall be controlled, construed, and interpreted in accordance with the laws of the Commonwealth of Massachusetts.

11. This Agreement shall be binding upon and inure to the benefit of the undersigned Parties and their respective successors and legal representatives.

PART II. ADMINISTRATIVE INFORMATION

Article 2. Definitions

The term “Parties” as used herein shall refer to the Town of Natick, Massachusetts and the United States of America, hereinafter called the Government, represented by the Department of the Army.

The term “Agreement” as used herein shall be defined as the articles in this cooperative agreement and its attachments.

The term “Recipient” as used herein shall be defined as the Town of Natick, Massachusetts.

The term “T-25 Site” as used herein shall be defined as the area within the Soldier Systems Center commonly known as the ‘T-25 Area,’ a 15.6 acre rectangular area in the northwestern portion of the SSC facility more fully described in the T-25 Area Ground Water Record of Decision and Phase II Remedial Investigation Report, pp. 1-2 through 1-19.

The term “Performance Year” as used herein shall refer to each consecutive twelve month period from the effective date of this agreement throughout the term of the agreement.

Article 3. Administrative Requirements

A. This agreement will be administered in accordance with, and recipients shall comply with the requirements of the following, which are incorporated herein by reference:

- OMB Circular A-87, Cost Principles for State and Local Governments;

- OMB Circular A-133, Audits of States, Local Governments, and Non-Profit Organizations;

- and DoD 3210.6-R, the DoD Grant and Agreement Regulations (DODGARs), 32 CFR Chapter 1, Subchapter B.

B. The following shall be the order of precedence, in descending order, in the event of a conflict:

1. The governing directives listed in paragraph A. above;
2. The articles in this agreement;
3. The attachments to this agreement.

Article 4. Administrative Responsibilities

Grants Officer:	Jerold J. Jeffrey U.S. Army Robert Morris Acquisition Center Natick Contracting Division Natick, MA 01760-5011
Grants Administration Office:	Department Of The Army U.S. Army Robert Morris Acquisition Center Natick Contracting Division Natick, Ma 01760-5011
Project Officer:	John McHugh Remediation Program Manager U. S. Army Natick Soldier Center Natick, MA 01760-5018 John.McHugh@natick.army.mil

Payment Office:	DFAS-SL-FPV Vendor Pay Blanch P.O. Box 200009, Bldg 110 St.Louis, MO 63120-0009
Remittance Address:	Town of Natick Attn: Paul Cohen, Acting Town Administrator 13 East Central Street Natick, MA 01760
Servicing Chief Counsel's office(for invention reporting):	U.S. Army SBCCOM Office of Chief Counsel Attn: V. Ranucci Kansas St. Natick, MA 01760
Recipient's Grants Officer:	Paul Cohen Acting Town Administrator Town of Natick 13 East Central Street Natick, MA 01760

Article 5. Period of Performance

This agreement shall remain in effect at least until remediation of the T-25 Site is completed as evidenced by approval of the Army's Remedial Action Completion Report by EPA; or alternatively, the Army and the Town agree that operation of the Springvale Treatment Facility is no longer needed as part of the Army's remediation of the T-25 Site.

PART III. FINANCIAL MATTERS

Article 6. Allotted Funding

The following funds are allotted to this agreement:

Fund Cite(s)	Amount
2112020000016N6N10493008140004150000000 W13G071074901013K14AS19130NZP000	$3,100,000.00

Article 7. Payment

A lump-sum payment will be made to the Recipient upon execution of the Record of Decision for the T-25 Site. The Recipient shall request payment by submitting a Request for Advance or Reimbursement (Standard Form 270). The original and two copies of the request shall be submitted to the Grants Administration Office listed in Article 4 above.

Article 8. Cost Sharing and Matching

A. Recipient's contributions may count as cost sharing or matching only to the extent that they are used for authorized purposes of the agreement, and such purposes are consistent with applicable cost principles. Failure of either party to provide its contribution as scheduled may result in a unilateral amendment to the agreement by the Grants Officer to reflect a proportional reduction in funding for the other party.

B. The parties to this agreement agree to cost share or match as follows:

Government Share	Recipient Share
Cash $3,100,000.00 In-kind $4,416,273.00* * $372,972 capital costs (existing treatment plant) plus $4,043,301 in ongoing O&M cost	Cash $0.00 In-kind $8,248,000.00* * $4,700,000.00 capital costs plus $6,648,00.00 O&M cost, minus $3,100,000.00 contribution from the Army
Total $7,516,273.00	Total $8,248,000.00

Article 9. Closeout Adjustments

The Government may make a downward adjustment to the Government funding amount after completion of the effort under an agreement, when appropriate in accordance with OMB A-87.

PART IV. INTELLECTUAL PROPERTY RIGHTS

Article 10. Inventions

A. The clause entitled "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms," (37 CFR 401) is hereby incorporated by reference and the clauses in paragraph 401.14 are modified as follows: replace the word "contractor" with "Recipient"; replace the words "agency," "Federal Agency" and "funding Federal Agency" with "government"; replace the word "contract" with "agreement"; delete paragraphs (g)(2), (g)(3) and the words "to be performed by a small business firm or domestic nonprofit organization" from paragraph (g)(1); paragraph (1), Communications, point of contact on matters relating to this clause will be the servicing Chief Counsel's office identified elsewhere in this agreement.

B. The Recipient shall file a single Invention (Patent) Report at the end of the term for this Agreement. The report is due 60 days after the expiration of the final performance period. The Recipient shall use DD Form 882, Report of Inventions and Subcontracts, to file an invention report. Negative reports are not required. The Recipient shall submit the original and one copy to the servicing Chief Counsel's office and one copy to the grants officer.

C. This Agreement cannot be closed out until the recipient delivers to the Government all disclosures of subject inventions required by this agreement, an acceptable final report pursuant to the article entitled *"Annual and Final Technical Reports,"* and all confirmatory instruments.

Article 11. Data Rights

A. All rights and title to data and technical data, as defined in 48 CFR 27.401, generated under this agreement shall vest in the Recipient.

B. The Recipient hereby grants to the U.S. Government a non-exclusive, non-transferable, royalty-free, fully paid-up license to use, duplicate, or disclose for governmental purposes any data, technology and inventions, whether patented or not, made or developed under this agreement.

C. The Recipient reserves the right to protect by copyright original works developed under this agreement. All such copyrights will be in the name of the Recipient. The Recipient hereby grants the U.S. Government a non-exclusive, non-transferable, royalty-free, fully paid-up license to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, for governmental purposes, any copyrighted materials developed under this agreement, and to authorize others to do so.

D. The Recipient is responsible for affixing appropriate markings indicating the rights of the Government on all data and technical data delivered under the agreement. The Government shall be deemed to have unlimited rights in all data and technical data delivered without markings.

PART V. TECHNICAL AND FINANCIAL REPORTING

Article 12. Annual and Final Technical Reports

A. Recipients shall submit performance/technical reports in accordance with OMB Circular A-87 and the following. All reports shall be marked in accordance with the article entitled *"Distributing Project Results."*

B. *Annual Technical Report*. Annual reports may be required for efforts of more than one year. This report will provide a concise and factual discussion of the significant accomplishments and progress of the Recipient during the year covered by the report. Each of the topics described below shall be addressed for the effort being performed:

(a) A description of unusual activities or MCL exceedences at the Springvale wellfield during the reporting period.

(b) Copies of all routine surveillance reports prepared for the Commonwealth of Massachusetts Department of Environmental Protection.

(c) Other pertinent information including, when appropriate, analysis and explanation of abnormal system performance issues.

C. Final Technical Report.

1. If requested by the Army, a Final Technical Report will be submitted at the completion of the agreement. This report will provide a comprehensive, cumulative, and substantive summary of the progress and significant accomplishments achieved during the total period of the effort covered by the agreement. Each of the topics described above shall be addressed as appropriate for the effort performed. Publications may be bound and attached as appendices.

2. When the results of a research effort have not previously been reported in scientific or technical publications, the Final Technical Report must

provide sufficient detailed discussions of findings and accomplishments obtained in pursuit of the planned objectives of the Agreement.

D. Submittal. The recipient shall submit annual and final technical reports in an original and two copies and an electronic copy on 3.5" disc in MS Word (or mutually acceptable format), or by e-mail; to the project officer within 90 days after completion of the period covered by the report. Provide a copy of the transmittal letter to the grants officer.

E. Format. Recipient is responsible for selecting appropriate format for annual and final technical reports; provided that required information is included.

Article 13. Informal Technical Reports

These reports shall be prepared upon request of the Army project officer, but will not be required more frequently than quarterly. When required, reports shall be submitted in letter format and need not be longer than three pages in length. The primary purpose is to inform the project officer about significant events, accomplishments, and anticipated problems that may affect the conduct of the planned effort. Reports should summarize the progress of the effort being performed, new discoveries, inventions or patent disclosures, anticipated changes in commitments of key personnel and in the planned approach; acquisition or fabrication of major or special research equipment; and the titles of manuscripts planned for publication. Reports shall be prepared and submitted within thirty (30) days of a request by the project officer. Electronic submission by e-mail is preferred; however, if a hard copy is submitted it shall be signed.

PART VI. DISTRIBUTING PROJECT RESULTS

Article 14. Distributing Project Results

A. Publications. The recipient is encouraged to publish results of the project, unless classified, in appropriate journals. One copy of each article planned for publication will be submitted to the project officer simultaneously with its submission for publication. Six copies of all publications resulting from the project shall be forwarded to the project officer as they become available.

B. Acknowledgment of Sponsorship. The recipient is responsible for assuring that an acknowledgment of Government support will appear in any publication of any material based on or developed under this project, in the following terms:

"Effort sponsored by the U. S. Army Soldier, Biological and Chemical Command, under Cooperative Agreement number DAAD16-01-2-0003. The

U.S. Government is authorized to reproduce and distribute reprints for Governmental purposes notwithstanding any copyright notation thereon."

C. Disclaimer. The recipient is responsible for assuring that every publication of material based on or developed under this project contains the following disclaimer:

> "The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies or endorsements, either expressed or implied, of the U. S. Army Soldier, Biological and Chemical Command or the U.S. Government."

D. Photographs. The recipient may photograph the progress or results of this project, including phenomena discovered, special equipment used, or special laboratory techniques designed. Copies of such photographs, suitable for reproduction, should be made available to SBCCOM as part of the project/scientific documentation. These photographs may be used later for other Government publications.

E. Marking and Distribution Requirements.

Mark all data delivered in accordance with MIL-STD-1806 with the following statement:

"Distribution Statement A. Approved for public release; distribution is unlimited."

PART VII. MISCELLANEOUS PERFORMANCE ISSUES

Article 15. Using Technical Information Resources

To the extent practical, the recipient will use the technical information resources of the Defense Technical Information Center (DTIC) and other Government or private facilities to investigate recent and on-going research and avoid needless duplication of scientific and engineering effort.

Article 16. Disclaimer

Both parties agree that the work is to be conducted on a best effort basis and the Recipient makes no other warranty or guarantee of any kind in connection with the data deliverables provided by the Recipient under this Agreement, and Recipient disclaims any and all warranties, including those of merchantability and fitness for a particular purpose, with respect to any information, design, or specification furnished to the Government, or to others at the Government's request, in connection with this agreement or the subject thereof.

Article 17. Disputes

A. General

The Parties shall communicate with one another in good faith and in a timely and cooperative manner when raising issues under this article.

B. Dispute Resolution Procedures

1. Any disagreement, claim or dispute between the Government and the Town concerning questions of fact or law arising from or in connection with this Agreement, and, whether or not involving an alleged breach of this Agreement, may be raised only under this article.

2. Whenever disputes, disagreements, or misunderstandings arise, the Parties shall attempt to resolve the issue(s) involved by discussion and mutual agreement as soon as practicable. In no event shall a dispute, disagreement or misunderstanding which arose more than three (3) months prior to the notification made under subparagraph B.3 of this article constitutes the basis for relief under this article, unless the Commander of the Soldier Systems Center in the interests of justice, waives this requirement.

3. Failing resolution by mutual agreement, the aggrieved Party shall document the dispute, disagreement, or misunderstanding by notifying the other Party (through the Grants Officer or Town Administrator) in writing of the relevant facts, identify unresolved issues, and specify the clarification or remedy sought. Within five (5) working days after providing notice to the other Party, the aggrieved Party may, in writing, request a joint decision by the SSC Commander and the Town Administrator or Town Board of Selectmen. The other Party shall submit a written position on the matter(s) in dispute within thirty (30) calendar days after being notified that a decision has been requested. The SSC Commander and the Town Administrator (or Board of Selectmen) shall conduct a review of the matter(s) in dispute and render a decision in writing within thirty (30) calendar days of receipt of such written position.

4. In the absence of a joint decision, upon written request to the SSC Commander made within thirty (30) calendar days of the expiration of the time for a decision under subparagraph B.3 of this article, the dispute shall be further reviewed. The SSC Commander may elect to conduct this review personally or through a designee or jointly with the Town Administrator or designee. Following the review, the SSC Commander or designee will resolve the issue(s) and notify the Parties in writing.

5. Subject only to this article and 41 U.S.C. § 321-322, if not satisfied with the results of completing the above process, either Party may within thirty (30) calendar days of receipt of the notice in subparagraph B.4 of this article pursue any right and remedy in a court of competent jurisdiction

C. Limitation of Damages

Each party waives all claims against the other party for any compensation due to loss, damage, personal injury or death occurring as a result of the reasonable and non-negligent implementation of this Agreement. In the event that any party to this Agreement shall fail to perform any of the covenants or obligations as described herein, then, in addition to any and all other rights and remedies the non-defaulting Party shall have against the defaulting Party, the defaulting Party shall pay to the non-defaulting Party all costs and expenses, including but not limited to reasonable attorneys' fees incurred by the non-defaulting Party to enforce its rights hereunder.

PART VIII. SUSPENSION AND TERMINATION

Article 18. Suspension and Termination Procedures

A. The Government reserves the right to terminate this agreement for cause. If the recipient fails to comply with the terms and conditions of this agreement, the grants officer will provide written notice of breach or deficiency to the recipient and will provide the recipient an opportunity to explain or correct the breach or deficiency within 30 days from receipt of notice. If grounds for termination for cause still exist, the Government may terminate or suspend performance. If suspension is invoked, the Government may withhold further payments, or prohibit the recipient from incurring additional obligation of funds until corrective action is taken. If this agreement is terminated after the recipient has received Government funding, the closeout procedures in OMB Circular, A-87 shall apply.

B. Notwithstanding the above, for security or safety reasons or in the case of a serious breach that could lead to irreparable damage, the grants officer may order immediate suspension of work, in whole or in part.

C. The recipient may terminate this agreement upon sending to the Federal awarding agency written notification setting forth the reasons for such termination, the effective date, to be not less than 30 days, and, in the case of partial termination, the portion to be terminated. However, if the government determines in the case of partial termination that the reduced or modified portion of the grant will not accomplish the purposes for which the grant was made, it may terminate the grant in its entirety.

E. In the event of termination by either party, recipient will be paid for all costs incurred within, and not to exceed, the funds presently allotted to the agreement.

PART IX. CERTIFICATIONS AND OTHER PROVISIONS

Article 19. Certifications

By signing the agreement or accepting funds under the agreement, the recipient provides the:

A. Certification at Appendix C, 32 CFR Part 25 regarding Drug-Free Workplace Requirements.

B. Certification at Appendix A, 32 CFR Part 25 regarding Debarment, Suspension, and Other Responsibility Matters--Primary Covered Transactions.

C. Certification at Appendix A, 32 CFR Part 28 regarding Lobbying.

Article 20. Nondiscrimination

By signing this agreement or accepting funds under this agreement, the recipient assures that it will comply with applicable provisions of the following national policies prohibiting discrimination:

A. On the basis of race, color, or national origin, in Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et.seq.), as implemented by DoD regulations at 32 CFR Part 195.

B. On the basis of handicap in § 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794), as implemented by Department of Justice regulations at 28 CFR Part 41 and DoD regulations at 32 CFR Part 56.

Article 21. Environmental Considerations

By signing this agreement or accepting funds under this agreement, the recipient assures that it will:

A. Comply with the applicable portions of the Clean Air Act (42 U.S.C. § 7401 et. seq.) and Clean Water Act (33 U.S.C. § 1251 et. seq.) as implemented by Executive Order 11738 (3 CFR 1971-1975 Comp., p. 799) and Environmental Protection Agency rules at 40 CFR Part 15. In accordance with EPA rules, the recipient further agrees that it will:

-- Not use any facility on the EPA's List of Violating Facilities in performing any award that is nonexempt under 40 CFR 15.5, so long as the facility remains on the list.

-- Notify the awarding agency if it intends to use a facility in performing this award that is on the List of Violating Facilities or that the recipient knows has been recommended to be placed on the List of Violating Facilities.

B. Identify to the agency any impact this award may have on:

1. The quality of the human environment, and provide help the agency may need to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C. § 4321 et. seq.) And to prepare Environmental Impact Statements or other required environmental documentation. In such cases, the recipient agrees to take no action that will have an adverse environmental impact (e.g., physical disturbance of a site such as breaking of ground) until the agency provides written notification of compliance with the environmental impact analysis process.

2. Flood-prone areas, and provide help the agency may need to comply with the National Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973 (42 U.S.C. § 4001 et. seq.), which require flood insurance, when available, for Federally assisted construction or acquisition in flood-prone areas.

3. Any existing or proposed component of the National Wild and Scenic Rivers system, and provide help the agency may need to comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. § 1271 et. seq.).

4. Underground sources of drinking water in areas that have an Aquifer that is the sole or principal drinking water source, and provide help the agency may need to comply with the Safe Drinking Water Act (42 U.S.C. § 300h-3).

Article 22. National Historic Preservation

The recipient agrees to identify to the awarding agency any property listed or eligible for listing on the National Register of Historic Places that will be affected by this award, and to provide any help the agency may need, with respect to this award, to comply with § 106 of the National Historic Preservation Act of 1966 (16 U.S.C. § 470 et. seq.), as implemented by the Advisory Council on Historic

Preservation regulations at 36 CFR Part 800 and Executive Order 11593 (3 CFR, 1971-1975 Comp., p. 559).

Article 23. Officials not to Benefit

No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit arising hereunder, in accordance with 41 U.S.C. § 22.