U.S. Army
Environmental
Center

FORT DEVENS
RECORD OF DECISION
AOCs 44 and 52

RECORD OF DECISION
BARNUM ROAD MAINTENANCE YARDS
FORT DEVENS, MASSACHUSETTS

IN ACCORDANCE WITH U.S. ARMY REGULATION 200-2, THIS DOCUMENT IS INTENDED BY THE U.S. ARMY TO COMPLY WITH THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1969.

MARCH 1995

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BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY INDEX OF APPENDICES

DECLARATION FOR THE RECORD OF DECISION

BARNUM ROAD MAINTENANCE YARDS
AREAS OF CONTAMINATION 44 & 52
FORT DEVENS, MASSACHUSETTS

STATEMENT OF PURPOSE

Fort Devens is a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List site which is located in Middlesex and Worcester Counties and is within the Towns of Ayer, Harvard, Lancaster and Shirley, Massachusetts. There are 73 Study Areas (SAs) and Areas of Contamination (AOCs) at Fort Devens which are currently under investigation.

The Record of Decision relates to the Barnum Road Maintenance Yards (AOCs 44 & 52). The site is situated in the northeast corner of the Main Post near the Barnum Gate (Figure 1) and approximately one mile southwest of the Town of Ayer Route 2A/110 intersection. This Decision Document presents the selected remedial action for the Barnum Road Maintenance Yard operable unit, developed in accordance with the CERCLA of 1980, as amended, 42 U.S.C. §§ 9601 et seq. and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), to the extent practicable, as amended, 40 C.F.R. Part 300. The Fort Devens Base Realignment and Closure (BRAC) Environmental Coordinator, the Deputy Assistant Secretary of the Army (Environmental, Safety, and Occupational Health), and the USEPA Region I Administrator have been delegated the authority to approve this Record of Decision.

The Commonwealth of Massachusetts has concurred with the selected remedy. A copy of the declaration of concurrence is included as Appendix D of this ROD.

STATEMENT OF BASIS

This decision is based on the Administrative Record which has been developed in accordance with Section 113(k) of CERCLA. The Administrative Record is available for public review at the Fort Devens BRAC Environmental Office, Building P12, Fort Devens, Massachusetts, and at the Ayer Town Hall, Main Street, Ayer, Massachusetts. The Administrative Record Index (Appendix E of the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Maintenance Yards, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to the public health or welfare or to the environment.

DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the Maintenance Yards which will address the contaminated surface soils and soils associated with two known releases (hot spot areas) at the Maintenance Yards.

Major Components of the Selected Remedy

- Excavate surface soil (top two feet across the site),
- Excavate the two hot spot areas,
- Stockpile soils for sampling and analysis,
- Cold mix asphalt batch soils exceeding site cleanup levels of 7 ppm (average) total carcinogenic polynuclear aromatic hydrocarbons (cPAHs) and 500 ppm total petroleum hydrocarbon compounds (TPHC),
- Backfill excavations with uncontaminated stockpiled soil and then place the asphalt batched material,
- Apply a pavement wearing course,
- Expand the existing stormwater collection system,
- Perform groundwater monitoring,
- As a precautionary measure, institute the following deed restrictions:

  1) prohibit residential development/use of the Maintenance Yards,

  2) minimize the possibility of long-term (working lifetime) exposure to subsurface soils, and

  3) require management of soils resulting from construction related activities.

The selected remedy involves excavating the top two feet of soil across the Maintenance Yards and contaminated soils associated with two hot spot areas (a reported release of "mogas" [motor vehicle gasoline] and leakage from a 1,000-gallon underground waste oil storage tank). Excavated soil will be placed in piles at the site for sampling and analysis.

Soils which exceed site cleanup levels will be cold mix asphalt batched. Cold mix asphalt batching is a technology that entails recycling petroleum contaminated soil into bituminous paving or road base product at ambient temperatures. Soil with contaminant concentrations below the cleanup criteria will be placed back in the excavation area. The asphalt batched material will be placed over the backfill as a base/subbase pavement course for parking lot construction at the Maintenance Yards. Asphalt batching will immobilize the contaminants exceeding cleanup levels present in the top two feet, thus minimizing direct contact/ingestion and inhalation of the soils having a carcinogenic risk. Excavating and asphalt batching soil from the hot spot areas will reduce the mobility of contaminants present in the highest concentrations at the Maintenance Yards. Placement of the asphalt batched soils onto the surface of the Maintenance Yards will also minimize the potential migration of contaminants to the groundwater through the construction of a low permeable pavement barrier.

The Army has chosen to add a pavement wearing course for a vehicle parking surface over the asphalt batched material as part of the selected remedy. Addition of the wearing course will ensure the integrity of the asphalt batched material as a parking lot base for current and future property use.

Applying the asphalt batched material and pavement wearing course to the Maintenance Yards will increase the amount of runoff during rain events. Therefore the selected remedy will include expansion of the existing stormwater collection system. Potentially, a detention basin and flow reducers will need to be incorporated into the design to minimize wetland impacts.

Sampling and analysis of groundwater from existing wells at the Maintenance Yards will be performed yearly for a period of five years upon commencement of remedial activities.

As a precautionary measure, institutional controls in the form of deed restrictions will be implemented to prevent potential circumstances which may result in risk of harm to health, safety, public welfare or the environment. These restrictions will include:

1. No residential development/use of the Maintenance Yards will be permitted. The quantitative risk evaluation and established cleanup level assume the property will remain zoned for commercial/industrial use.

2. Removal of the 2-foot cover or an asphaltic barrier from the Maintenance Yards will be prohibited to prevent surface soil exposure to existing subsurface soils (2-foot to 5-foot level). This deed restriction will be implemented as a precautionary measure to minimize the possibility of long-term (working lifetime) exposure to subsurface soils. This restriction will not apply to excavations undertaken in connection with construction of buildings or other structures, utilities, infrastructures or any other construction related purpose where the cover is penetrated and/or temporarily removed and protection

from long-term exposure to subsurface soil is not jeopardized. To comply with this deed restriction, the 2-foot layer of cover material (which may consist of one or combination of "clean" site soil used as backfill, asphalt batched material, off-site soils/aggregate and bituminous pavement) will remain over the subsurface soil (existing 2- to 5-foot soil level) to minimize direct contact/ingestion to the present subsurface soils. The continuity of the paved surface need not be maintained providing the cover thickness of 2 feet is provided. As an alternative, a continuous and maintained paved surface which would prevent exposure to subsurface soils could be substituted for the 2-foot thick cover.

This restriction also would not apply to excavation and use that is within the scope of any authorized response action. The deed restriction may be nullified, as approved by the regulatory agencies, should there be future evidence showing that contaminant levels within the 2- to 5-foot soil zone are below site surface soil cleanup levels.

3. Excavation below 2 feet at the Maintenance Yards, subsequent to completion of the remedial action established in this ROD, will require:

a. Development and implementation of a Health and Safety Plan for the work area; and

b. Development and implementation of a Sampling and Analysis Plan for management of the excavated soils in accordance with the following:

Where reuse of soil within the Maintenance Yards is intended, sampling and analysis of stockpiled soils excavated below 2 feet will follow criteria detailed in this ROD for hot spot area soils. Soils with contaminants exceeding the 500 ppm cleanup level for TPHC will be treated in a manner consistent with this ROD. Soils with contaminants below the established cleanup level may be returned to the excavation. Soil excavated below 2 feet but returned to the top 2 feet (as surface soil) must also be sampled, analyzed and, if required, treated for cPAH contaminants as detailed in this ROD.

Where reuse of soil outside the Maintenance Yards is intended, sampling/analysis and action levels for stockpiled soils excavated below 2 feet will follow criteria governed by the regulations or policies in effect for the final disposal area.

DECLARATION

The selected remedy is protective of the human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate for this remedial action, and is cost effective. This remedy satisfies the statutory preference for remedies that utilize treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances. In addition, this remedy utilizes permanent solutions and innovative treatment technologies to the maximum extent practicable.

The foregoing represents the selection of a remedial action by the Department of the Army and the United States Environmental Protection Agency, Region I, with the Concurrence of the Commonwealth of Massachusetts Department of Environmental Protection. Concur and recommend for immediate implementation:

UNITED STATES DEPARTMENT OF THE ARMY

James C Chambers

JAMES C. CHAMBERS
Fort Devens
BRAC Environmental Coordinator

21 MAR 95
Date

The foregoing represents the selection of a remedial action by the Department of the Army and the United States Environmental Protection Agency, Region I, with the Concurrence of the Commonwealth of Massachusetts Department of Environmental Protection. Concur and recommend for immediate implementation:

UNITED STATES DEPARTMENT OF THE ARMY

Edward R. Nuttall
Colonel, U.S. Army
Installation Commander

21 Mar 95
Date

The foregoing represents the selection of a remedial action by the Department of the Army and the United States Environmental Protection Agency, Region I, with the concurrence of the Commonwealth of Massachusetts Department of Environmental Protection. Concur and recommend for immediate implementation:

U.S. ENVIRONMENTAL PROTECTION AGENCY

JOHN P. DEVILLARS
Regional Administrator

3/28/95
Date

RECORD OF DECISION
BARNUM ROAD MAINTENANCE YARDS
AREAS OF CONTAMINATION 44 & 52
FORT DEVENS, MASSACHUSETTS

MARCH 1995

RECORD OF DECISION SUMMARY
BARNUM ROAD MAINTENANCE YARDS
AREAS OF CONTAMINATION 44 & 52
FORT DEVENS, MASSACHUSETTS

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BARNUM ROAD MAINTENANCE YARDS
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FORT DEVENS, MASSACHUSETTS

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EXECUTIVE SUMMARY

Fort Devens is located in Middlesex and Worcester Counties and is within the Towns of Ayer, Harvard, Lancaster and Shirley, Massachusetts. There are 73 Study Areas (SAs) and Areas of Contamination (AOCs) at Fort Devens which are currently under investigation for potential environmental restoration.

This Record of Decision (ROD) relates to the Barnum Road Maintenance Yards (AOCs 44 & 52). The site is situated in the northeast corner of the Main Post near the Barnum Gate (Figure 1 of Appendix A). This ROD sets forth the selected remedy for the Barnum Road Maintenance Yards which addresses the contaminated surface soils and soils associated with two known releases (hot spot areas). This decision is based on the Administrative Record which is available for public review at the Fort Devens Base Realignment and Closure (BRAC) Environmental Office, Building P12, Fort Devens, Massachusetts, and at the Ayer Town Hall, Main Street, Ayer, Massachusetts. The Administrative Record Index (Appendix E) identifies the reports, correspondence and other documentation comprising the Administrative Record upon which the selection of the remedial action is based.

The total area of the Barnum Road Maintenance Yards is approximately 8.8 acres. The Barnum Road Maintenance Yards are divided into two study areas which were investigated and identified as AOCs 44 and 52 (Figure 2 of Appendix A). AOC 44 is known as the Cannibalization Yard. It is an area where vehicles were stored before being dismantled for usable parts. AOC 52 is a maintenance yard where vehicles are stored while awaiting repairs. It was previously known as the TDA Maintenance Yard. Northwest of the Cannibalization Yard is a separately fenced vehicle storage yard known as the RTS Yard. An area that is fenced southeast of the main portion of the TDA Maintenance Yard is known as the K-Yard. All four of these yards have a long and continuing history of vehicle storage and possible crankcase releases and have been combined as one site identified as the Maintenance Yards. The only known significant vehicle release was an estimated 20 gallons of "mogas" (motor vehicle gasoline) and hydraulic fluid released near the center of the Cannibalization Yard in 1985. Also, a 1,000-gallon underground waste oil storage tank was located in the Cannibalization Yard until its removal in May 1992.

The Army conducted a series of field investigations during the 1992 to 1993 period. Site investigation and feasibility study reports were written in 1993 detailing the investigations performed, the nature and extent of contamination found at the

Maintenance Yards, and the potential health risks associated with the site.

In general, contamination at the Maintenance Yards consists of pollutants commonly associated with used motor oil. Contaminants creating a potential health risk are located in the surface soil (top two feet) at the site. Additionally, contaminants were detected in deeper soil around the former waste oil storage tank and in the vicinity of the reported mogas spill in the Cannibalization Yard (hot spot areas). There is no evidence that contaminants found in the Maintenance Yard soils are affecting groundwater quality.

The Army developed seven remedial options for the Maintenance Yards in a document entitled "Final Feasibility Study Report for Unsaturated Soils at the Maintenance Yards." This report evaluated each of the alternatives using criteria developed by the United States Environmental Protection Agency (USEPA) for use in the Superfund process.

Of the seven alternatives, one was chosen as the preferred alternative by the Army. State and community acceptance, were evaluated following receipt of comments from the Massachusetts Department of Environmental Protection (MADEP) and the public on the Proposed Plan. Details of the preferred alternative were provided to the public in a Fact Sheet and Proposed Plan issued on May 16, 1994. On May 24, 1994, the Army held an informational meeting at Fort Devens to discuss the results of the field investigations and to present the Army's Proposed Plan. From May 25 to June 24, 1994, the Army held a 30-day public comment period to accept public comments on the alternatives presented in the Feasibility Study and the Proposed Plan. On June 15, 1994 the Army held a formal public meeting at Fort Devens to accept any verbal comments on the preferred alternative. A transcript of this meeting and the comments and the Army's response to comments are included in the responsiveness summary (Appendix C). The comments received by the community and local governments generally support the selected remedy. MADEP has reviewed the various alternatives and formally concurs with the selected remedy for the Maintenance Yards. A copy of the declaration of concurrence is attached as Appendix D.

The selected remedy is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate for this remedial action, and is cost effective. This remedy satisfies the statutory preference for remedies that utilize treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances. In addition, this remedy utilizes permanent solutions and innovative treatment technologies to the maximum extent practicable.

The selected remedy includes the following components:

- Excavate surface soil (top two feet across the site),
- Excavate the two hot spot areas,
- Stockpile soils for sampling and analysis,
- Cold mix asphalt batch soils exceeding site cleanup levels of 7 ppm (average) total carcinogenic polynuclear aromatic hydrocarbons (cPAHs) and 500 ppm total petroleum hydrocarbon compounds (TPHC),
- Backfill excavations with uncontaminated stockpiled soil and apply the asphalt batched material over the surface of the site,
- Apply a pavement wearing course for a vehicle parking surface,
- Expand the existing stormwater collection system,
- Perform groundwater monitoring,
- As a precautionary measure, institute the following deed restrictions: 1) prohibit residential development/use of the Maintenance Yards, 2) minimize the possibility of long-term (working lifetime) exposure to subsurface soils, and 3) require management of soils resulting from construction related activities.

Site restoration is estimated to take approximately four months to complete. Estimated capital cost for remediation is $1,865,000. Total operation and maintenance costs are estimated to be $72,000. Total present worth cost is $1,937,000.

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RECORD OF DECISION SUMMARY
BARNUM ROAD MAINTENANCE YARDS
AREAS OF CONTAMINATION 44 & 52

MARCH 1995

I. SITE NAME, LOCATION AND DESCRIPTION

Fort Devens is a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) National Priorities List (NPL) site which is located in Middlesex and Worcester Counties and is within the Towns of Ayer, Harvard, Lancaster and Shirley, Massachusetts. There are 73 Study Areas (SAs) and Areas of Contamination (AOCs) at Fort Devens which are currently under investigation.

The Record of Decision relates to the Barnum Road Maintenance Yards (AOCs 44 & 52). The site is situated in the northeast corner of the Main Post near the Barnum Gate (Figure 1) approximately one mile southwest of the Town of Ayer Route 2A/110 intersection.

The total area of the site is approximately 8.8 acres (Figure 2). The Maintenance Yards are bordered to the north by Massachusetts Army National Guard property, which is used for similar vehicle storage activities as the Barnum Road Maintenance Yards. Boston and Maine Railroad property and Barnum Road border the site to the west and east, respectively. Building 3713, located south of the site, is a 6-acre building used by the Army for vehicle maintenance activities. The Maintenance Yards are fenced and presently used for military vehicle storage. AOC 44 is known as the Cannibalization Yard. It is an area where vehicles are stored before being dismantled for usable parts. AOC 52 is a maintenance yard where vehicles are stored while awaiting repairs. It was previously known as the TDA (Table of Distribution and Allowances) Maintenance Yard. Northwest of the Cannibalization Yard is a separately fenced vehicle storage yard known as the RTS (Regional Training Site) Yard. An area that is fenced-off southeast of the main portion of the TDA Maintenance Yard is known as the K-Yard. All yards show evidence of being at least partly paved at one time. In areas where pavement is visible, the pavement has generally been broken-up with age if not mostly disintegrated. All four of these yards have a long and continuing history of vehicle storage; hence at the direction of the Army, they were all included as AOCs 44 & 52 and combined as one operable unit. They are referred to collectively in this Record of Decision (ROD) Summary as the Maintenance Yards, or the Site.

Soils in the area of the Maintenance Yards are products of glacial meltwater deposition in lake and ice-contact environments during the final retreat of Pleistocene glaciers. The yards are located on a kame terrace. The deposits consist of stratified sands and gravelly sands possibly overlying till.

Groundwater in the aquifer underlying the yards has been assigned to Class I under Commonwealth of Massachusetts regulations. Class I consists of groundwater that is designated as a source of potable water supply. Based on a 1992 Site Investigation water level survey, inferred groundwater flow from the Maintenance Yards is northeast toward Grove Pond. The town of Ayer currently owns and operates two water supply wells within 150 feet of the south side of Grove Pond and approximately one-half mile from the yards (Figure 1). The wells are currently used as a backup to the town's other supply wells on Spectacle Pond. As part of a plan for meeting future water needs, the town of Ayer is planning to return its well source on Grove Pond to regular service. The town engaged a consultant to establish a Zone II area of influence around the wells which is defined as the conceptual zone of contribution to the wells under specific set of conditions which simulate the most severe pumping and recharge conditions that can be anticipated realistically. The report shows the Zone II area as including the Maintenance Yards (Figure 1). The Maintenance Yards are also located approximately 1,600 to 1,700 feet from the Fort Devens Grove Pond wellfield, which is within the default Zone II (one-half mile radius) of this Army wellfield. Currently there is no evidence that contaminants found in the Maintenance Yards' soils are affecting groundwater quality.

The Maintenance Yards are located approximately 1,200 feet west of Cold Spring Brook. Surface water from the Maintenance Yards drain into part of the Fort Devens stormwater collection system which discharges to Cold Spring Brook (Figure 3). Cold Spring Brook merges with Bowers Brook and flows northeast into Grove Pond and then to Plow Shop Pond. Ultimately these ponds drain into Nonacoicus Brook which flows about 1 mile northwest before its confluence with the Nashua River.

A more complete description of the Maintenance Yards can be found in the Site Investigation (SI) Report, April 1993, Sections 2 and 4 of Volume I and the Feasibility Study (FS) Report, January 1993, Section 1.2.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Land Use and Response History

Fort Devens was established in 1917 as Camp Devens, a temporary training camp for soldiers from the New England area. In 1931, the camp became a permanent installation and was redesignated as

Fort Devens. Throughout its history, Fort Devens has served as a training and induction center for military personnel and a unit mobilization and demobilization site. All or portions of this function occurred during World Wars I and II, the Korean and Vietnam conflicts, and operations Desert Shield and Desert Storm. The primary mission of Fort Devens is to command, train, and provide logistical support for non-divisional troop units and to support and execute Base Realignment and Closure (BRAC) activities. The installation also supports the Army Readiness Region and the National Guard units in the New England area.

As a support for these activities, the Maintenance Yards on Barnum Road have had a long and continuing history of Army vehicle storage. As a consequence, the soils of the site have been exposed to possible crankcase releases over a long duration. Gasoline, motor oil, and other automotive fluids have also likely been released during vehicle dismantling operations in the Cannibalization Yard. Individual releases are not likely to have been of significant volume, but numerous releases during the period in which the yard has been used account for the soil contamination problem. The only recorded significant vehicle release was an estimated 20 gallons of "mogas" (motor vehicle gasoline) and hydraulic fluid released near the center of the Cannibalization Yard in 1985 during the cannibalization process. Approximately 4 cubic yards (cy) of visibly contaminated soils were excavated immediately and containerized by Army personnel.

A 1,000-gallon underground storage tank (UST), formerly used to store waste oil, was located in the Cannibalization Yard until its removal in May 1992. Visibly contaminated soil was stockpiled, and laboratory analysis of soil samples from the bottom and one side of the tank excavation showed total petroleum hydrocarbon compound (TPHC) concentrations of 17,600 parts per million (ppm) and 9,780 ppm, respectively. Laboratory analysis was also conducted on a waste oil sludge sample obtained from inside the tank. Results revealed the following levels of semivolatile organic compounds (SVOCs) and Toxicity Characteristic Leaching Procedure (TCLP) metals: 110 ppm naphthalene, 128 ppm bis(2-ethylhexyl)phthalate (B2EHP), 240 ppm 2-methylnaphthalene, 0.04 ppm cadmium, 0.4 ppm lead, 0.05 ppm nickel and 3.07 ppm zinc. Analytical results did not reveal the presence of volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs). Reportedly, the tank was observed to be in good condition with no holes or severe corrosion. However, inspection revealed that the fill pipe was improperly connected to the bung of the tank, allowing the pipe contents to leak at the connection. Later in July 1992, contaminated soils surrounding the removed tank were excavated. Laboratory tests on samples collected by the contractor from two sidewalls and stockpile following the over excavation revealed residual TPHC concentrations ranging from 1,110 to 2,740 ppm. A total of 91 tons (an estimated 120 cy) of contaminated soils were removed from the waste oil storage tank area in May and July and shipped off-site for treatment and reuse.

Exploratory test pits were excavated for construction of a concrete spill-containment basin in the southeast corner of the TDA Maintenance Yard (Figure 2), in July 1991. These test pits revealed zones of contaminated soil below the surface. TCLP analyses detected 3 to 7 micrograms per liter (μg/l) of benzene in leachate from the soil samples. TPHC was found at 420 to 700 ppm concentrations in surface soil samples and at 80 ppm in one sample from a 4-foot depth. TPHC was not detected in the 8-foot-deep soil samples. In November and December 1991 the approximate 100-foot by 160-foot proposed spill-containment basin area was excavated to begin construction. Excavation continued until field screening (non-dispersive infrared analysis [NDIR]) and visual observation indicated that contaminated soils had been removed. It was possible to distinguish the contaminated ("dirty", dark brown and black sand and silt) upper layer from the non-contaminated ("clean", reddish yellow coarse sand) lower layer. The contaminated layer was between 8 and 12 inches thick. The uncontaminated layer extended below the upper layer to the construction subgrade limit throughout the spill-containment basin's extent. Approximately 1,200 tons of soil were excavated and stockpiled. Laboratory analysis (USEPA Method 418.1) was performed on samples from stockpiled soil. TPHC concentrations ranged from 130 to 800 ppm. In addition, a petroleum identification analysis (ASTM D 3328) was performed on six of the 10 stockpile samples. These samples showed a presence of a hydrocarbon pattern in the C24 to C36 range but the pattern did not match any of the fuel standards for gasoline, No. 2, 4, and 6 fuel oils, kerosene or motor oil/transmission fluid. The soil was suspected to be an asphalt treated, gravel road base. Samples collected from the proposed basin's subgrade at the bottom of the excavation contained TPHC concentrations ranging from nondetect to 7 ppm.

A more detailed description of the site history can be found in the SI Report, April 1993, Sections 2 and 4 of Volume I and the FS Report, January 1993, Section 1.2.

B. Enforcement History

In conjunction with the Army's Installation Restoration Program (IRP), Fort Devens and the U.S. Army Environmental Center (USAEC; formerly the U.S. Army Toxic and Hazardous Materials Agency) initiated a Master Environmental Plan (MEP) in 1988. The MEP consists of assessments of the environmental status of SAs, specifies necessary investigations, and provides recommendations for response actions with the objective of identifying priorities for environmental restoration at Fort Devens. AOCs (SAs) 44 & 52 were identified as potential sources of contamination in the MEP. The MEP recommended that a record search be conducted to better define past and current activities. It also recommended that the extent of contamination be determined by drilling soil borings and sampling for the United States Environmental Protection Agency (USEPA) hazardous substance list compounds and TPHC. It suggested installing monitoring wells if the deeper soils were found contaminated.

On December 21, 1989, Fort Devens was placed on the National Priorities List under CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA). The listing of Fort Devens as an NPL site was a result of contamination at two other sites (VOC contamination in the groundwater at the Shepley's Hill Landfill and metal contamination in the groundwater at the Cold Spring Brook Landfill), and the proximity of both locations to public water supplies. A Federal Facilities Interagency Agreement (IAG) was developed and signed by the Army and USEPA Region I on May 13, 1991 and finalized on November 15, 1991. The IAG provides the framework for the implementation of the CERCLA/SARA process at Fort Devens.

Under Public Law 101-510, the Defense BRAC Act of 1990, Fort Devens was selected for cessation of operations and closure. An important aspect of BRAC actions is to determine environmental restoration requirements before property transfer can be considered. As a result, an Enhanced Preliminary Assessment (PA) was performed at Fort Devens to address areas not normally included in the CERCLA process, but requiring review prior to closure. Although the Enhanced PA covers MEP activities, its main focus is to determine if additional areas require detailed records review and site investigation and to provide information and procedures to investigate installation wide areas requiring environmental evaluation. A final version of the Enhanced PA report was completed in April 1992. No additional findings or recommendations for AOCs 44 & 52 were provided in the PA. A current total of 59 SAs have been identified and placed in 13 priority groups defined in the IAG between the Army and USEPA.

In 1992, the Department of Defense (DoD), through USAEC, initiated a SI for AOCs 44 & 52 along with 10 other SAs in SA Groups 3, 5 and 6 at Fort Devens. The Final SI Report was issued April 1993. The purpose of the SI was to verify the presence or absence of environmental contamination and to determine whether further investigation or remediation was warranted. In June 1993, a supplemental SI (SSI) was conducted to fill specific data gaps identified during the FS process. The SI and SSI met the requirements of a Remedial Investigation in defining the nature and extent of contamination at the Maintenance Yards. As a result of the SI and SSI, the Maintenance Yards SAs were designated as AOCs due to contamination detected in the unsaturated soils. A FS was prepared to evaluate remedial action alternatives for cleanup of the Maintenance Yards. This study identifies and screens 11 remedial alternatives and provides a detailed analysis of seven remedial alternatives to allow the decision-makers to select a remedy for cleanup of the Maintenance Yards. The Final FS was issued January 1994. The Proposed Plan detailing the Army's preferred remedial alternative was issued in May 1994 for public comment. Technical comments presented during the public comment period are included in the Administrative Record. A summary of these comments as well as the Army's responses, which describe how these comments affected the remedy selection, are included in the Responsiveness Summary, Appendix C of this document.

III. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has generally centered around the fact that the Maintenance Yards are located in close proximity to the town of Ayer Grove Pond wells. The Army has kept the community and other interested parties apprised of site activities through regular and frequent informational meetings, fact sheets, press releases and public meetings.

The Army released a community relations plan in February 1992, that had been submitted earlier for public review, outlining a program to address community concerns, and to keep citizens informed about and involved in activities during remedial activities. As part of this plan, the Army established a Technical Review Committee (TRC) in early 1992. The TRC, as required by SARA Section 211 and Army Regulation 200-1, includes representatives from USEPA, USAEC, Fort Devens, Massachusetts Department of Environmental Protection (MADEP), local officials and the community. The committee generally met quarterly (until January 1994, when it was replaced by the Restoration Advisory Board [RAB]) to review and provide technical comments on work products, schedules, work plans and proposed activities for the SAs at Fort Devens. The SI and FS Reports, Proposed Plan and other related support documents were all submitted to the TRC for their review and comment. Additionally, AOCs 44 & 52 activity was specifically discussed at TRC meetings held March 24, 1992, January 5, 1993, August 2, 1993 and January 26, 1994.

As part of the Army's commitment to involving the affected communities, a RAB is formed when an installation closure involves transfer of property to the community. The RAB was formed in February 1994 to add members of the Citizen's Advisory Committee (CAC) with current TRC members. The CAC was previously established to address Massachusetts Environmental Policy Act (MEPA)/Environmental Assessment issues concerning the reuse of property at Fort Devens. The RAB consists of 28 members (15 original TRC members plus 13 new members) who are representatives from the Army, USEPA Region I, MADEP, local governments and citizens of the local communities. It meets monthly and provides advice to the installation and regulatory agencies on Fort Devens cleanup programs. Specific responsibilities include: addressing cleanup issues such as land use and cleanup goals; reviewing plans and documents; identifying proposed requirements and priorities; and conducting regular meetings which are open to the public. The proposed plan for AOCs 44 & 52 was presented at the June 2, 1994 RAB meeting.

On May 16, 1994, the Army issued a fact sheet to more than 100 citizens and organizations, providing the public with a brief explanation of the preferred alternative for cleanup of the Maintenance Yards. It described the opportunities for public participation, and provided details on the public comment period and public meetings to be held.

On May 16, the Army issued a press release concerning the proposed cleanup at the Maintenance Yards, to the Lowell Sun, Worcester Telegram, Fitchburg-Leominster Sentinel & Enterprise, Harvard Post, Public Spirit (Ayer) and Fort Devens Dispatch. During the week of June 6, 1994, the Army published a public notice concerning the Proposed Plan and public hearing in the Public Spirit, the Fitchburg-Leominster Sentinel & Enterprise, the Lowell Sun, and the Fort Devens Dispatch. The Army also made the plan available to the public at the information repositories located at the libraries in Ayer, Shirley, Lancaster, Harvard and at Fort Devens.

On May 24, 1994, the Army held an informal informational meeting at Fort Devens to discuss the results of the field investigation and the cleanup alternatives presented in the FS and to present the Army's Proposed Plan. This meeting also provided the opportunity for open discussion concerning the proposed cleanup. From May 25 to June 24, 1994, the Army held a 30-day public comment period to accept public comments on the alternatives presented in the FS and the Proposed Plan and on other documents released to the public. On June 15, 1994 the Army held a formal public meeting at Fort Devens to discuss the Proposed Plan and to accept any verbal comments from the public. A transcript of this meeting and the comments and the Army's response to comments are included in the attached responsiveness summary (Appendix C).

All supporting documentation for the decision regarding the Maintenance Yards is placed in the Administrative Record for review. The Administrative Record is a collection of all the documents considered by the Army in choosing the remedy for the Maintenance Yards. On May 27, 1994 the Army made the Administrative Record available for public review at the Fort Devens BRAC Environmental Office, and at the Ayer Town Hall, Ayer, Massachusetts. An index to the Administrative Record was available at the USEPA Records Center, 90 Canal Street, Boston, Massachusetts and is provided as Appendix E.

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

The remedy selected for the Maintenance Yards will provide protection of human health and the environment by reducing the toxicity and mobility of carcinogenic polynuclear aromatic hydrocarbons (cPAHs) and TPHC in the surface soil (top two feet) and mogas spill and waste oil storage tank soils (referred to in this ROD as hot spot area soils) through on-site treatment. The selected remedy also minimizes the potential migration of contamination to the groundwater, reduces the potential of off-site runoff of contaminants to the Cold Spring Brook wetlands, and provides environmental monitoring of groundwater for a period of five years following remediation. The remediation of the Maintenance Yards will not adversely impact any future response actions at the Maintenance Yards should they be required.

This remedial action will address the threat to human health posed from long-term exposure to contaminated surface soils at the Maintenance Yards and remove known hot spot areas at the site.

V. SUMMARY OF SITE CHARACTERISTICS

Section 1.0 of the FS contains an overview of the SI and SSI performed at the Maintenance Yards. In 1992, the USAEC initiated a SI for the Maintenance Yards along with 10 other SAs in SA Groups 3, 5 and 6 at Fort Devens. Field investigations were conducted from May to October 1992. During the preparation and regulatory review of the FS, specific data gaps were identified which required supplemental field investigation and data gathering. As a result, a SSI was conducted in June 1993. The significant findings of the SI and SSI regarding soil, groundwater and surface water and sediment are summarized in the following paragraphs.

A. Soil

1. SI Results

The Maintenance Yards are located on a kame terrace. Soil data from borings in these yards indicate that the soil in the area is generally clean sand with variable gravel and silt content. Grain-size analysis for soils encountered during the drilling program at the Maintenance Yards reveal a gravel content ranging between 4 and 23 percent; a sand content ranging between 74 and 93 percent; and a fine content (percent passing the #200 sieve) ranging between 2 and 19 percent.

During the SI, 16 soil borings were advanced to observe and sample soils throughout the Maintenance Yards (Figure 4). One of these borings, G3M-92-04X, was converted to a monitoring well. Soil samples were collected at the 0- to 2-foot, 5- to 7-foot and 10- to 12-foot depths. (Except G3M-92-04X where samples were collected at 0- to 2-foot, 12- to 14-foot, and 26- to 28-foot depths.) The SI focused on sampling soil for analysis of a variety of organic and inorganic analytes and for TPHC. Tables 1 and 2 present the laboratory results for organic compounds from each of the 16 soil borings. Tables 3 and 4 present the results for inorganic analytes. Figures 5, 6, and 7 show the distribution of total VOCs, SVOCs and TPHC in soils collected at the three depth intervals. Figures 8, 9 and 10 show the distribution of total cPAHs, total polynuclear aromatic hydrocarbons (PAHs) and total SVOCs at the same three depth intervals. Figures 11, 12, and 13 show the distribution of inorganic analytes at the three depth intervals exceeding calculated background concentrations for typical Fort Devens soils.

Aromatic VOCs (ethylbenzene, toluene and xylenes at maximum concentrations of 0.5 ppm, 0.05 ppm, and 4.0 ppm, respectively) were detected in three out of a total of 48 soil samples. One of the three samples was from boring 44B-92-06X, which is believed to be associated with the 1985 mogas spill. There appears to be no obvious lateral or vertical distribution pattern of VOCs in soil. SVOCs, predominantly PAHs, were detected in 34 of 48 samples throughout the Maintenance Yards. Carcinogenic PAH concentrations ranged from nondetect to 220 ppm. SVOC concentrations are typically higher in surface samples and are generally absent or of lower concentration with depth. TPHC appears to mimic the vertical distribution of SVOCs. The average TPHC concentrations across the site at the 0- to 2-foot, 5- to 7-foot and 10- to 12-foot ranges are 315 ppm, 52 ppm and 33 ppm, respectively. Maximum concentrations are 1210 ppm, 170 ppm and 119 ppm, respectively. These values exclude the TPHC concentrations at boring 44B-92-06X (that may be associated with the mogas spill) and TPHC concentrations associated with the waste oil UST. No lateral distribution pattern for SVOCs or TPHC is evident. No chlorinated solvents were detected.

Generally, the same vertical trend in concentrations found for the SVOCs and TPHC appears to exist with the inorganic analytes (i.e., higher concentrations of inorganic analytes are found near the ground surface). Soils near the surface exhibit inorganic analyte concentrations generally two to three times higher than soils at 5-foot and 10 foot depths. Chromium, copper, nickel, zinc, sodium and beryllium are analytes that show a pattern of consistent exceedances above background concentrations. The appearance of chromium, copper, nickel and zinc in almost all surface soil samples could be the result of vehicle maintenance activity. Sodium is likely attributable to road salting. Beryllium occurs on a more random basis (in instances at higher concentration at greater depth) and is believed to be naturally occurring. Surface soils that appear to contain the most inorganic analytes were found at sampling locations 44B-92-06X, 44B-92-01X, 52B-92-01X and 52B-92-06X.

Motor oil is a potential source of the organic and inorganic analytes detected. Cutting and welding activities may be an additional source of the inorganic analytes associated with metal alloys. The potential routes of contaminant migration which could occur at the Maintenance Yards include downward migration via precipitation infiltration to the groundwater and by stormwater discharge via the stormwater collection system to Cold Spring Brook (Figure 3). Sampling of groundwater and Cold Spring Brook surface water and sediments was performed as part of the SI and SSI to assess these potential migration routes. A summary of these sampling results are discussed in later paragraphs in this section.

2. SSI Results (Hot Spot Area Investigation)

Defining the vertical and horizontal extent of contamination around the former underground waste oil tank and spill areas was required to better assess the remedial alternatives to be evaluated in the FS. Although soil removal actions have taken place around the excavated tank, the extent (specifically depth) of remaining contamination was not readily defined due to the lack of conclusive analytical data at the time of the soil over-excavation. The horizontal and vertical extent of contamination from the mogas spill was unknown except perhaps in the vicinity of existing boring 44B-92-06X. This boring may have been located only at the periphery of the spill or not in the spill area at all. An Army Pollution Incident Report located the mogas spill closer to the center of the Cannibalization Yard.

The SSI entailed drilling a total of four borings, (44B-93-07X, -08X, -09X and -10X), in the Cannibalization Yard in the vicinity of the excavated underground tank area and mogas spill area (Figure 14) and then sampling soil from these borings to better define the extent of contamination. Soil analyses were conducted for inorganics (only lead in 44B-93-09X and -10X) SVOCs, TPHC, and PCBs. Table 5 presents the laboratory results for organic and inorganic compounds for each of the four borings. Figures 15 through 18 show the distribution of SVOCs, TPHC, PCBs and inorganics at four depth intervals (5, 10, 15 and 25 feet below ground surface [bgs]).

TPHC was detected in only two of 16 samples; 121 ppm in boring 44B-93-08X at 10 feet bgs and 38.1 ppm in boring 44B-93-09X at 5 feet bgs. Boring 44B-93-08X is located near the southeast end of the excavated UST. The TPHC detected at the 10-foot level generally corresponds with the location of the tank bottom and is likely due to residual contamination from the excavated UST. Boring 44B-93-09X is located in the Cannibalization Yard approximately 25 feet north of the area where the mogas spill was suspected of occurring. The duplicate of this sample revealed a concentration below the detection level (29.6 ppm). It is not conclusive if this detected concentration is a result of the mogas spill. The only SVOC compounds detected were B2EHP at 1.4 ppm in 44B-93-09X at the 25-foot depth and trace concentrations of fluoranthene, phenanthrene and pyrene (0.25, 0.09, and 0.12, respectively) in 44B-93-09X at the 5-foot depth. The duplicate of the 5-foot depth sample revealed concentrations below detection level for these PAHs.

Inorganics which exceed background concentrations include arsenic, beryllium, copper, nickel and sodium. Of these analytes, only arsenic is a typical constituent of used automotive oil. Nickel was also detected in a waste oil sludge sample taken from the UST. These five inorganic analytes are present in the mogas spill and waste oil storage tank area soils at concentrations which are the same order of magnitude above background as detected on an AOCs 44 and 52 site-wide basis.

B. Groundwater

1. SI Results

During the SI, seven monitoring wells were installed (one in the TDA Maintenance Yard, as shown in Figure 4). Well locations were selected to provide circumferential coverage of the Group 3 SAs and to provide for evaluation of the Maintenance Yards impact on groundwater. Groundwater at well location G3M-92-04X, located in the TDA Maintenance Yard, is approximately 28.5 feet bgs.

Monitoring wells were sampled in July 1992 and October 1992. Only chloroform was detected in the samples collected from monitoring well G3M-92-04X. The chloroform is likely to be a laboratory contaminant since it was also detected in half of the method blanks at a similar concentration. Of the inorganic analytes detected, only manganese was detected at a concentration above its drinking water standard. However, only a secondary Maximum Contaminant Level (MCL) exists for manganese. No health-based drinking water standard exists for this analyte. Based on groundwater sampling conducted during the SI, there is no evidence that contaminants found in Maintenance Yards soils are affecting groundwater quality.

2. SSI Results

The need to investigate groundwater directly downgradient of the former waste oil tank and mogas spill was discussed during a draft FS review meeting held at Fort Devens on May 5, 1993. During the meeting it was suggested that the existing wells located in and around the area of the Maintenance Yards may not be positioned to readily detect the full impact of the tank and spill contamination sources on the groundwater.

To assess groundwater conditions near these two potential contamination sources, two additional groundwater monitoring wells, G3M-93-10X and -11X, were installed downgradient of the removed underground waste oil storage tank and mogas spill in the Cannibalization Yard, respectively (Figure 14). Table 6 presents the results for two rounds of sampling from these monitoring wells for organic and inorganic analytes. Analysis was performed for VOCs, SVOCs, TPHC, inorganics and total suspended solids (TSS). Figure 19 shows the distribution of organic and inorganic analytes detected in these two wells.

Results from Round 1 (June 1993) show no detectable concentrations of TPHC or VOCs present. The only organic contaminant detected was B2EHP at 22 $\mu g/l$ in G3M-93-10X. Historically, B2EHP has been found to be a lab contaminant. Inorganic contaminants generally exceeded background concentrations, but are likely due to suspended particulates and are not representative of groundwater quality at that location. TSS for G3M-93-10X and -11X were 206 and 1,110 milligrams per liter (mg/l), respectively.

In Round 2 (September 1993), trace concentrations of toluene (2.6 $\mu g/l$ and 1.25 $\mu g/l$ in G3M-93-10X and -11X, respectively) and tetrachloroethene (2.6 $\mu g/l$ in G3M-93-10X) were detected in the groundwater. Concentrations for both these analytes are below state and federal MCLs for drinking water. The exact source of these compounds is unknown but they are not believed to be derived from soils at the Maintenance Yards. No tetrachloroethene was detected in soil samples from borings upgradient or in the vicinity of G3M-93-10X, or in any other soil samples collected at the Maintenance Yards. Sludge samples from the excavated UST upgradient of G3M-93-10X were free of VOC contaminants. Trace concentrations of toluene (0.05 ppm and lower) were detected in only three of 67 soil samples collected in the Maintenance Yards during the SI and SSI. No toluene was detected in soil samples collected below 5 feet in depth. As in Round 1, inorganic contaminants in Round 2 unfiltered samples generally exceeded background concentrations but are due to suspended particulates and are not representative of groundwater quality at that location. Only sodium exceeded background concentration in filtered samples (13,800 and 16,800 μg/l for G3M-93-10X and -11X respectively) and is likely due to use of road salt. Detected concentrations of sodium are below state and federal guidelines for drinking water. Based on the sampling results from these two wells and the sampling conducted in the SI for the Group 3 area, there is no evidence that contaminants associated with the hot spot areas or those found in other areas of the Maintenance Yards have adversely affected groundwater quality.

C. Cold Spring Brook Surface Water and Sediment

During the SI, surface water and sediment samples were collected from Cold Spring Brook to assess potential contaminant migration from the Group 3 SAs. No organic compounds were detected in surface water and few inorganic analytes were detected. Sediment samples exhibited some organic compound contamination. The results of sediment sampling support the conclusion that contaminant migration via storm and surface water runoff is a possible source of sediment contamination in Cold Spring Brook. However, it is not possible to conclude if the organic compounds detected in the downstream sediment sample are specifically derived from the Maintenance Yards or some other location serviced by the same stormwater collection system. Figure 3 shows the stormwater drainage system layout for the Maintenance Yards. Cold Spring Brook sediments are outside the scope of this operable unit. The Army is addressing sediment issues under Area Requiring Environmental Evaluation (AREE) 70 Storm Water Discharge System.

A complete discussion of site characteristics can be found in the SI Report, April 1993, Section 4, Volume I and the FS Report, January 1994, Section 1.

VI. SUMMARY OF SITE RISKS

A Quantitative Human Health Risk Evaluation and a Preliminary Ecological Risk Evaluation were performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Maintenance Yards. The results of the Quantitative Human Health Risk Evaluation and Preliminary Ecological Risk Evaluation for the site are discussed in the following subsections. Subsection A discusses the general approach and assumptions used in performing the baseline risk assessment. Subsection B discusses the results of the baseline risk assessment. Subsection C discusses the ecological risk evaluation.

A. Baseline Risk Assessment Approach and Assumptions

The human health risk assessment followed a four step process: 1) contaminant identification, which identified those hazardous substances that, given the specifics of the site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks.

Thirty-seven contaminants of concern, listed in Table 7 and 8 (for surface and subsurface soils, respectively) of this ROD were selected for evaluation in the risk assessment. These contaminants constitute a representative subset of the more than 43 contaminants identified at the Maintenance Yards during the SI. The 37 contaminants of concern were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each of the contaminants of concern can be found in the risk evaluation detailed in the SI Report, Section 4, Volume I and the FS Report, Section 1.

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively through the development of the following hypothetical exposure pathways:

- Exposure to soil associated with crankcase releases (across the Maintenance Yards) considering:

  - Ingestion/dermal contact/inhalation with surface and subsurface soil by construction workers;
  - Ingestion/dermal contact with surface soil by long-term workers;

- Exposure to soil associated with the mogas spill (localized in the Cannibalization Yard) considering ingestion/dermal contact with surface and subsurface soils by construction workers.

These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Maintenance Yards. The site has a long history of vehicle storage and repair and will continue to be used for this purpose until the yards close. (During the development of the FS, the Army was projecting that the yards would be closed in the summer of 1996. However, due to recent redevelopment interests, this schedule may be accelerated and the Army could vacate the yards by early 1995). Following closure of the Maintenance Yards, the site and surrounding area is expected to remain commercial/industrial property based on Fort Devens Federal Land Disposition plans by the Massachusetts Government Land Bank. Reuse possibilities of the yard and adjacent Building 3713 being investigated include development of a rail yard with railroad car refurbishing facility. The area directly south of Building 3713 (DOL vehicle maintenance building) is anticipated to become part of the Devens Inland Port due to proximity to the railway. The following is a brief summary of the exposure pathways evaluated. For each pathway evaluated, an average and a reasonable maximum exposure estimate was generated corresponding to exposure to the average and the maximum concentration detected in that particular medium. A more thorough description can be found in the human health risk evaluation detailed in the SI Report, Section 4, Volume I and the FS Report, Section 1.

1. Crankcase Releases

Under current and future use, it is possible that a worker could be exposed to chemicals detected in soil if excavation were to occur. This might occur for utility repair or new building construction. It is also possible that an employee of Building 3713 could contact contaminants in surface soil during an activity such as grounds maintenance.

For the construction worker exposure scenario, it was assumed that a construction worker would be exposed to surface and subsurface soils (to a depth of 10 feet) for a period of three months (five workdays for 12 weeks). It was further assumed that the worker would be exposed through direct contact with the chemicals on his arms and hands and through the incidental ingestion of soil particles.

For the long-term worker exposure scenario, it was assumed that an employee of Building 3713 could be exposed to chemicals in the surface soil (to a depth of 2 feet) in the Maintenance Yards for a working lifetime of 25 years (250 days/year). As for the construction worker scenario, it was assumed that the worker would be exposed through direct contact on his arms and hands and incidental ingestion.

To evaluate the impact of inhalation exposure, the construction worker receptor was also evaluated for potential exposures to surface and subsurface soil contaminants (to a depth of 10 feet) via the inhalation of particulates raised during construction activities. It was assumed that contaminant concentrations in airborne particulates would be equivalent to the concentrations (arithmetic average) of contaminants in surface and subsurface soil. A range of potential Exposure Point Concentrations (EPCs) in air was then calculated. First, it was assumed that the respirable particulate concentration (PM10) in the air was equal to the National Ambient Air Quality Standard (NAAQS) of 50 μg per cubic meter ($\mu g/m^3$) annual arithmetic mean concentration. Second, a reasonable air upper-bound EPC was calculated by assuming that the PM10 concentration was equal to 150 $\mu g/m^3$, the NAAQS maximum concentration for a 24-hour period not to be exceeded more than once per year. Using the calculated air contaminant EPCs that construction workers were assumed exposed to for the entire exposure duration, and an inhalation rate of 2.5 m^3 per hour (or 20 m^3 per day divided by an 8-hour workday), risks were evaluated for the particulate inhalation pathway. Toxicity constants (i.e., inhalation cancer slope factors, and inhalation reference concentrations) were obtained from the USEPA Integration Risk Information System (IRIS) or USEPA's Health Effects Assessment Summary Tables (HEAST). Inhalation toxicity constants were used if available. Chemicals lacking inhalation slope factors or reference concentrations were evaluated using oral slope factors or oral reference doses as surrogate values. As with the other exposure routes (direct contact and incidental ingestion), a construction worker was assumed to inhale particles five days per week for a three month-long construction project.

The site worker receptor was not evaluated for the particulate inhalation pathway. Normal site worker activities are unlikely to raise dust in amounts or for periods of time which would result in significant exposures. Therefore, risks from the particulate inhalation pathway under exposure scenarios that do not include dust-producing activities can be expected to be insignificant compared to risks from other soil exposure pathways, and have not been quantified.

2. Mogas Spill

Under current and future use, it is possible that a worker could be exposed to chemicals detected in soil if excavation were to occur in the mogas spill area. This might occur for utility repair or new building construction. Because of the limited extent of this spill (represented by sampling location 44B-92-06X), long-term, repeated exposure is considered to be unlikely. Therefore, worker exposure that would be chronic in duration was not evaluated.

It was assumed that a construction worker would be exposed to chemicals in the surface and subsurface soil in the area of the mogas spill for a period of three months (5 workdays for 12 weeks). This represents a conservative assumption because repeated exposure to soil in this particular area is unlikely. It was further assumed that the worker would be exposed through direct contact with the chemicals and through the incidental ingestion of soil particles. The maximum concentration detected at any depth at sampling location 44B-92-06X was selected to represent the EPC. Most of the residual contamination associated with the mogas release was detected and reported as TPHC. This is consistent with the composition of mogas, a high-octane leaded gasoline. Because no dose-response value exists with which to evaluate the toxicity of TPHC, a surrogate dose-response value was used, that of gasoline. Details of this evaluation are covered in SI Report, Section 4, Volume I.

B. Baseline Risk Assessment Results

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the exposure level with the chemical-specific cancer factor. Cancer potency factors have been developed by USEPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g., 1×10^{-6} for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure as defined to the compound at the stated concentration. Current USEPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. Two standard approaches are commonly used for estimating cancer risks for cPAHs. The first and more conservative is the benzo(a)pyrene

[B(a)P] approach. Cancer risk estimates are made assuming that all cPAHs are as potent as benzo(a)pyrene. This standard approach was the method used by USEPA Region I at the time that the risk estimates for the Maintenance Yards were developed. The second method is the toxic equivalency factor (TEF) approach which utilizes TEFs to convert each cPAH's concentration to an equivalent concentration of benzo(a)pyrene thereby establishing a potency relative to B(a)P, which is the method which has been recently adopted for use by USEPA Region I.

The hazard index was also calculated for each pathway as USEPA's measure of the potential for non-carcinogenic health effects. A hazard quotient is calculated by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for non-carcinogenic health effects for an individual compound. Reference doses have been developed by USEPA to protect sensitive individuals over the course of a lifetime and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The hazard quotient is often expressed as a single value (e.g., 0.3) indicating the ratio of the stated exposure as defined to the RfD value (in this example, the exposure as characterized is approximately one-third of an acceptable exposure level for the given compound). The hazard quotient is only considered additive for compounds that have the same or similar toxic endpoint and the sum is referred to as the hazard index (HI). (For example: the hazard quotient for a compound known to produce liver damage should not be added to a second whose toxic endpoint is kidney damage).

Tables 9 through 16 depict the carcinogenic and non-carcinogenic risk summary for the contaminants of concern for each exposure pathway previously described for the Maintenance Yards.

1. Crankcase Releases

Risk estimates made under a construction worker exposure scenario for crankcase releases at the Maintenance Yards fell within the USEPA Superfund target risk range of 1E-4 to 1E-6 excess cancer risk for carcinogens and a target HI of 1. The cancer risk estimates ranged from 4E-6 to 5E-5, assuming exposure to AOC average and maximum concentrations (in soil to a depth of 10 feet). Impacts from inhalation exposure were determined to be negligible. The carcinogenic risks from inhalation ranged from 3E-8 to 8E-8 at the ambient particulate limits of 50 and 150 $\mu g/m^3$, respectively. The hazard indices ranged from 0.04 to 0.1. These risks are well within USEPA Superfund target risk limits.

Risk estimates made under a long-term worker exposure scenario exceeded the USEPA Superfund target risk range of 1E-4 to 1E-6 excess cancer risk for carcinogens. The cancer risk estimates ranged from 4E-3 to 7E-4, assuming exposure to AOC maximum and average concentrations (in soil to a depth of 2 feet).

The chemicals that contribute most significantly to carcinogenic risk are cPAHs, arsenic, and beryllium. (Although the cancer risk associated with long-term exposure to arsenic is 1.3×10^{-5}, the average concentration of arsenic in surface soil across the Maintenance Yards [14 ppm] is below the base-wide calculated background concentration of 21 ppm. As discussed in the SI Report, beryllium does not appear to be related to Army activity and is probably naturally occurring.) The hazard indices for both exposure scenarios are below or approximate 1.

2. Mogas Spill

Risk estimates made under a construction worker exposure scenario for the mogas spill in the Cannibalization Yard fell within the acceptable USEPA Superfund target risk range of 1E-4 to 1E-6 excess cancer risk for carcinogens. The cancer risk estimate was calculated to be 2E-6, assuming exposure to the maximum concentration found at sampling location 44B-92-06X. The HI was estimated at 1.9. The chemicals that contribute most significantly to the HI are arsenic (HI = 0.8) and TPHC (HI = 0.7). Following USEPA risk assessment guidance, when an HI exceeds 1.0, it is appropriate to consider the toxicological endpoints upon which the non-carcinogenic hazards are based and the target organs for toxicological effects. Hazard indices for individual compounds should properly be added together only if the toxicological endpoints or mechanisms of action of the compounds are similar. In the case of arsenic and TPHC, their toxicological effects would be expected to differ. The dose/response value for arsenic is based on effects to the skin (i.e., hyperpigmentation and keratosis) while the dose/response value for TPHC (gasoline) is based on reduction in body weight gain. The toxicity of gasoline is attributed primarily to Central Nervous System effects. Because the toxicological endpoints of concern for arsenic and TPHC are different, it is inappropriate to add their hazard indices together. Therefore, based on this consideration, the noncarcinogenic HI would be less than 1.0.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health and welfare. Specifically, current or future exposure to the surface soils for a working lifetime poses a threat to human health. Therefore, based on estimated human health risk, the remedial method focuses on treatment of, and/or minimizing exposure to contaminants within the top two feet such that the cancer risk estimates fall within USEPA Superfund target risk range. Contaminants which drive the risk in the top two feet of soil are predominantly cPAHs. Arsenic and beryllium also are carcinogenic compounds but only contribute approximately 5 percent to the cancer risk estimate and are believed to be naturally occurring. Therefore, based on estimated risk, remedial methods will focus on the organic contaminants present, primarily cPAHs.

C. Ecological Risk Evaluation

A preliminary ecological risk evaluation was performed for the Maintenance Yards. It was concluded that no significant habitat for resident or migratory ecological receptors occur at the site, and no rare or endangered species are known to occur in the vicinity of the Maintenance Yards. The Maintenance Yards are typically filled with parked heavy equipment vehicles and are surrounded by fence. The sites are devoid of any woody or herbaceous vegetation. Based on the lack of ecological exposure pathways, no comparison of surface soil analytes to protective contaminant level (PCL) reference values was conducted.

In conclusion, based on this evaluation, it is not likely that the contaminants found within the Maintenance Yards will impact ecological receptors at the site. Potential risks for exposure to surface water and sediments in the portion of Cold Spring Brook adjacent to this general area are being evaluated as part of the AREE 70 evaluation.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

Under its legal authorities, the Army's 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 the 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 a remedial action be cost-effective and utilize 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 these Congressional mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to aid in the development and screening of alternatives. These remedial action objectives were developed to mitigate existing and future potential threats to public health and the environment. The response objectives are:

1. Minimize direct contact/ingestion and inhalation with surface soils at the Maintenance Yards which are estimated to exceed the USEPA Superfund target range of 1E-4 to 1E-6 excess cancer risk for carcinogens.

2. Reduce off-site run-off of contaminants that might result in concentrations in excess of ambient surface water quality standards and in background concentrations in sediments.

3. Reduce or contain the source of contamination to minimize potential migration of contaminants of concern which might result in groundwater concentrations in excess of the MCLs.

B. 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 was developed for the site.

The FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long-term management. This range also included alternatives that treat the principal threats posed by the site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternatives that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

As discussed in Sections 3 and 4 of the FS, the FS identified, assessed and screened technologies and process options based on implementability, effectiveness and cost. Over 20 technologies were determined to be potentially applicable to meet the remedial response objectives. This assessment retained certain technologies and process options which led to the assembly of a number of remedial alternatives. Section 5 of the FS identified, evaluated and screened 11 remedial alternatives based on implementability, effectiveness and cost, as described in Section 300.430(e)(4) of the NCP. From this screening process, seven remedial alternatives were retained for detailed analysis. Table 17 identifies the seven alternatives that were retained through the screening process, as well as those that were eliminated from further consideration.

VIII. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each alternative as evaluated in the FS. Eleven alternatives were initially developed in the FS Report. Of the 11 alternatives, seven were retained in the FS screening step and were evaluated in detail. The seven alternatives are summarized below. Time and cost for completion of each Alternative as reported in the FS was based on the Army occupying the Maintenance Yards until the summer of 1996. A detailed tabular assessment of each alternative can be found in Table 7-1 of the FS Report.

A. Alternative 1: No-Action

- Groundwater and stormwater/sediment monitoring.

The No Action Alternative involves sampling of groundwater monitoring wells and stormwater catch basins located within and downgradient of the Maintenance Yards. There is no data indicating that off-site migration of contaminants is a problem at the Maintenance Yards. However, as a conservative measure, sampling of groundwater from six existing wells and stormwater/sediment from the two catch basins located in the Maintenance Yards would be performed yearly for a five-year period to monitor for any potential migration of contaminants, even though such migration is not likely. Analytes tested would be those tested in the SI (ABB-ES, 1993) for the Maintenance Yards. The No Action Alternative does not involve remedial actions to control migration of contaminants or institutional controls to prevent exposure to contaminated soils within the Maintenance Yards. As required by CERCLA, Alternative 1 is developed to provide a baseline for comparison with the other remedial alternatives.

Estimated Time for Restoration: not applicable
Estimated Capital Costs: $0
Estimated Operation and Maintenance Costs: $133,000
(net present worth)
Estimated Total Costs: $133,000
(net present worth, assuming 10 percent discount rate)

B. Alternative 2: Fencing/Asphalt Batching Hot Spot Areas

- Excavate hot spot areas,
- Asphalt batch hot spot area soils on site,
- Maintain fencing around the Maintenance Yards and implement deed and land use restrictions, and
- Groundwater and stormwater/sediment monitoring.

This alternative includes preventing access by maintaining fencing around the site that would prevent access thereby minimizing potential exposure pathways. Deed restrictions would act as an institutional control to ensure that the fence remained intact in the future. Excavation and cold mix asphalt batching soil from the hot spot areas in the would reduce the volume of contaminants present in the highest concentrations at the Maintenance Yards. Sampling and analysis of groundwater, stormwater and sediments as discussed in Alternative 1 would also be performed as a conservative measure to monitor for off-site migration.

The location-specific applicable or relevant and appropriate requirement (ARAR) identified for this alternative regarding wetlands protection will not be met if contaminants from the Maintenance Yards are currently migrating off-site via the stormwater system. This alternative will not reduce potential off-site runoff of contaminants in surface water from the Maintenance Yards to the wetlands. Alternative 2 would not comply with chemical-specific risk-based values because the remediation would not reduce contaminant concentrations to these levels. Remediation would limit exposure to these chemicals.

Estimated Time for Restoration: Approximately three weeks for
treatment; restoration completed prior to closing of the
Maintenance Yards
Estimated Capital Costs: $204,000
Estimated Operation and Maintenance Costs: $152,000
(net present worth)
Estimated Total Costs: $356,000
(net present worth, assuming 10 percent discount rate)

C. Alternative 3: Capping Site/Asphalt Batching Hot Spot Areas

- Excavate hot spot areas,
- Asphalt batch hot spot area soils on site,
- Cap entire site with asphalt pavement and implement deed and land use restrictions, and
- Groundwater monitoring.

This alternative entails excavating and asphalt batching the hot spot area soils on site, capping the entire site with asphalt pavement, and groundwater monitoring. Excavation and asphalt batching soil from the hot spot areas in the Cannibalization Yard would reduce the volume of contaminants present in the highest concentrations at the Maintenance Yards. Asphalt batched material from the hot spots can be used as paving base material for the cap. Capping the site with bituminous pavement would minimize potential exposure pathways, thus mitigate future risk to public health associated with the surface soil. Additionally, potential of contaminant migration off-site is minimized. Deed and land use restrictions would act as an institutional control to ensure that the cap remained intact in the future. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would also be performed as detailed in Alternative 1.

The location-specific ARAR identified for this alternative regarding wetlands protection would be met. This alternative covers the site with pavement, thus reducing potential off-site runoff of contaminants in surface water from the Maintenance Yards to the wetlands. The remedy will be designed and constructed to manage the increased surface water flow (due to paved surfaces) in a manner that will minimize impact to the adjacent wetlands. Alternative 3 would not comply with chemical-specific risk-based values because the remediation would not reduce contaminant concentrations to these levels. However, remediation would limit exposure to these chemicals.

Estimated Time for Restoration: Approximately three months; restoration completed prior to closing of the Maintenance Yards.
Estimated Capital Costs: $1,017,000
Estimated Operation and Maintenance Costs: $204,000 (net present worth)
Estimated Total Costs: $1,221,000 (net present worth, assuming 10 percent discount rate)

D. Alternative 5: Asphalt Batching Site/Asphalt Batching Hot Spot Areas

- Excavate the top two feet across the site and contaminated soils in the hot spot areas,
- Stockpile/sample/analyze soils and asphalt batch soil that exceed cleanup levels,
- Backfill excavations with stockpiled soil not found to be contaminated above site cleanup levels,
- Place asphalt batched material on the site surface, and
- Groundwater monitoring.

This alternative involves excavating the top two feet of soil across the Maintenance Yards and contaminated soils in the hot spot areas; placing excavated soils in piles at the site for sampling and analysis; asphalt batching soils which exceed site cleanup levels; and performing groundwater monitoring at the Maintenance Yards. Soil with concentrations below the cleanup criteria will be placed back in the excavation area. Asphalt batching would immobilize the contaminants exceeding cleanup levels present in the top two feet, thus minimizing direct contact/ingestion and inhalation of the soils having a carcinogenic risk. Excavation and asphalt batching soil from the hot spot areas in the Cannibalization Yard would reduce the volume of contaminants present in the highest concentrations at the Maintenance Yards. Additionally, potential of contaminant migration off-site is minimized. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would also be performed as detailed in Alternative 1.

As described in the May 1994 Final FS Addendum, a pavement wearing course placed over the batched material was not included in the FS cost as it reportedly would not be required by the regulatory agencies. However, as detailed in the Proposed Plan, the Army has chosen to add a pavement wearing course for a vehicle parking surface over the asphalt batched material as part of Alternative 5. Addition of the wearing course will ensure the integrity of the asphalt batched material as a parking lot base for current and future property use.

The location-specific ARAR identified for this alternative regarding wetlands protection would be met. This alternative covers the site with pavement, thus reduces potential off-site runoff of contaminants in surface water from the Maintenance Yards to the wetlands. The remedy will be designed and constructed to manage the increased surface water flow (due to paved surfaces) in a manner that will minimize impact to the adjacent wetlands. Alternative 5 would not comply with chemical-specific risk-based values, because remediation would not reduce contaminant concentrations to these levels. However, remediation would limit exposure by immobilizing the contaminants. Asphalt batching binds the contaminants within an asphalt matrix via chemical and physical processes. Cleanup levels are achieved by reducing the concentration of mobile contaminants.

Estimated Time for Restoration: Approximately four months for treatment; restoration completed prior to closing of the Maintenance Yards.
Estimated Capital Costs w/ wearing course: $1,865,000
Estimated Operation and Maintenance Costs: $72,000 (net present worth)
Estimated Total Costs: $1,937,000 (net present worth, assuming 10 percent discount rate)

E. Alternative 7: Bioventing Site and Hot Spot Areas

- Install and operate bioventing system to treat entire site and the hot spot soils.
- Groundwater monitoring.

This alternative includes bioventing the entire site and the hot spot areas, and performing groundwater monitoring. Details of the bioventing technology are discussed in Section 4.3 of the FS. This alternative includes initial nutrient injection by tractor; and installation of vapor extraction and injection trenches and approximately 20 bioventing wells, with associated piping, blowers, and humidifier. To prevent short circuiting of air, an asphalt pavement cap will be installed over the entire area of the Maintenance Yards. Bioventing will reduce the contaminants present in the top two feet thus minimize direct contact/ingestion and inhalation of the soils having a carcinogenic risk. Additionally, the concentrations of the contaminants of concern are reduced towards background levels in depths below two feet over the site area as well as in the hot spot areas. Because the bioventing system requires a cap to prevent short circuiting of air, the potential of contaminant migration off-site is immediately minimized upon construction of the cap. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would be performed as detailed in Alternative 1. Duration of monitoring would be for the treatment period (estimated to be 10 years).

The location-specific ARAR identified for this alternative regarding wetlands protection would be met because the wetlands would not be adversely affected by the remedial action. This alternative covers the site with pavement, thus reduces potential off-site runoff of contaminants in surface water from soils of the Maintenance Yards to the wetlands. The remedy will be designed and constructed to manage the increased surface water flow (due to paved surfaces) in a manner that will minimize impact to the adjacent wetlands. Alternative 7 would comply with the chemical-specific risk-based cleanup levels by promoting destructive biodegradation of the carcinogenic organic compounds in the top two feet of the soil and reducing the risk to within the USEPA Superfund target risk range of 1E-4 to 1E-6.

The initial injection of nutrients would need to be monitored so as to not impact either Grove Pond and its wetlands or the Grove Pond water supply wells. This would minimize human health risks associated with nitrate/nitrite in groundwater and ecological risks associated with nitrate and phosphate migrating to surface water. The MADEP Central Regional Office Water Supply Section has indicated that bioventing is not recommended within public water supply aquifer area. The concerns that they have include: high soil permeability, proximity to the Grove Pond Wells, mobilization of contaminants through nutrient addition, the time to complete degradation, and the difficulty biodegrading cPAHs. However, nutrients would be scientifically applied and monitored and are not expected to increase the solubility and migration of cPAHs.

Treatability studies were conducted to determine the effectiveness of bioventing in reducing cPAH and TPHC concentrations within the soils of the Maintenance Yards. Based on the 1993 Biological Treatability Study Report by ABB Environmental Services, Inc. (ABB-ES), bioventing does not appear to be nearly as effective as landfarming or composting and in fact may not be an effective alternative. The estimated treatment period to achieve a total cPAH concentration reduction to 7 ppm is 10 years.

Estimated Time for Restoration: up to 10 years treatment; site restored approximately eight years after closing of the Maintenance Yards.
Estimated Capital Costs: $1,070,000
Estimated Operation and Maintenance Costs: $478,000 (net present worth)
Estimated Total Costs: $1,548,000 (net present worth, assuming 10 percent discount rate)

F. Alternative 8: Landfarming Site/Excavating and Landfarming Hot Spot Areas

- Mechanically screen surface soil to remove pavement pieces.
- Excavate hot spots.
- Landfarm hot spot soils and site soils.
- Groundwater monitoring.

This alternative involves mechanically screening out the asphalt pavement pieces from surface soil, landfarming the entire area of the Maintenance Yards, excavating and landfarming the hot spot area soils that exceed cleanup levels, and performing groundwater monitoring. Landfarming will reduce the contaminants present in the top two feet thus minimize direct contact/ingestion and inhalation of the soils. Additionally, the concentration of the contaminants of concern could be reduced in depths below two feet over the site area by applying excess nutrients and water to the soil surface. To enable the yards to be used in part during remediation, design would be based on treating a portion of the yard while the other portion remained functional as a maintenance yard. After yard closure, the remaining portion would be remediated. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would be performed as detailed in Alternative 1. Duration of monitoring would be for the treatment period (estimated to be seven years assuming yard closure in the summer of 1996).

The location-specific ARAR identified for previous alternatives regarding wetlands protection is not applicable since as part of the landfarming operation, for Alternative 8, catch basins would be removed thus eliminating any flow to the wetlands. Alternative 8 would comply with the chemical-specific risk-based cleanup levels by promoting destructive biodegradation of the carcinogenic organic compounds in the top two feet of the soil and reducing the risk to within the USEPA Superfund target risk range of 1E-4 to 1E-6.

As described in Alternative 7, nutrients would need to be monitored so as to not impact either Grove Pond and its wetlands or the Grove Pond water supply wells. The MADEP Central Regional Office Water Supply Section has indicated that landfarming is not recommended within a public water supply aquifer area for the same concerns discussed in Alternative 7. Nutrients would be scientifically applied and monitored and are not expected to increase the solubility and migration of cPAHs.

Treatability testing and literature studies indicate that the TPHC and cPAH contaminants in the Maintenance Yard soils are biodegradable. Biodegradation of cPAHs in the soil is expected to occur slowly, because it was not observable within the laboratory treatment time of 69 days. However, bioremediation treatment time data indicates that cPAHs (specifically benzo(a)pyrene, which is one of the more difficult cPAHs to biodegrade) have a half-life of approximately 11.5 months. Treatability testing also indicated that approximately 50 percent of the TPHC biodegraded within the first month followed by slower reduction of the more recalcitrant TPHC compounds.
Bioremediation pilot-scale testing of the AOCs 44 and 52 soils is

recommended as a design activity. Bioremediation of the first 20 percent of the Maintenance Yards will serve as this test. Results will be used to further refine the design for treatment of the remaining 80 percent of the yards.

Estimated Time for Restoration: up to seven years treatment.
Site restored approximately five years after closing of the Maintenance Yards.
Estimated Capital Costs: $621,000
Estimated Operation and Maintenance Costs: $932,000
(net present worth)
Estimated Total Costs: $1,553,000
(net present worth, assuming 10 percent discount rate)

G. Alternative 9: Treatment of Site and Hot Spot Area Soils at a Central Soil Treatment Facility

- Excavate the top two feet across the site and contaminated soils in the hot spot areas. Mechanically screen to remove pavement pieces.

- Stockpile/sample/analyze soils and remove soil that exceeds cleanup levels off-site for treatment.

- Compost/asphalt batch soils at a central soil treatment facility or dispose/treat off-base if unsuitable for treatment on-base.

- Groundwater monitoring.

Alternative 9 includes excavating the top two feet of soil across the site and contaminated soils in the Cannibalization Yard hot spot areas; placing excavated soils in piles at the site for sampling and analysis; transporting soils which exceed site cleanup levels to a central soil treatment facility on base; and performing groundwater monitoring at the Maintenance Yards. As a pre-treatment process, surface soil in areas of the site containing bituminous pavement pieces would be mechanically screened to remove large sized fragments. Screened debris and pavement will be transported to the central soil treatment facility for crushing and asphalt batching. As evaluated in the FS, the top two feet of soil from approximately 20 percent of the yard (west end of the yard) and the Cannibalization hot spot areas would be excavated first. This phase of the remediation would serve as a pilot test for windrow composting treatment. The remaining 80 percent of the yard would continue to be utilized by the Army and would not be remediated as part of Alternative 9 until yard closure.

The proposed facility is discussed in the FS Report and the Final Siting Study Report (January 1994). The treatment methods to be used at the facility would be composting and cold mix asphalt batching. These treatment methods would result in the reuse of soils on Fort Devens. Excavated soil which is unsuitable for treatment (if any) at the central soil treatment facility will be treated and/or disposed of off-base at an approved facility.

Alternative 9 would reduce the contaminants present in the top two feet and hot spot areas excavated. Soils with contaminants exceeding cleanup levels would be removed from the site upon yard closure permitting immediate reuse of the site. This will meet the remedial objectives of minimizing direct contact/ingestion and inhalation of the soils having a carcinogenic risk. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would also be performed as detailed in Alternative 1.

The location-specific ARAR identified for this alternative regarding wetlands protection would be met. This alternative removes contaminated surface soils, thus reduces potential off-site runoff of contaminants in surface water from soils of the Maintenance Yards to the wetlands. This alternative also needs to be in compliance with the Massachusetts Hazardous Waste Rules, Location Standards for Facilities (310 CMR 30.700-30.707) regarding locating treatment facility operations on lands that are not overlaying an actual, planned, or potential public or private drinking water supply. If a groundwater recharge area does underlie a selected site, the site has to be relocated or a waiver, if appropriate, would have to be obtained under the State regulations. Details of the siting evaluation for the proposed facility are covered by the Siting Study Report. Alternative 9 would comply with the chemical-specific risk-based cleanup levels. Compliance is achieved by physically removing soils containing carcinogenic organic compounds exceeding the cleanup concentration in the top two feet of the soil thereby mitigating the risk to within the USEPA Superfund target risk range of 1E-4 to 1E-6. As described in Alternative 8, treatability testing and literature studies were conducted. They indicate that the TPHC and cPAH contaminants in the Maintenance Yard soils are biodegradable, however, biodegradation of cPAHs and recalcitrant TPHC in the soil are expected to occur slowly.

Estimated Time for Restoration: Site restoration complete approximately two months after closing of the Maintenance Yards.
Estimated Capital Costs: $2,739,000
(net present worth)
Estimated Operation and Maintenance Costs: $659,000
(net present worth)
Estimated Total Costs: $3,398,000
(net present worth, assuming 10 percent discount rate)

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum the Army is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. Specific discussion regarding this analysis is provided in Section 6.0 of the FS Report. The nine criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP.

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with ARARs** addresses whether or not a remedy will meet all of the ARARs of other federal and state environmental laws and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria.

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including

how treatment is used to address the principal threats posed by the site.

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

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

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used on the final evaluation of remedial alternatives generally after the Army has received public comment on the FS and Proposed Plan.

8. **State acceptance** addresses the state's position and key concerns related to the preferred alternative and other alternatives, and the state's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Table 7-1 of the FS Report. It should be noted that Section VIII of the ROD presents the alternatives as they appear in the FS Report. Upon the Army's selection of the preferred alternative and development of the Proposed Plan, two concerns were raised by the regulatory agencies that subsequently resulted in applying deed restrictions.

One concern was potential residential exposure to Maintenance Yard soils. The Maintenance Yards and adjacent Barnum Road area have been targeted by the Massachusetts Government Land Bank for future redevelopment as a rail/industrial area. The quantitative risk evaluation and cleanup levels for the site assume this area will remain zoned for commercial/industrial use. Since the risk evaluation was not performed considering residential exposure, an institutional control would need to be implemented to ensure that the proposed commercial/industrial use for the Maintenance Yards could not be changed to residential use. Consequently, the Army has applied a deed restriction to Alternatives 5, 7, 8 and 9 which would prohibit residential development within the Maintenance Yards.

The second concern was the lack of analytical data for soil between 2 feet and 5 feet bgs. Sampling and analyses were performed during the SI on soil depths of 0 to 2 feet, 5 to 7 feet, and 10 to 12 feet bgs (Boring G3M-92-04X was sampled at 0-2, 12-14 and 26-28 foot intervals). Soil between 2 and 5 feet was not sampled. However, contaminants were found to be typically higher in surface soil samples (0 to 2 feet) and generally absent or of lower concentration with depth which is consistent with the reported release mechanisms (leaking or spilled vehicular fluids). Contaminant concentrations in subsurface soils are unlikely to be higher than or equal to contaminant concentrations in surface soils. Risk estimates for only one of three probable soil exposure scenarios evaluated exceeded acceptable limits for carcinogens. The scenario for which risks exceeded acceptable limits assumes a working lifetime exposure (250 days/year for 25 years) of a maintenance worker to surface soil (top 2 feet). Risk estimates for construction worker scenarios (exposure to surface and subsurface soils [0 to 10 feet] for three months) were within acceptable limits.

Although risks associated with exposure to soils deeper than 2 feet are within acceptable range, the possibility exists that the entire top two feet of soil could be removed for a future land-use scenario, and the 2- to 4-foot subsurface soil would become "surface" soil. The possibility also exists that contaminants below 2 feet in depth could be at greater or similar concentrations to the surface soils. There is no analytical information available for this soil level to conclude, without a doubt, that there would be no carcinogenic risk should the top two feet of soil be removed.

Consequently, as a protective measure, the Army has applied institutional controls in the form of deed restrictions to Alternatives 5, 8 and 9. (Alternative 7, which entails treatment of subsurface soils would not require these institutional controls). The deed restrictions will prohibit the removal of the top 2-foot cover or barrier from the site to prevent any possible future long-term (working lifetime) surface soil exposure scenarios to what are presently classified as subsurface soils. Additionally, the deed restrictions will institute soil management procedures should future excavation below 2 feet occur.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. A detailed assessment of each alternative according to the nine criteria can be found in Section 6.0 of the FS Report.

1. Overall Protection of Human Health and the Environment

This criterion is one that, according to CERCLA, must be met for a remedial alternative to be chosen as the final remedy for the site. Overall Protection of Human Health and the Environment addresses how an alternative as a whole will protect human health and the environment. This includes an assessment of how public health and environmental risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Alternative 1, the No Action alternative is not protective in that it provides no remedial action, and does not impose institutional controls to prevent exposure to known contaminants. USEPA's target risk range would likely continue to be exceeded indefinitely for a site worker without some type of remediation. Alternatives 2 and 3 would eliminate risks by minimizing exposure through institutional controls (preventing access to the site and capping, respectively). Alternative 5, the Preferred Alternative, would achieve an irreversible reduction in mobility of the contaminants. It is expected that remedial action time would be approximately four months. Alternative 7, bioventing, would achieve risk reduction by contaminant destruction in approximately 10 years. However, the risk also would be eliminated by minimizing exposure upon installation of the cap prior to the start of bioremediation. (A cap is required for the bioventing technology.)

Alternative 8, landfarming, would achieve risk reduction by contaminant destruction in approximately seven years, based on yard closure by the summer of 1996 as projected by the Army during the development of the FS Report, or five years, based on potential accelerated yard closure by early 1995. Alternative 9, would be protective immediately following soil excavation, removal, and backfilling at the site, estimated to be within two months after operations in the Maintenance Yards cease. The soil would then be remediated at a central Fort Devens soil treatment facility. Alternatives 5, 7, 8 and 9 would have deed restrictions as previously discussed in this Section.

2. Compliance with ARARs

CERCLA also requires that the selected alternative comply with ARARs or a waiver be obtained if the alternative does not comply. (ARARs identified for Alternative 5 are provided in Table 19). The location-specific ARAR identified for the Maintenance Yards alternatives entails regulations that protect wetlands. Alternatives 1 and 2 will not reduce potential off-site runoff of contaminants in surface water from the Maintenance Yards to the wetlands. Alternatives 3, 5, 7, 8, and 9 all minimize the potential of off-site migration of contaminants via the stormwater system. Impacts to wetlands due to increased stormwater runoff from paved surfaces (Alternatives 2, 3, 5, and 7) would need to be considered during remediation and design of the stormwater collection system expansion. Additional location-specific ARARs for siting of hazardous waste treatment facilities would apply to the central soil treatment facility (Alternative 9).

Action-specific regulations for groundwater monitoring is an ARAR for all of the alternatives, including No Action, and would be met for all alternatives by instituting a groundwater monitoring program for each alternative. The Massachusetts Hazardous Waste Regulations contain ARARs for all remedial alternatives because of the nature of contamination at the site. Each alternative would comply with these regulations during the design and implementation of the remedial activity.

Federal and state air quality regulations would be met by all the alternatives. In particular, dust suppression would be required for alternatives involving excavation, tilling, or other activities that could generate dust.

Requirements specific to remedial actions such as soil recycling by asphalt batching, biological treatment, and land treatment would be met by the alternatives to which they apply.

Although there are no chemical-specific ARARs for establishing cleanup levels for the soils at the Maintenance Yards, risk-based cleanup criteria have been developed as a remediation goal. Alternatives 1, 2, 3, and 5 do not reduce contaminant concentrations to meet these cleanup levels; however, Alternatives 2, 3, and 5 do reduce risks by minimizing the potential for exposure to the contaminants. Alternatives 2 and 3 rely on institutional controls to minimize the exposure to surface soils. Alternatives 5, 7, 8, & 9 do not require institutional controls to minimize exposure to surface soils under current and proposed industrial use scenarios. However, they do use institutional controls to prohibit redevelopment for residential use. Alternative 5 utilizes a treatment process (asphalt batching) to immobilize the contaminants in surface soils but requires restrictions on removal of the 2-foot cover or barrier from the site to prevent any possible exposure to subsurface soils (2-foot to 5-foot level where sampling was not performed). Also soil management procedures are required should future excavation below 2 feet occur. Although there is no current evidence that suggests contaminant levels at 2 to 5 feet bgs would create a risk if uncovered, precautions in the form of deed restrictions would be taken regarding subsurface soils. Alternatives 8 and 9 would meet surface soil cleanup objectives by using either in-situ or ex-situ response actions but also have similar subsurface soil restrictions for the same reasons as Alternative 5. Alternative 7 would treat surface and subsurface soils and would not have these restrictions.

3. Long-Term Effectiveness and Permanence

This criterion evaluates the reliability of each alternative in protecting human health and the environment after the response objectives have been met, in terms of the magnitude of residual risk, the reliability of controls and the degree of certainty that they will prove successful.

Alternative 1 provides no controls or treatment to protect human health and the environment. Alternatives 2 and 3 rely mainly on institutional controls to prevent exposure to the surface soils at the Maintenance Yards. Alternatives 5, 7, 8 and 9 utilize treatment technologies (in-situ and ex-situ) for permanently immobilizing or destroying the contaminants and only use deed restrictions to prevent future conditions from developing that may result in risk to human health or the environment. All alternatives utilize groundwater monitoring for five years or for the duration of treatment at the site (whichever is longer) from the start of remediation. Groundwater monitoring is used as a means of assessing contaminant migration to the groundwater. In terms of risk reduction over the entire site, Alternatives 8 and 9 might be considered the most effective in that the target contaminants are destroyed or physically removed in lieu of immobilizing as in Alternative 5. However, biodegradation of cPAHs in the soil is expected to occur slowly (Alternatives 7, 8 and 9). Treatability testing detailed in the FS Report indicates that Alternative 7, bioventing, is not nearly as effective in reducing contaminants as landfarming (Alternative 8) or composting (component of Alternative 9) and, in fact, may not be an effective alternative.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment are three principal measures of the overall performance of an alternative. The 1986 amendments to the Superfund statute emphasize that, whenever possible, a remedy should be selected that uses a treatment process to reduce permanently the level of toxicity of contaminants at the site, the spread of contaminants away from the source of contamination, and the volume or amount of contamination at the site.

All alternatives except Alternative 1 employ treatment as an important element. Alternatives 2 and 3 will each reduce the mobility of contaminants in the hot spot areas that will become asphalt batched material and be utilized as a pavement base course. Alternative 5 would reduce the mobility of contaminants in the hot spot area soils and in the top two feet of soil across the 8.8-acre site which exceed cleanup levels. Asphalt batched material will be the residual remaining after treatment, which will be placed in a layer on the surface of the site. Alternatives 7 and 8, which utilize biological treatment technologies entirely, will reduce the toxicity, mobility, and volume of soil contaminants and will produce no residuals after treatment. Alternative 7, which will entail bioventing the entire site, will treat the top two feet and hot spot areas with potential of reducing contaminant concentrations with decreasing effectiveness down to an approximate 10-foot depth across the site.

Alternatives 8 and 9, which will entail landfarming and off-site treatment, respectively, would treat the hot spot areas and the top two feet of soil. Alternative 8 would have the potential of reducing contaminant concentrations with decreasing effectiveness at depths below 2 feet. Alternative 9 removes the hot spot area soil and the top two feet of soil which exceed cleanup criteria from the site. The off-site treatment process entails biological treatment which reduces the toxicity, mobility, and volume of soil contaminants and produces no residuals after treatment. It also uses asphalt batching on some soil which would reduce the mobility of contaminants in the soil. Asphalt batched material will be the residual after treatment which would be used as roadway material.

5. Short-Term Effectiveness

Short-term effectiveness refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until cleanup goals are achieved. This criterion also considers the duration of the remedial alternative.

Alternative 1 would have the least impact during implementation because it would not involve construction or operation. Alternative 7 would also have minimal impact on the community, workers, and environment because remediation would take place in-situ. However, increased stormwater runoff from the cap would need to be controlled to minimize impacts on the wetland which receives drainage from this area. Runoff control would also be an issue for Alternatives 3, 5, and 2 (to a lesser extent) which would place the impermeable asphalt batched material over the site. Alternatives 2, 3, 5, 8, and 9 involve excavation and handling of contaminated soils. Adverse impacts from potential worker exposure would be mitigated by protective clothing and equipment and safe work practices. Fugitive dust would be controlled by application of water during remedial actions.

Completion of remedial actions would be essentially immediate for Alternatives 2, 3, and 5 because work on site could be accomplished within a few weeks or months. As evaluated in the FS Report, on-site remedial actions associated with Alternative 9 would be completed following closure of the Maintenance Yards. Soils exceeding cleanup levels would be taken off-site to an on-base treatment facility. During the development of the FS, the Army was projecting that the yards would be closed in the summer of 1996. Based on this projection, excavation at the site would be phased (excavation of hot spots and 20 percent of the site to begin in 1994, and the remainder to begin in 1996) to accommodate the Maintenance Yards closure schedule. However, due to recent redevelopment interests, this schedule may be accelerated and the Army could vacate the yards by early 1995. It is likely that even under the accelerated schedule, soils from the site would need to be removed in phases to minimize the size requirement of the on-base treatment facility. Similarly, Alternative 8 would take up to seven years to complete, based on phased remediation (remediation of hot spots and 20 percent of the site to begin in 1994, and the remainder to begin in 1996) to accommodate the Maintenance Yards FS projected closure schedule, or five years if the yards close early in 1995. Although bioventing under Alternative 7 could begin in 1994 without major disruption to normal operations, remediation is expected to take 10 years to complete, because this type of bioremediation is not as aggressive as landfarming or composting.

6. Implementability

This criterion evaluates each alternative's ease of construction and operation; administrative feasibility; and availability of services, materials, equipment, and specialists that may required to construct and operate the technology. This criterion also considers the ease or difficulty of implementing further remedial actions at a later date, and the effect the remedial alternative would have on continued operations at the Maintenance Yards.

Alternative 1, which only includes groundwater monitoring, would be the easiest alternative to implement at the site, and would have the least impact on future remedial actions and Maintenance Yards activities. Similarly, Alternative 2 would be relatively easy to construct and would have minimal impact on activities at the site. Alternatives 3 and 5 would be easy to construct because they involve asphalt batching/paving the site, which utilize common construction practices. However, if the yards are still functional upon commencement of remedial activities, these alternatives would disrupt the yards for several weeks during stormwater collection system modification, excavation and paving. Also, if further action is warranted at a later date, the pavement may need to be removed.

Alternative 9 involves excavating and transporting soil, which are common technologies. Composting technology has been used for treatment of sewage sludge and is also applicable to biodegradable contaminants in soil. This alternative would have minimal effect on future remedial actions. However, if the yards are still functional upon commencement of remedial actions, implementation would impact Army activities by confining current operations to 80 percent of the yards until the Maintenance Yards close. An existing central soil treatment facility is not currently available; therefore, a facility will need to be sited and constructed for soils from the Maintenance Yards. Construction of a facility with sufficient capacity to treat all of the soil at once would be difficult in terms of facility siting and other regulatory issues. Operation of the facility would be relatively simple and would not require skilled operators, but may require bioremediation specialists to monitor performance and troubleshoot on an as-needed basis.

Alternatives 7 and 8 would not be difficult to construct or operate but pose aquifer protection concerns. Nutrients for Alternatives 7 and 8 would need to be monitored so as to not impact either Grove Pond and its wetlands or the Grove Pond water supply wells. Stormwater collection system expansion would also be an issue for Alternative 7, since this alternative entails capping the entire site. Also, if further action is warranted at a later date, the paving may need to be removed. Alternative 8 would have minimal impact on future actions. Alternative 7 will create similar disturbances within the yards as Alternative 3 due to the installation of the bioventing system and stormwater piping and appurtenances, and the paving of the site. Alternative 8 will create similar disturbances within the yards as Alternative 9 if the yards are still functioning upon commencement of remedial activities.

7. Cost

A comparison of the estimated total present worth costs (based on a 10 percent discount) for each alternative is as follows:

Alternative	Total Capital	Total O&M (net present worth)	Total Costs (net present worth
#1	$ 0	$ 133,000	$ 133,000
#2	$ 204,000	$ 152,000	$ 356,000
#3	$ 1,017,000	$ 204,000	$ 1,221,000
#5	$ 1,865,000	$ 72,000	$ 1,937,000
#7	$ 1,070,000	$ 478,000	$ 1,548,000
#8	$ 621,000	$ 932,000	$ 1,553,000
#9	$ 2,739,000	$ 659,000	$ 3,398,000

Capital, O&M, and present worth costs for each alternative were calculated within a range of accuracy of +50 percent to -30 percent. The alternatives with the lowest capital costs are those that include little remedial action, such as Alternatives 1, 2, and 3, and those that utilize in-situ treatment technologies (Alternatives 8 and 7). Alternatives 5 and 9, which involve excavation and treatment of soil, require larger capital. O&M costs are computed on an annual basis, and are lowest for Alternative 5, which does not require long-term maintenance. O&M costs for Alternatives 1, 2, 3, and 5 include environmental monitoring for 5 years. Alternatives 7, 8, and 9 include operation of the treatment systems and groundwater monitoring for the estimated duration of treatment.

Alternatives 1, 2 and 3 which have low capital costs, also have lower total present worth cost. Alternatives 7 and 8 have high present worth costs due to longer treatment durations; Alternative 5 has high costs due to treatment costs. Alternative 9 is the most expensive due to treatment facility construction and extended treatment duration.

8. State Acceptance

MADEP has been actively involved with the Maintenance Yards during the development of the SI, FS and this ROD.

MADEP provided comments on the Army's Preferred Alternative during the public hearing. In summary, MADEP believes that Alternative 5 is the most protective of the proposed alternatives. MADEP expressed the desire that the Army excavate any grossly contaminated soil that is encountered, besides the top two feet and the two hot spot areas. These would include any areas where previous sampling has shown that soil below 2 feet was contaminated above cleanup levels. MADEP also requested that the Army review their spill management plan for the Maintenance Yards to ensure that in the interim before remediation, there is a good management plan for spills and that the spill containment pad is utilized to minimize the likelihood of further contaminating soils.

A summary of these and other MADEP comments, and the Army's responses, are included in the Responsiveness Summary attached as Appendix C to this ROD. The Commonwealth of Massachusetts has indicated it's support for the remedy and the concurrence letter is located in Appendix D of this ROD.

9. Community Acceptance

The comments received by the community and local governments are summarized and responded to in the Responsiveness Summary attached to the ROD as Appendix C.

Comments were received from a merchant and two town officials from the town of Ayer and representative of the Fort Devens Reuse Center. Comments generally supported the Army's choice of the selected remedy.

X. THE SELECTED REMEDY

The remedy selected to address the contamination identified at the Maintenance Yards is Alternative 5, Asphalt Batching the Site/Asphalt Batching the Hot Spot Areas. The remedy includes the following components: excavating the top two feet of soil across the site and the two hot spot areas; placing excavated soils in piles at the site for sampling and analysis; cold mix asphalt batching soils which exceed site cleanup levels; backfilling site excavations with stockpiled soil not found to be contaminated above cleanup levels and with the cold mix asphalt batched material; expanding the existing stormwater collection system including construction of detention pond(s); and applying a pavement wearing course for a vehicle parking surface over the Maintenance Yards; performing groundwater monitoring; and instituting deed restrictions to: prohibit residential development/use of the Maintenance Yards, minimize the possibility of long-term (working lifetime) exposure to subsurface soils, and require management of soils resulting from construction related activities.

The approximate cleanup timeframe for the selected remedy is four months following commencement of remedial activities.

A. Soil Cleanup Levels

The FS investigated several methods for establishing a cleanup level to achieve a cancer risk that is within the USEPA Superfund target risk range. During a Draft FS Report review meeting with USEPA and MADEP, a cleanup level of 7 ppm average total cPAHs was selected for the FS Report from the computed target range. This value was arrived at assuming all cPAHs are as potent as benzo(a)pyrene (the B[a]P approach), which was USEPA Region I's standard approach for computing risk estimates for cPAHs at the time the quantitative risk evaluation was performed for the Maintenance Yards. This cleanup level for known and suspect carcinogens (Classes A, B, and C compounds) achieves a 10^{-4} excess cancer risk level considering exposures via dermal contact and incidental ingestion. (Although inhalation is a potential exposure route, risk estimates indicate that it is an insignificant contributor to the overall risk at the Maintenance Yards).

Since the development of the target level for cPAHs, USEPA views two critical assumptions differently than at the time of the FS. The first assumption involves the use of the dermal exposure route. Although benzo(a)pyrene has been known to cause skin cancer, USEPA Region I no longer includes the dermal route of exposure when developing target levels for cPAHs because of inconclusive data. The second assumption involves assessing the relative toxicity of the cPAHs. The toxic equivalency factor (TEF) approach involves applying TEFs to cPAHs based on each compounds relative potency to that of benzo(a)pyrene. Toxicologists within USEPA Region I have reviewed the TEF approach in light of USEPA provisional guidance and have recently accepted the TEF method. To determine the effects of these assumptions on the target levels presented in the FS, target levels were recalculated excluding the dermal route of exposure and applying the relative potency factors (TEF approach). Results are listed in the following table.

SOIL CLEANUP LEVELS FOR cPAHs
VARIOUS COMPUTATION APPROACHES

Approach	Target Level (ppm) at 10^{-4} Risk Average Total cPAH Concentrations: Ingestion/Dermal Routes	Ingestion Route Only
USEPA B(a)P approach	6.4	78
USEPA TEF approach	23	1300

USEPA Region I has recently formally accepted the TEF approach for new RI/FS sites where risk assessment is not substantially underway or where the USEPA remedial project manager decides to reevaluate risk with the new approach. However, MADEP's acceptance of the NCP risk assessment approach for the site is contingent upon the dermal exposure pathway being utilized and the TEF approach not being used, such that the cleanup level is consistent with the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000 (November 19, 1994). Consequently, the cleanup level at the Maintenance Yards will be 7 ppm average total cPAHs as was selected in the FS Report.

It is noted that the CERCLA risk approach to risk assessments does not measure risk resulting from TPHC, which are a combination of a number of compounds often including cPAH contaminants. Although not required to do so under CERCLA or the NCP, the Army has agreed, with MADEP approval, to establish TPHC cleanup levels for soils at the Maintenance Yards based on guidance from the MCP. The MCP establishes 500 ppm as the cleanup criteria for TPHC using MCP Method 1 and S-1 Soil and GW-1 groundwater categories. As noted in the footnote to Table 2 in the MCP regulations (310 CMR 40.0975(6)(a)), entitled "MCP Method 1: Soil Category S-1 Standards", the Method 1 S-1 soil standard for TPHC does not apply to benzene, toluene, ethylbenzene, and xylene (BTEX) compounds or specific PAH compounds. Therefore, the S-1 soil standard for TPHC is used for AOC 44 and 52 soils in conjunction with the site-specific cleanup level for cPAHs identified above. Benzene was not detected in AOC 44 and 52 soil. As reported in Appendix A of the FS, the risks associated with toluene, ethylbenzene, and xylenes in AOC 44 and 52 soils fall well outside the Superfund target HI of one; assuming worker exposure to the maximum detected concentrations of these compounds results in hazard quotients on the order of 3×10^{-7} or less. Use of the TPHC soil standard under the Method 1, S-1 soil and GW-1 groundwater categories results in the most health-protective of the Method 1 standards. This is because S-1 soil is, by definition, the most accessible and therefore presents the greatest potential for exposure, and GW-1 groundwater is assumed to be potable.

Based on the Baseline Risk Evaluation in the FS Report, exposure to non-carcinogenic Classes D and E compounds are at an acceptable level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime. Consequently no cleanup levels for these compounds were derived.

The cPAH and TPHC cleanup levels of 7 ppm average total cPAHs and 500 ppm TPHC must be met at the completion of the remedial action within the present fenced surface area of the Maintenance Yards to a two-foot depth and in the two hot spot surface and subsurface soil areas identified as the mogas spill area and the leaking UST area. The cleanup level for cPAHs attains USEPA's risk management goal for remedial actions and has been determined by USEPA to be protective of human health and the environment. The cleanup level for TPHC meets the requirement of the MADEP for this contaminant.

B. Description of Remedial Components

The following is a description of the remedial components of the selected remedy for the Maintenance Yards:

- Excavate surface soil (top two feet across the site),
- Excavate the two hot spot areas,
- Stockpile soils for sampling and analysis,
- Cold mix asphalt batch soils exceeding site cleanup levels,
- Backfill excavations with uncontaminated stockpiled soil and with the asphalt batched material,
- Expand the existing stormwater collection system,
- Apply a pavement wearing course,
- Perform groundwater monitoring.
- Institute deed restrictions to prohibit residential development/use of the Maintenance Yards, minimize the possibility of long-term (working lifetime) exposure to subsurface soils, and require management of soils resulting from construction related activities.

Excavate Surface Soils: Prior to commencement of the remedial design, predesign test pits will be excavated to better predict the typical soil characteristics (color, texture, and presence of pavement) and layers containing cPAHs that may be encountered when the top 2 feet of soil is removed during remediation. This preview will enable planned optimization of soil excavation and handling activities during remedial action; improve estimates on the volume of soils that will require treatment; and provide soil gradation data for the asphalt batching design. Details of these test pitting activities will be provided in a predesign work plan.

It is proposed that the Maintenance Yards surface soils be excavated in 6-inch layers down to a 2-foot depth, and stockpiled and sampled in 100-cy batches. Layers of other thickness may be excavated depending on the observed thickness of layers in the test pits. It is believed that layers with pavement will contain the highest concentration of cPAHs. If proven to be true from test pit results, this soil will be stockpiled separately. Soils will be initially screened for visible and olfactory evidence of waste material or overtly contaminated soils. Soils observed to contain broken pieces of pavement will be segregated as cPAH-contaminated soil in maximum 100 cy piles and kept in separate piles for analytical screening. Soils with fuel odor or evidence of petroleum contamination will also be separated from soil with no evidence of contamination.

All soil to a 2-foot depth will be excavated, stockpiled and sampled regardless of physical evidence of contamination. This amounts to a total unexcavated soil volume of approximately 28,400 cy of soil. A topographic survey, to be performed as a predesign activity, will more accurately quantify the soil volume to be excavated. Excavation sequence of surface soils and installation of utilities will be detailed in the design and/or Contractors work plan.

An air monitoring program will be established to assess air quality during all excavation and soil handling activities. Air monitoring will ensure that total suspended particulates (TSPs) do not exceed predetermined action levels. Details of this program will be provided in the remedial design.

<u>Excavate Hot Spot Areas</u>: Trench exploration will first be performed to include or exclude the boring 44B-93-10X area as the potential mogas spill area. To initially identify the potential hot spot area, trenches will be excavated over 44B-93-10X. Headspace screening by photoionization detector (PID) or NDIR Modified Method 418.1 screening on the trench sidewalls. This area will be excluded from further investigation and excavation if there is no detection of volatiles or if TPHC is not over 500 ppm.

Trenches will also be excavated over boring 44B-92-06X to initially define the extent of the hot spot area detected in this area. Headspace and NDIR screening will be performed on sidewalls and/or bottom of trench if staining is not evident.

The hot spot will then be fully excavated to the approximate dimensions as determined by the trench screening and excavation will continue until laboratory analysis reveals concentrations less than 500 ppm.

The hot spot area around the waste oil UST will also be excavated. This area has been previously over-excavated and backfilled with clean soil. The clean backfill soil in the over-excavated area will be excavated, segregated and sampled to ensure clean backfill and native soil are clearly distinguished. Upon reaching native soil, excavation and sampling for TPHC will be continue until laboratory analysis reveals concentrations less than 500 ppm.

Any other "hot spot areas" observed during the excavation of the surface soils will be excavated, segregated, stockpiled and sampled in a similar manner as described in this ROD.

Depth of contamination is unknown in the hot spot areas. For planning purposes, contamination was assumed to extend to an average 17-foot depth. Details of the trenching, excavation and sampling for excavating the hot spot areas will be provided in the remedial design.

Stockpiling and Sampling and Analysis: Soils excavated from hot spot areas will be placed on, and covered with, a minimum 8-mil polyethylene tarp to prevent mixing of TPHC contaminated soils with clean soils. Surface soils will also be placed on polyethylene tarpaulins if there is potential for soil to contaminate clean soil. All stockpiling of soils will be restricted to the areas at the Maintenance Yards to be detailed in the design. Excavation work sequence in relation to stockpiling methods will be detailed in the Contractor's work plan. Stockpiling and analytical work will be done concurrently to minimize the duration that soils are left on-site. Jersey barriers or concrete blocks may be used to separate piles if required.

Sampling and analysis to classify stockpiled soils from hot spot and surface soil excavations as acceptable for reuse at the site without treatment, will require collecting five soil subsamples and field compositing to yield one sample for every 100 cy of stockpiled soil or for every segregated stockpile, whichever smaller in volume. Samples from hot spot stockpiled soils will be analyzed in the field laboratory for TPHC using the Modified Method 418.1 (NDIR). Samples from surface soil stockpiled soils will be analyzed in the field laboratory for TPHC using the Modified Method 418.1 (NDIR) and for the following seven cPAHs using Modified Method 8270 (GC/MS) by a field laboratory:

Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Chrysene
Dibenzo(a,h)anthracene
Indeno(1,2,3-cd)pyrene

All analytical samples will be screened through a No. 20 sieve at the laboratory to remove any pavement particles down to the size of coarse sand prior to performing the analysis.

Asphalt Batch Soils Exceeding Site Cleanup Levels: Stockpiled soils with contaminants exceeding an average total cPAH concentration of 7 ppm and 500 ppm TPHC, will be cold mix asphalt batched on-site. Asphalt batching has been accepted by the regulators as a technology that is successful at immobilizing compounds common in petroleum releases. As detailed in the FS Report, leaching of contaminants from asphalt batched soils has been evaluated (with favorable results) by sampling groundwater wells near stockpiled treated soils and by performing laboratory leaching tests. Coupled with the formation of a relatively impermeable barrier, the chemical and physical fixation of contaminants by asphalt batching is considered to be protective of human health and effective in minimizing contaminant migration to the groundwater. Asphalt batching site soils will immobilize the contaminants exceeding cleanup levels present in the top two feet, thus minimizing direct contact/ingestion of the soils having a carcinogenic risk. Asphalt batching the hot spot areas in the Cannibalization Yard will reduce the mobility of organic contaminants present in the highest concentrations at the site.

The cold mix asphalt batching technology is performed at ambient temperatures and entails recycling petroleum contaminated soil into a bituminous paving or road base product. Excavated soils may be processed through a crusher or screen to produce a physically uniform soil material. The soil may then be blended with other aggregate (if required due to existing soil conditions) and asphalt emulsion in a pugmill. Soil gradation results and the pavement design will dictate soil preparation needs. The finished product will be used as the base or subbase material for parking lot construction over the Maintenance Yards. For costing purposes the FS Report assumed that approximately 17,000 cu yds (excavated volume) of surface and hot spot soils will require asphalt batching. This estimate may be refined upon completion of the predesign test pit field work.

Backfill Excavations: Excavations will be backfilled with "clean" stockpiled soil and with the soils which have been asphalt batched. Site soil will be classified as "clean" if it meets the cleanup criteria of 500 ppm for TPHC and the risk-based cleanup criteria of 7 ppm (average) for total cPAHs. This soil will be used to refill a portion of the excavated areas at the Maintenance Yards. Preferably, upon receipt of analytical results, the soil will be immediately backfilled into designated areas. If backfill areas are not available, the soil will be stored in designated piles separate from other soil for later use as on-site backfill. The asphalt batched material will then be spread and rolled to the thickness and contours to be detailed in the final design and will serve as the subbase or base course for the paved parking lot.

As an additional benefit, the asphalt batched material serves as a low-permeable barrier minimizing surface water infiltration through site soils, thereby providing greater aquifer protection. The quantity of off-site aggregate and pavement required for the parking lot construction will be estimated in the remedial design based on pavement design loads, soil gradation test results, a refined estimate of the soil requiring asphalt batching, site grading, and other design details. Contingencies will also be considered for pavement design should soils requiring asphalt batching be more and less than anticipated.

Expand the Existing Stormwater Collection System: Construction of the paved parking lot at the Maintenance Yards will increase the amount of stormwater runoff during rain events. Therefore, the selected remedy will include expansion of the existing stormwater collection system including installation of additional catch basins, additional stormwater piping, and oil and grease traps as required. Additionally, potential impacts to wetlands at stormwater outfalls will be investigated and, as needed, minimized by construction of detention basins and flow reducers.

Prior to the design of this system, a predesign investigation of the existing stormwater system will be performed. To enable developing a representative model of the system, information relating to the existing storm drainage system will be reviewed and field inspections will be made as necessary. The model will be used to compute the current stormwater runoff flow and predict future stormwater flow after construction of the parking lot. It will also be used as a design tool by predicting the impact of detention pond(s) and other flow restriction devices on system flows, enabling design criteria to be met. Details of the predesign investigation work and the stormwater system expansion will be provided in a predesign work plan and the remedial design respectively.

Apply a Pavement Wearing Course: A paving wearing course is a top coat of pavement that is placed over a pavement base course to provide a smooth, durable surface in high traffic areas. A pavement wearing course placed over the batched material is not a required remedial component for selected remedy. However, the Army has chosen to add a pavement wearing course for a vehicle parking surface over the asphalt batched material as an ancillary component. Addition of the wearing course will ensure the integrity of the asphalt batched material as a parking lot base for current and future property use.

Perform Groundwater Monitoring: The objective of groundwater monitoring is to provide assurance to the public and the regulatory agencies that the groundwater in the aquifer underlying the facility remains unaffected by past Maintenance Yard activities and that it has not been impacted by the remedial activities. Sampling and analysis of groundwater from existing wells at the Maintenance Yards will be performed yearly for a period of five years upon commencement of remedial activities. Sampling will be for the same analytes tested for during the SI. Details of this program will be provided in the remedial design.

Institute Deed Restrictions: Institutional controls in the form of deed restrictions will be implemented to prevent potential circumstances which may result in risk of harm to health, safety, public welfare or the environment. These restrictions will include:

1. No residential development/use of the Maintenance Yards will be permitted. The quantitative risk evaluation and established cleanup level assume the property will remain zoned for commercial/industrial use.

2. Removal of the 2-foot cover or an asphaltic barrier from the Maintenance Yards will be prohibited to prevent surface soil exposure to existing subsurface soils (2-foot to 5-foot level). This deed restriction will be implemented as a precautionary measure to minimize the possibility of long-term (working lifetime) exposure to subsurface soils. This restriction will not apply to excavations undertaken in connection with construction of buildings or other structures, utilities, infrastructures or any other construction related purpose where the cover is penetrated and/or temporarily removed and protection from long-term exposure to subsurface soil is not jeopardized. To comply with this deed restriction, the 2-foot layer of cover material (which may consist of one or combination of "clean" site soil used as backfill, asphalt batched material, off-site soils/aggregate and bituminous pavement) will remain over the subsurface soil (existing 2- to 5-foot soil level) to minimize direct contact/ingestion to the present subsurface soils. The continuity of the paved surface need not be maintained providing the cover thickness of 2 feet is provided. As an alternative, a continuous and maintained paved surface which would prevent

exposure to subsurface soils could be substituted for the 2-foot thick cover.

This restriction also would not apply to excavation and use that is within the scope of any authorized response action. The deed restriction may be nullified, as approved by the regulatory agencies, should there be future evidence showing that contaminant levels within the 2- to 5-foot soil zone are below site surface soil cleanup levels.

3. Excavation below 2 feet at the Maintenance Yards, subsequent to completion of the remedial action established in this ROD, will require:

a. Development and implementation of a Health and Safety Plan for the work area; and

b. Development and implementation of a Sampling and Analysis Plan for management of the excavated soils in accordance with the following:

Where reuse of soil within the Maintenance Yards is intended, sampling and analysis of stockpiled soils excavated below 2 feet will follow criteria detailed in this ROD for hot spot area soils. Soils with contaminants exceeding the 500 ppm cleanup level for TPHC will be treated in a manner consistent with this ROD. Soils with contaminants below the established cleanup level may be returned to the excavation. Soil excavated below 2 feet but returned to the top 2 feet (as surface soil) must also be sampled, analyzed and, if required, treated for cPAH contaminants as detailed in this ROD.

Where reuse of soil outside the Maintenance Yards is intended, sampling/analysis and action levels for stockpiled soils excavated below 2 feet will follow criteria governed by the regulations or policies in effect for the final disposal area.

C. Other Components of the Selected Remedy

To assure that the remedial action continues to protect human health and the environment, and to the extent required by law, USEPA will review the operable unit at least once every five years after the initiation of remedial action if any hazardous substances, pollutants or contaminants remain at the site. USEPA will also review the operable unit before Fort Devens is proposed for deletion from the NPL.

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Maintenance Yards is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs and is cost-effective. The selected remedy also satisfies the statutory preference for treatment which permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element. Additionally, the selected remedy utilizes alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

A. The Selected Remedy is Protective of Human Health and the Environment

The remedy at the Maintenance Yards will permanently reduce the risks posed to human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls, and institutional controls. Specifically, the risk presented by the Maintenance Yards is from long-term (working lifetime) direct contact/ingestion of the surface soil containing cPAHs. Therefore, the selected remedy uses asphalt batching to immobilize these carcinogenic contaminants, minimizing the toxic effects on human health and the environment and the potential for off-site run-off of contaminants. Additionally, asphalt batching soils from the hot spot areas will reduce the mobility of TPHC contaminants present in the highest concentrations at the site. The stormwater system expansion and stormwater flow controls will be used as engineering controls to manage increased stormwater runoff, resulting from the application of the low-impermeable (pavement) surface. Institutional controls are not needed to minimize human health risk, but will be utilized as a precautionary measure to prohibit residential development, minimize the possibility of long-term (working lifetime) exposure to subsurface soils, and to require management of soils resulting from construction related activities.

Moreover, the selected remedy will achieve potential human health risk levels that attain the 10^{-4} to 10^{-6} incremental cancer risk range for cPAHs.

B. The Selected Remedy Attains ARARs

This remedy will attain all applicable or relevant and appropriate federal and state requirements that apply to the Site. No waivers are required. ARARs for the Site were identified and discussed in the FS (Sections 1.7 and 6). Table 19, in Appendix B of this ROD, presents a tabular summary of the

ARARs for the selected remedy, including the regulatory citation, a brief summary of the requirement, and how it will be attained. The following is a summary of the key ARARs and how they pertain to the selected remedy:

Location Specific

Federal Standards:

National Environmental Policy Act; [40 CFR Part 6]. This ARAR is applicable and pertains to the protection of wetlands. It requires that Federal agencies minimize the degradation, loss, or destruction of wetlands, and preserve and enhance natural and beneficial values of wetlands under Executive Orders 11990 and 11988. The wetlands adjacent to the Maintenance Yards may currently be impacted by surface water runoff via the storm water system. The selected alternative covers the site with pavement, thus reducing potential off-site runoff of contaminants in surface water from soils at the Maintenance Yards to the wetlands. The remedy will also be designed and constructed to manage the increased flow from the paved surface in a manner that will minimize impact to adjacent wetlands.

Action Specific

State Standards:

Massachusetts Air Pollution Control Regulations; [310 CMR 6.00 - 7.00]. This ARAR is applicable and pertains to particulate matter standards (Section 6.0) and application of toxic air pollutant control program requirements. Specifically, Section 6.04 provides ambient air quality criteria such as particulate matter standards which is pertinent to the Maintenance Yards remedial activity. As a minimum, respirable particulate matter (PM_{10}) for treatment and excavation activities must be maintained at an annual mean arithmetic concentration of 50 $\mu g/m^3$ and a maximum 24-hour concentration of 150 $\mu g/m^3$. Section 7.02 provides emissions limitations from facilities and operations and requires BACT. The emissions limits for particulate matter and fugitive emissions at the Maintenance Yards will be managed through engineering controls during excavation and treatment activities.

Massachusetts Hazardous Waste Management Rules (MHWMR) Identification and Listing of Hazardous Wastes [310 CMR 30.100]. This ARAR is applicable. The wastes found at this site were determined not to be characteristic hazardous wastes; however, waste oil is a listed hazardous waste under this rule.

Massachusetts Hazardous Waste Management Rules (MHWMR) Provisions for Recyclable Material and for Waste Oil; [310 CMR 30.200] This ARAR is applicable and contains procedural and substantive requirements for handling regulated recyclable materials. The substantive requirements include preventing and reporting releases to the environment, proper maintenance of treatment and control systems, and handling of regulated recyclable materials. Asphalt batching of soil on site will comply with the substantive requirements of this regulation.

Massachusetts Hazardous Waste Management Rules (MHWMR) Waste Piles; [310 CMR 30.640 - 30.649]. This ARAR is applicable and pertains to waste pile facilities. A waste pile facility must install a liner, provide a leachate collection system, provide a run-on/run-off control system, comply with the groundwater monitoring requirements, perform inspections, and close the facility properly. These requirements will be addressed in the design of an area for stockpiling of wastes for on-site treatment.

Massachusetts Hazardous Waste Management Rules (MHWMR) Groundwater Protection; [310 CMR 30.660 - 30.679]. This ARAR is Relevant and Appropriate and pertains to groundwater monitoring that is conducted during and following remedial actions. Concentration limits for the hazardous constituents are specified in 310 CMR 30.667. There is no current evidence that contaminants associated with the Maintenance Yards have adversely affected the groundwater quality. However, groundwater monitoring will be conducted as a component of the remedy specifically to provide assurance to the public and the regulatory agencies that the groundwater in the aquifer underlying the facility remains unaffected by past Maintenance Yard activities and that it has not been impacted by the remedial activities.

The following guidance will also be considered (TBCs) during implementation of the remedial action:

Standards for Analytical Data for Remedial Response Action [WSC-300-89] This "To Be Considered" policy describes the minimum standards for analytical data submitted to the MADEP. All sampling plans will be designed with consideration of the analytical methods provided in this non-promulgated advisory.

C. The Selected Remedial Action is Cost-Effective

In the Army's judgment, the selected remedy is cost effective, i.e., the remedy affords overall effectiveness proportional to its costs. In selecting this remedy, once the Army identified alternatives that are protective of human health and the environment and that attain, or, as appropriate, waive ARARs, the Army evaluated the overall effectiveness of each alternative by assessing the relevant three criteria -- long- term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs. The costs of this remedial alternative are specified in Table 18.

The Army, based upon USEPA guidance, evaluates cost-effectiveness only in selecting a remedy from among protective alternatives. Alternatives 1, 2, and 3 in the FS are all less costly than the selected remedy. However, each of those alternatives allows the surface soils to continue to pose an unacceptable risk for an excessive time period. This is because each of these alternatives relies solely on institutional controls in the area where risk is demonstrated to be outside USEPA's acceptable risk range. Since these alternatives are not sufficiently protective, their cost-effectiveness cannot be analyzed.

Alternative 9 in the FS is the most expensive alternative and also the least cost-effective, assuming for comparison that soils treated at the facility would be limited to Maintenance Yards soils. Any enhanced protectiveness at the Maintenance Yards provided by Alternative 9 is not proportional to its additional costs. Institutional controls would still be required as a precautionary measure to prevent future conditions from developing that may result in risk to human health or the environment. Additionally, Alternative 9 would not have the benefit of providing greater aquifer protection as does the selected remedy through construction of the low-permeable (asphalt batched soil) layer.

Alternatives 7 and 8 are less expensive than the selected remedy, but may actually be less cost effective than the selected remedy. Alternative 7, bioventing, would require an estimated treatment time of 10 years, and based on FS treatability testing may not be effective at cPAH reduction. Alternative 8, Landfarming, would require 5 to 7 years (depending upon the timing of the closure of the Maintenance Yards). It would present a greater short-term exposure to contaminants, and would not have the benefit of providing greater aquifer protection as does the selected remedy.

D. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Army identified those alternatives that attain or, as appropriate, waive ARARs and that are protective of human health and the environment, the Army identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasizes long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considers the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

The Army believes that the selected remedy and Alternatives 7, 8, and 9 compare similarly in terms of long-term effectiveness and permanence, and reduction of toxicity, mobility, or volume through treatment. The selected remedy and Alternatives 7, 8, and 9 all use treatment technologies to permanently and irreversibly immobilize or destroy cPAHs in the surface soils. The selected remedy does not reduce risk by destroying or removing organic contaminants as do the other three alternatives. However, the selected remedy does immobilize the contaminants in the asphalt batching process and the resultant material is used on-site as pavement. As a side benefit, this low-permeable pavement layer provides greater long-term protection of groundwater. Alternative 7 also involves construction of a pavement surface (low-permeable layer) but requires application of nutrients to the soil which is a potential threat to the aquifer below the site.

The selected remedy requires the shortest period of time (four months) for remediation, thereby potentially impacting the surrounding community, workers and the environment for the least duration. Alternative 7 would also have minimal impact on the community, workers and environment because remediation would take place in-situ. However, remediation would take approximately 10 years and would require application of nutrients to the soil which would be a potential threat to the aquifer during this entire period. Alternative 8 requires five to seven years of remediation at the site depending upon the timing of the Maintenance Yard closure. Alternative 9 requires approximately three months on-site activity and up to four years for biodegradation of contaminants at a central soil treatment facility.

The selected remedy is the easiest to implement, involving common construction practices. Alternative 9 requires siting and construction of an off-site soil treatment facility which could be difficult in terms of facility siting and other regulatory issues including reuse of treated soils in a manner compliant with current regulations. Alternatives 7 and 8 would not be difficult to construct or operate, but pose difficulties administratively due to aquifer protection concerns. The selected remedy is less expensive than Alternative 9 but more expensive than Alternatives 7 and 8. As previously discussed in Paragraph C, any enhanced protectiveness at the Maintenance Yards provided by Alternative 9 is not proportional to the required additional $1,461,000 expenditures.

As described in more detail in the Responsiveness Summary, state and community comments generally support the Army's choice of the selected remedy. Considering such support, and based on the above analysis of statutory criteria, the Army believes that the selected remedy utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable.

E. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The principal element of the selected remedy is source control. This element addresses the primary threat at the Maintenance Yards, which is the threat of ingestion or contact with contaminated surface soils. The selected remedy satisfies the statutory preference for treatment as a principal element by treating the contaminants in the surface soils and hot spot areas, thereby providing significant reduction in the toxicity and mobility of the contaminants. Therefore, the selected remedy satisfies the statutory preference for treatment as a principal element.

XII. DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Army presented a proposed plan (preferred alternative) for remediation of the site on May 16, 1994. The components of the preferred alternative included:

- Excavating surface soil (top two feet across the site),
- Excavating the two hot spot areas,
- Stockpiling soils for sampling and analysis,
- Cold mix asphalt batching soils exceeding site cleanup levels,
- Backfilling excavations with stockpiled soil not found to be contaminated above cleanup levels and with the asphalt batched material,
- Expanding the existing stormwater collection system,
- Applying a pavement wearing course,
- Performing groundwater monitoring.
- Instituting deed restrictions to either prohibit removal of the top 2-foot cover or requiring a physical barrier over the present subsurface soils (existing 2- to 5-foot soil level).

The selected remedy contains no significant changes from that proposed in the Proposed Plan. It is noted however, that additional deed restrictions have been added. The additional deed restrictions prohibit residential use and require sampling, analysis and management of soils resulting from construction related excavations.

An additional change concerns the computed acreage of the Maintenance Yards. The Proposed Plan states that the area of the Maintenance Yards is approximately 8.8 acres. A topographic survey of the yards performed in July 1994 revealed that the total area is 8.1 acres (7.8 acres excluding the spill containment basin area).

It is also noted that the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) conducted a survey in the fall of 1994 to establish the history of radioactive sources at Fort Devens. The locations and activities of sources, and the uses or accidents that may have contaminated areas at Fort Devens were presented by USACHPPM in a November 7, 1994 report entitled "Industrial Radiation Historical Data Review No. 27-43-E3QX-95 Fort Devens Massachusetts." This report identified the Cannibalization Yard and the TDA Maintenance Yard as areas with potential radioactive contamination. Vehicles and equipment with radium dials, depleted uranium armor, and radioluminescent paint were once stored in the TDA Maintenance and Cannibalization Yards before being dismantled in the Cannibalization Yard for usable parts. To determine if any release of radioactive material occurred, a scanning survey and soil sampling program were conducted from December 11 to 15, 1994. Scanning and sampling of surface soils were performed in accordance with the "Final Radiological Work Plan, AOCs 44 & 52, Barnum Road Maintenance Yards, Fort Devens, Massachusetts", dated December 14, 1994. Investigation results are detailed in the "Final Radiological

Status Report For Cannibalization Yard & TDA Maintenance Yard, Fort Devens, Massachusetts" dated March 1995. Results show that the Cannibalization Yard and TDA Maintenance Yard were well below the levels which pose a risk, and therefore meet the requirements for unrestricted use in accordance with U.S. Nuclear Regulatory Commission guidelines. The USACHPPM data review report, the radiological work plan and the final radiological status report can be found in the Administrative Record.

XIII. STATE ROLE

The Commonwealth of Massachusetts has reviewed the various alternatives and has concurred with the selected remedy for the Maintenance Yards. The state has also reviewed the SI, Risk Evaluation and FS to determine if the selected remedy is in compliance with applicable or relevant and appropriate state environmental laws and regulations. A copy of the declaration of concurrence is attached as Appendix D.

APPENDIX A

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY

APPENDIX A

FIGURES

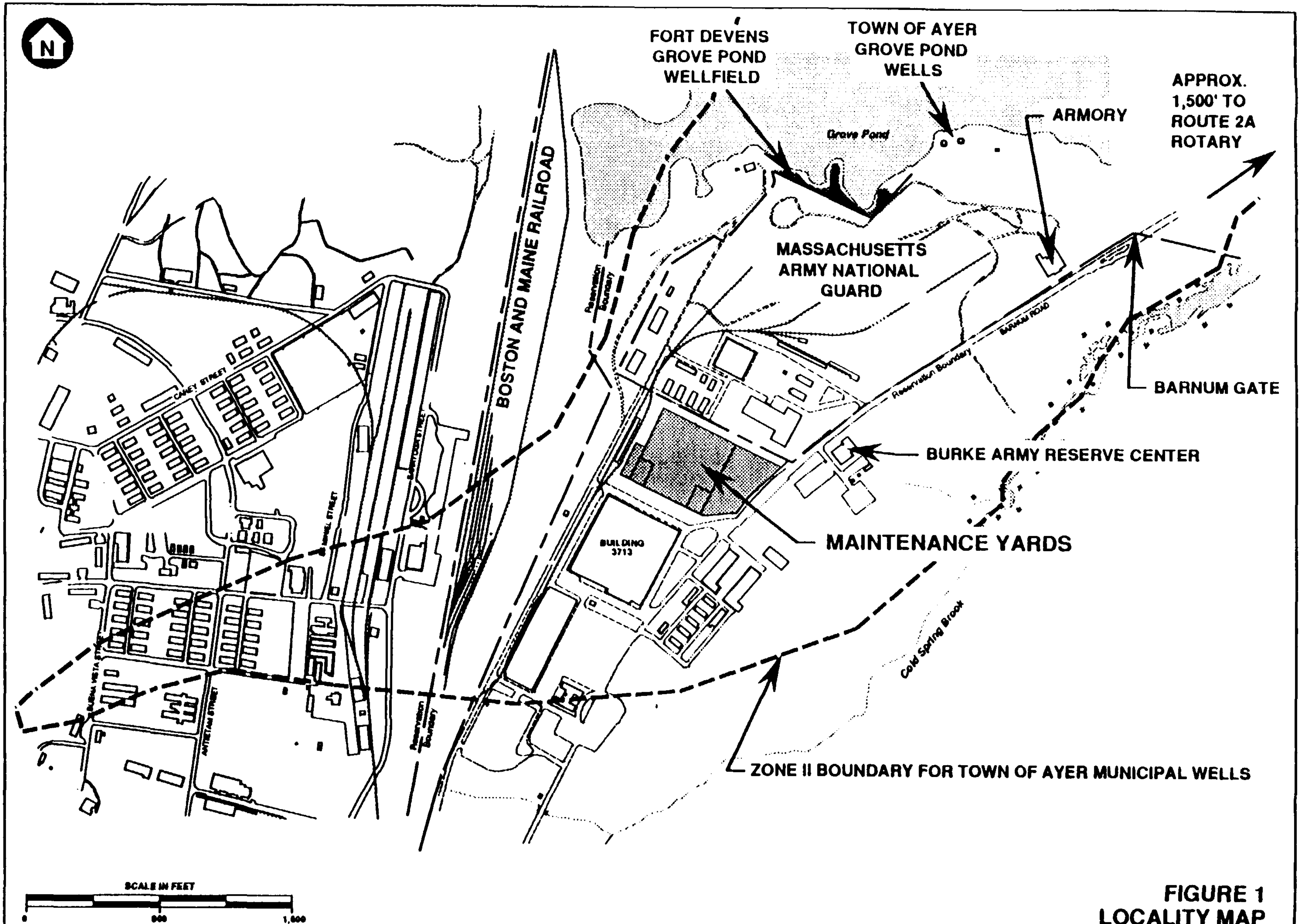

FIGURE 1
LOCALITY MAP
MAINTENANCE YARDS
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(j)

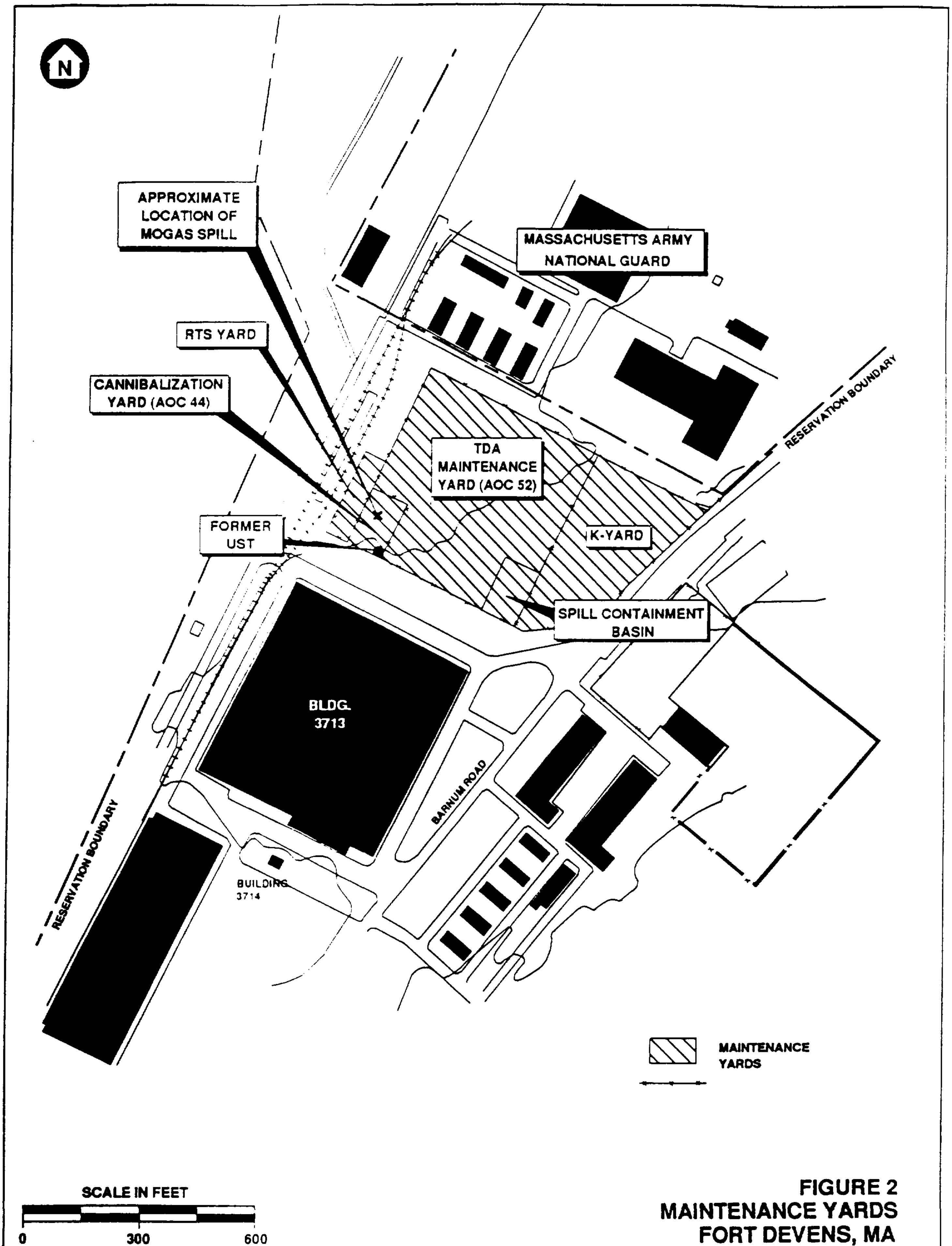

FIGURE 2
MAINTENANCE YARDS
FORT DEVENS, MA

ABB Environmental Services, Inc.

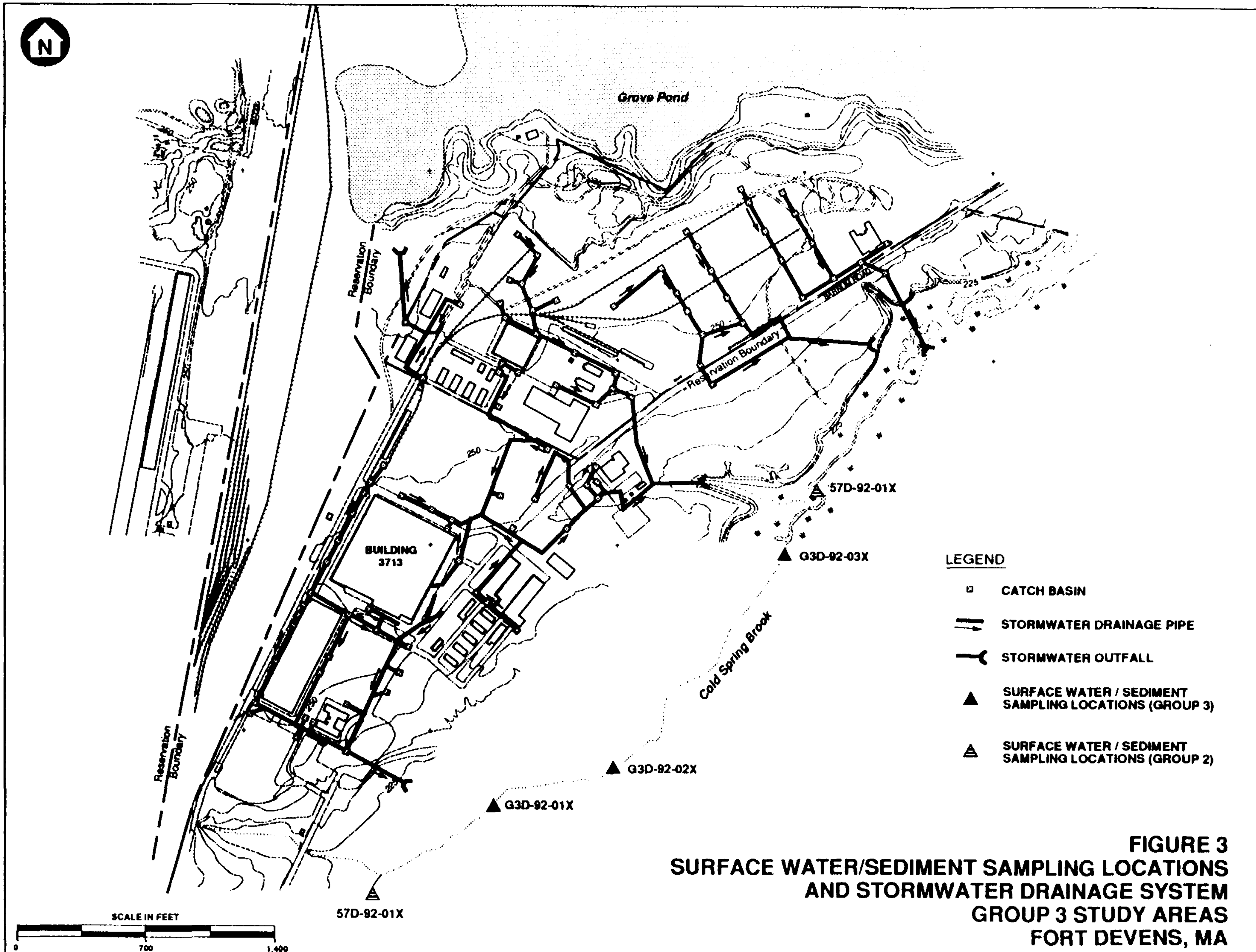

FIGURE 3
SURFACE WATER/SEDIMENT SAMPLING LOCATIONS AND STORMWATER DRAINAGE SYSTEM GROUP 3 STUDY AREAS FORT DEVENS, MA

ABB Environmental Services, Inc.

6917 07(l) 1

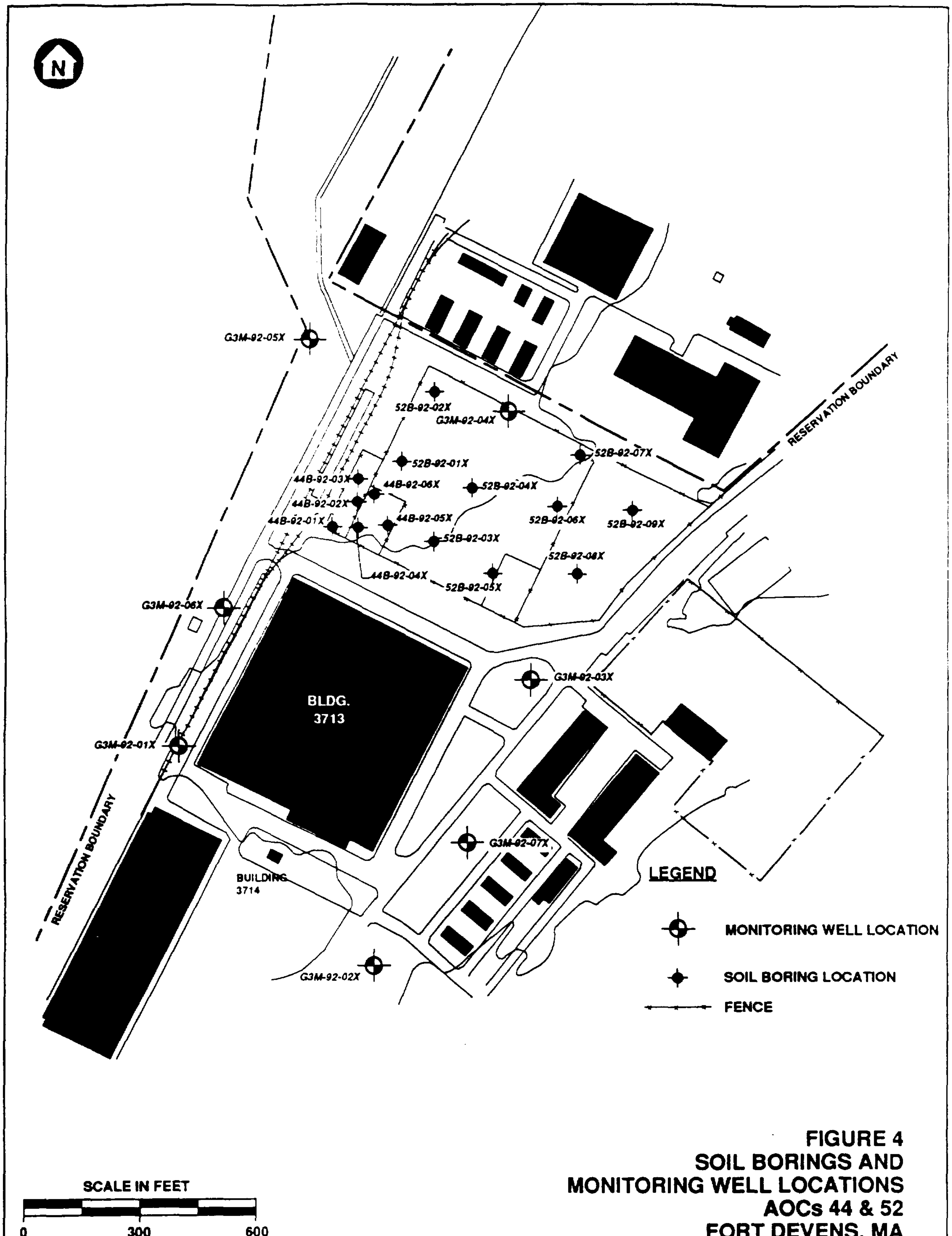

FIGURE 4
SOIL BORINGS AND
MONITORING WELL LOCATIONS
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 3 7

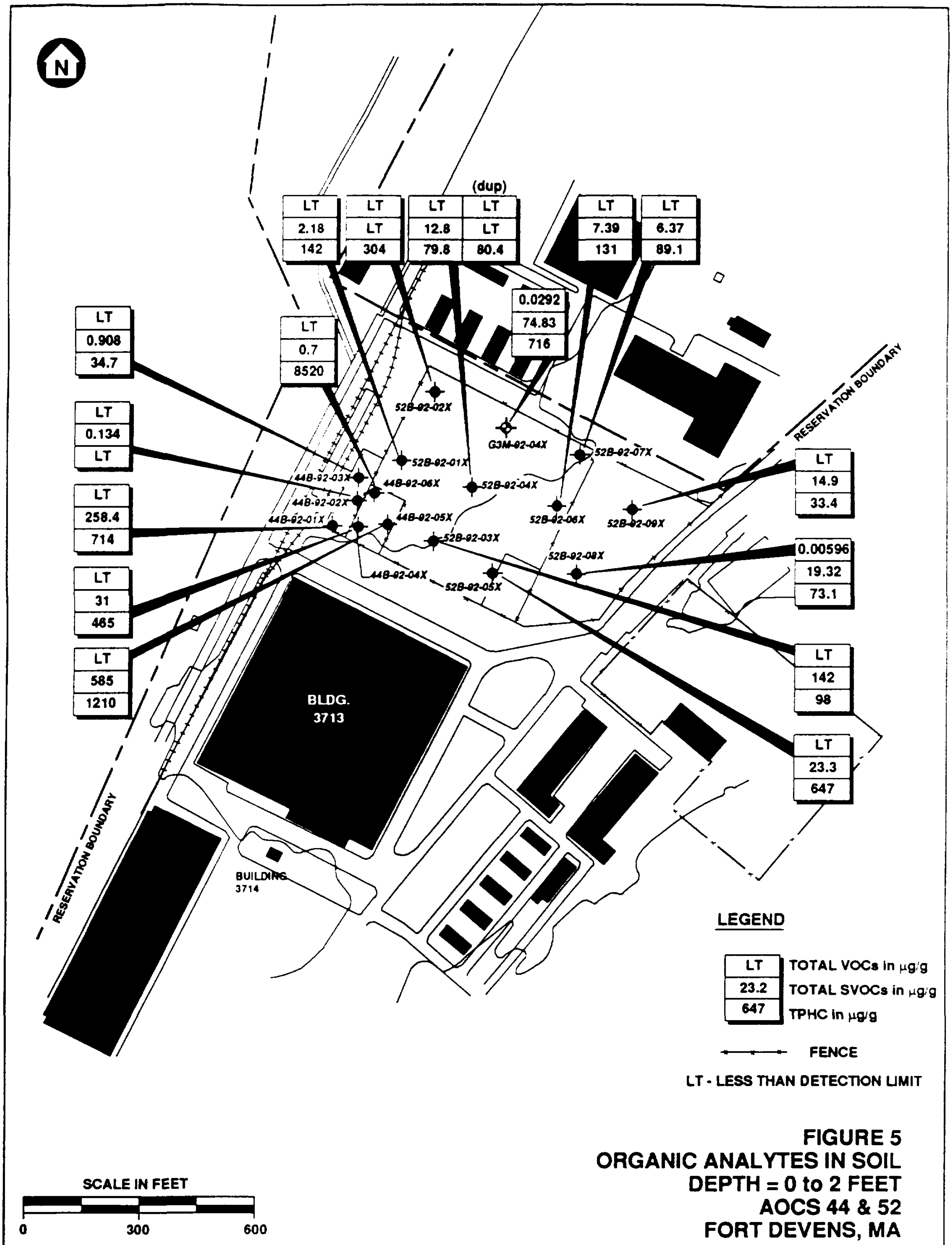

FIGURE 5
ORGANIC ANALYTES IN SOIL
DEPTH = 0 to 2 FEET
AOCS 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 9

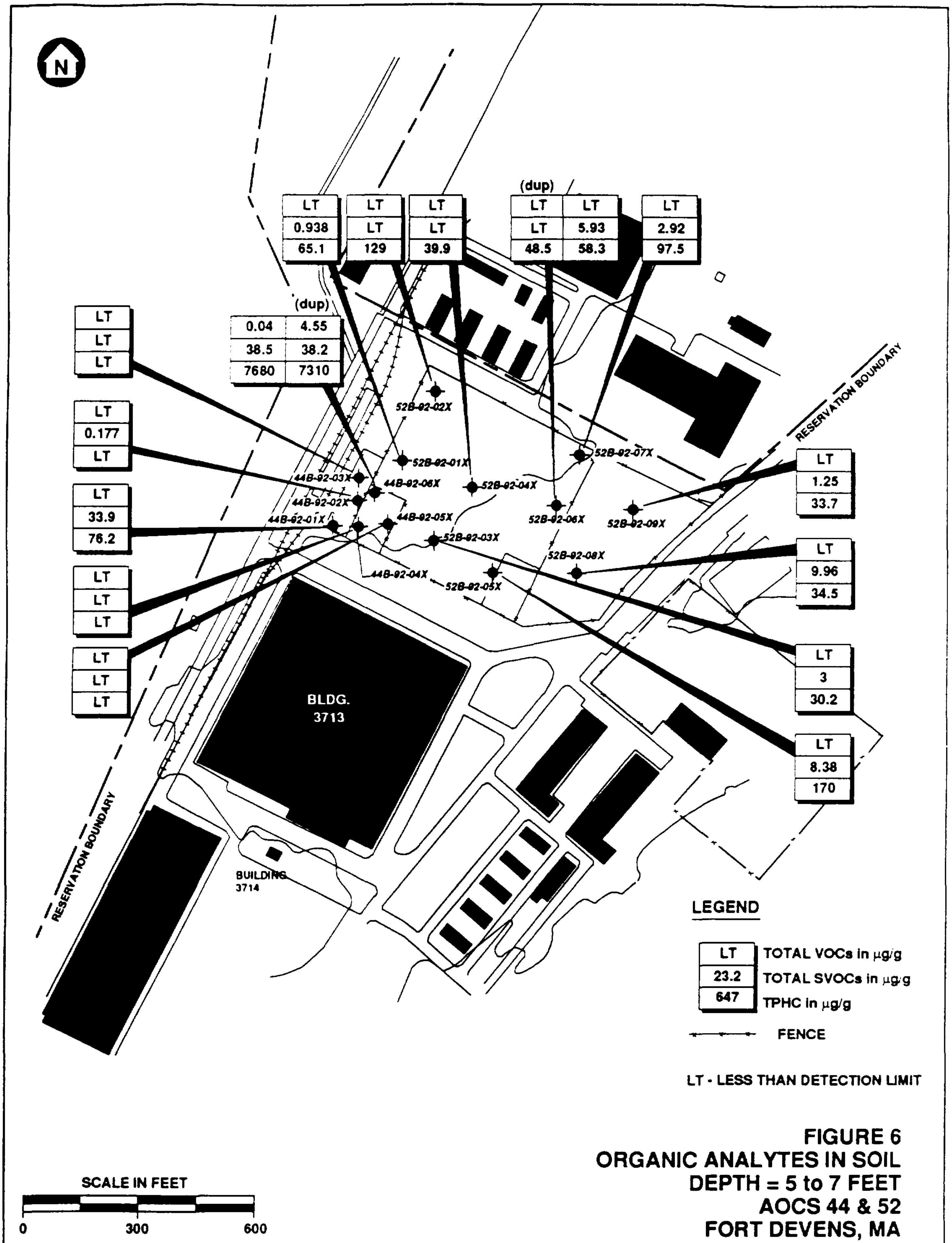

FIGURE 6
ORGANIC ANALYTES IN SOIL
DEPTH = 5 to 7 FEET
AOCS 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 0

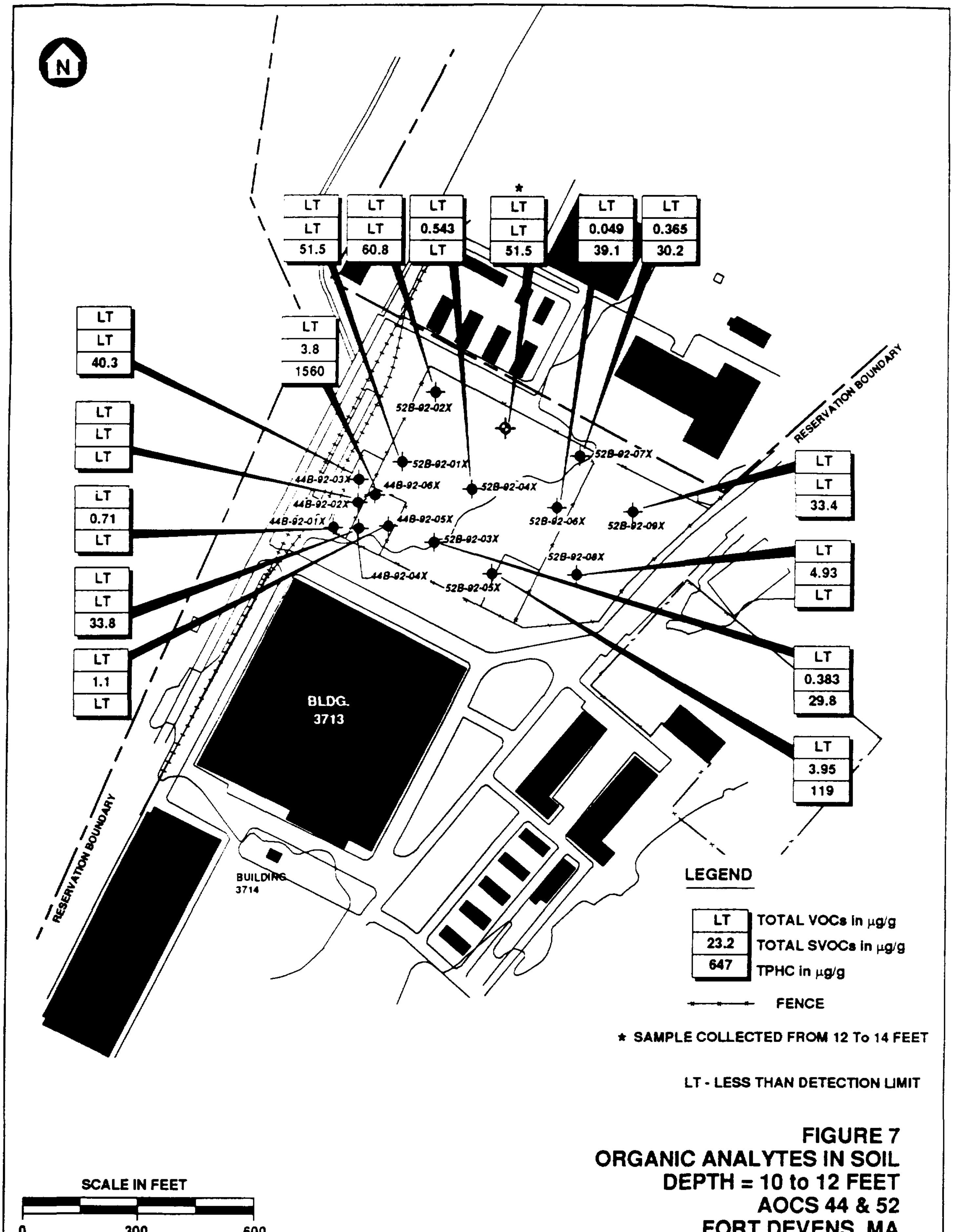

FIGURE 7
ORGANIC ANALYTES IN SOIL
DEPTH = 10 to 12 FEET
AOCS 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 A

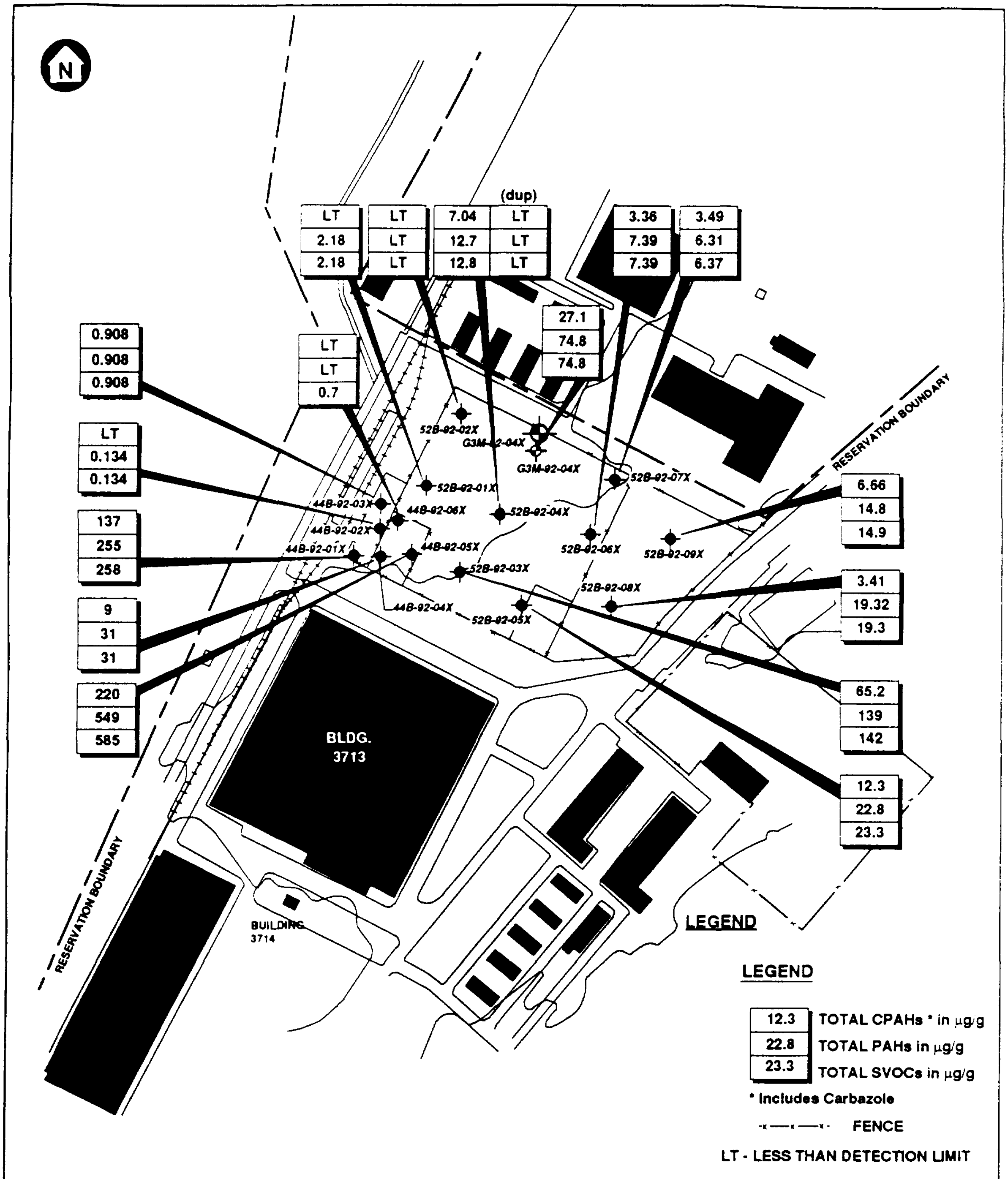

FIGURE 8
SEMIVOLATILE ORGANIC ANALYTES IN SOIL
DEPTH = 0 to 2 FEET
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

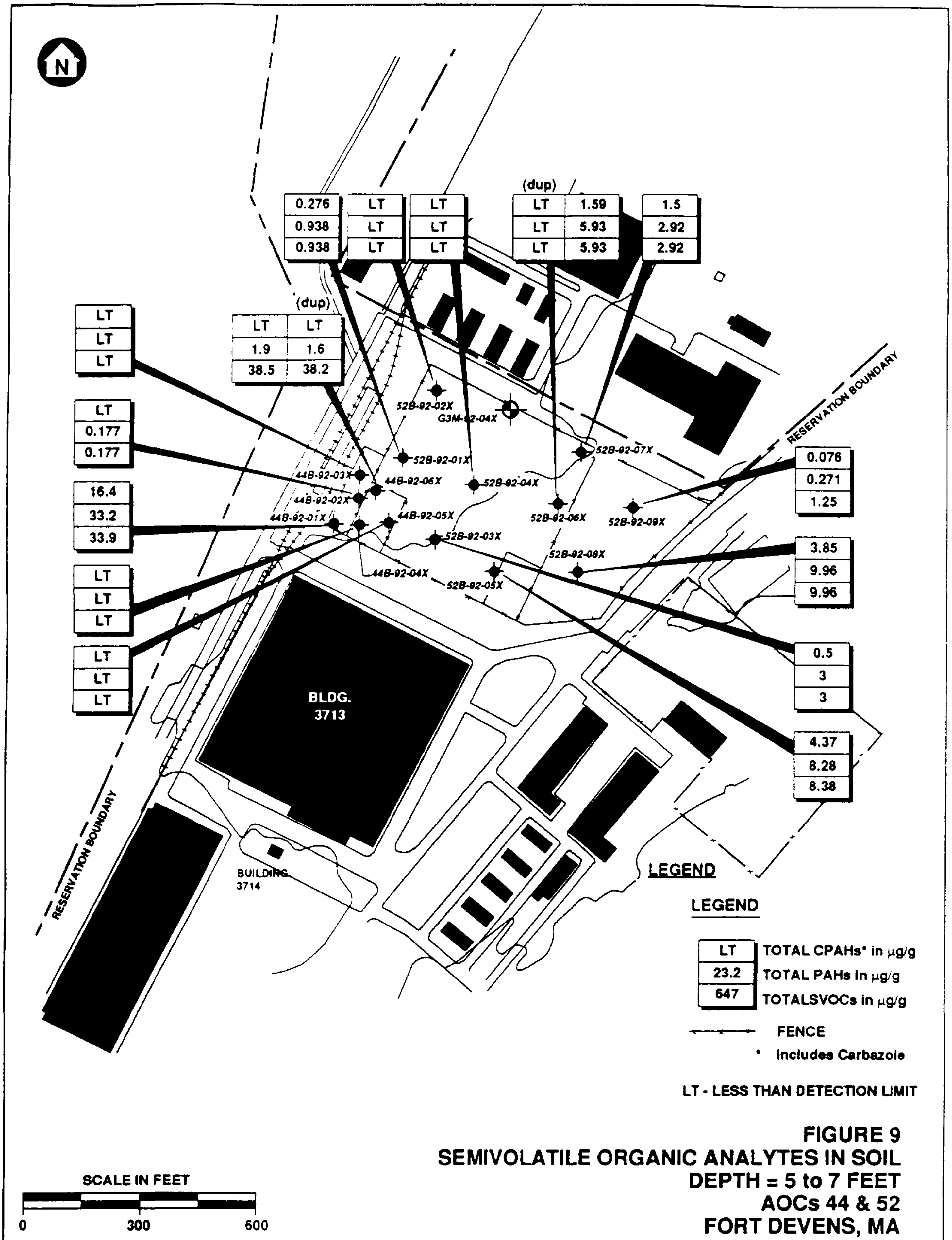

FIGURE 9
SEMIVOLATILE ORGANIC ANALYTES IN SOIL
DEPTH = 5 to 7 FEET
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 0

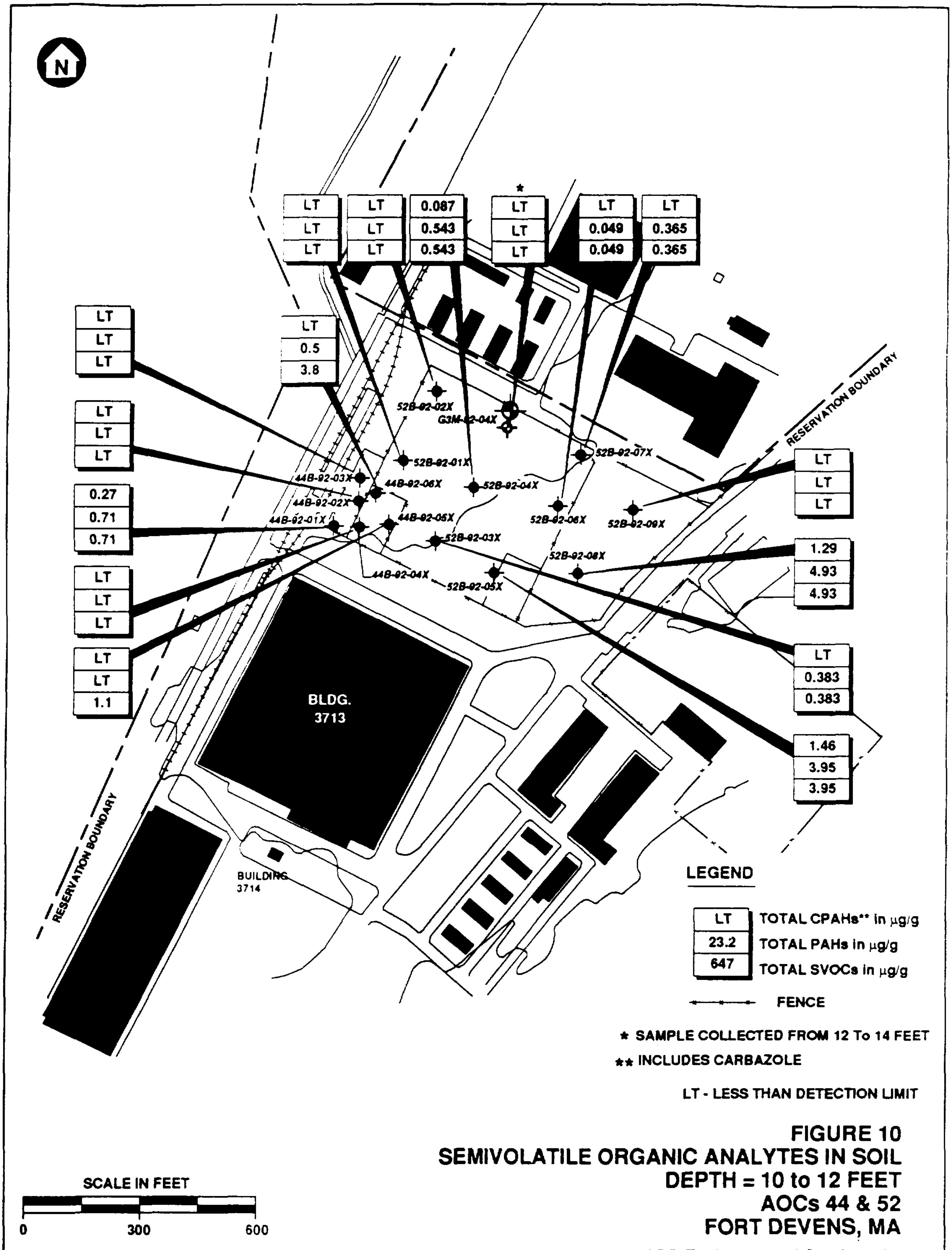

FIGURE 10
SEMIVOLATILE ORGANIC ANALYTES IN SOIL
DEPTH = 10 to 12 FEET
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 A

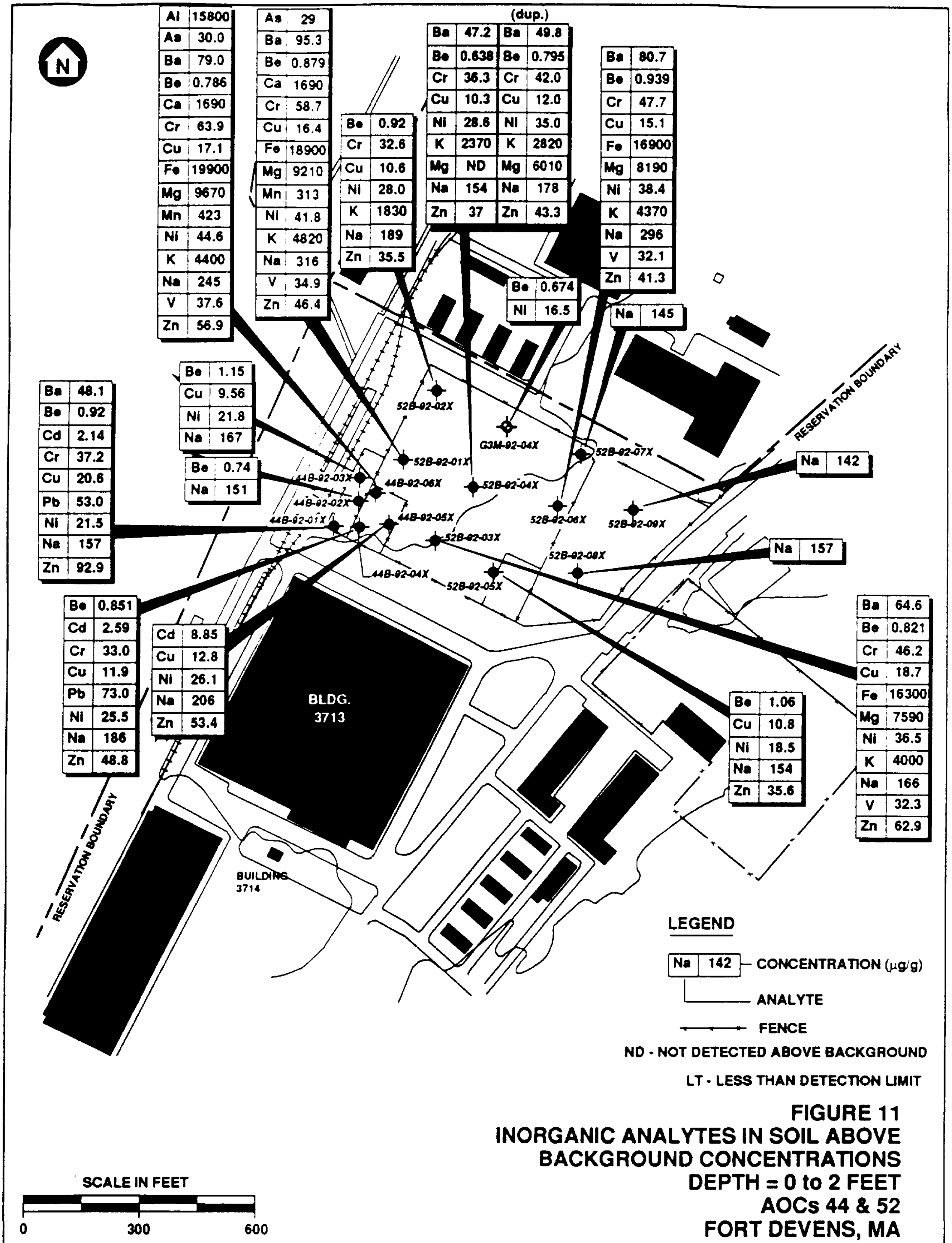

FIGURE 11
INORGANIC ANALYTES IN SOIL ABOVE BACKGROUND CONCENTRATIONS
DEPTH = 0 to 2 FEET
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 B

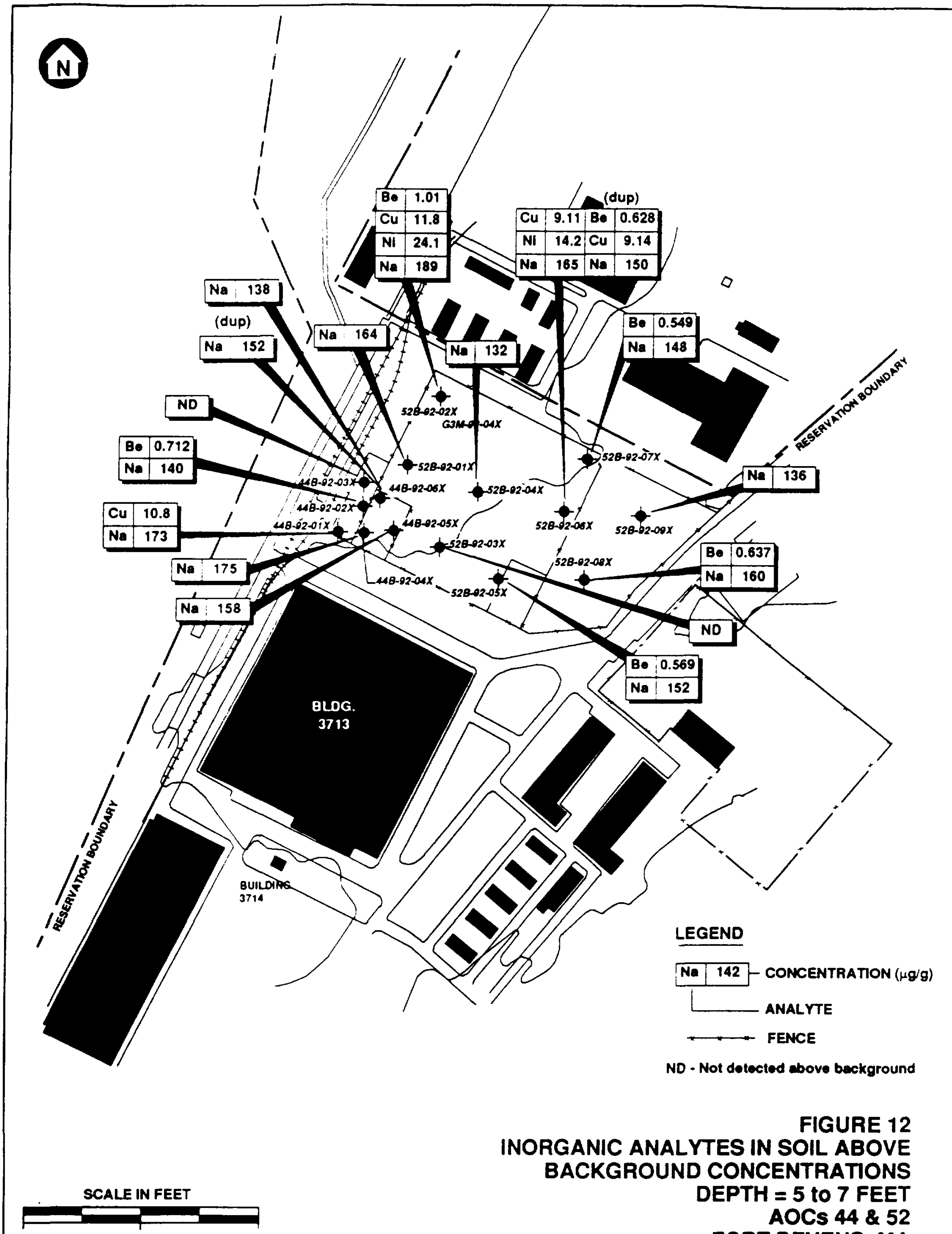

FIGURE 12
INORGANIC ANALYTES IN SOIL ABOVE BACKGROUND CONCENTRATIONS
DEPTH = 5 to 7 FEET
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 C

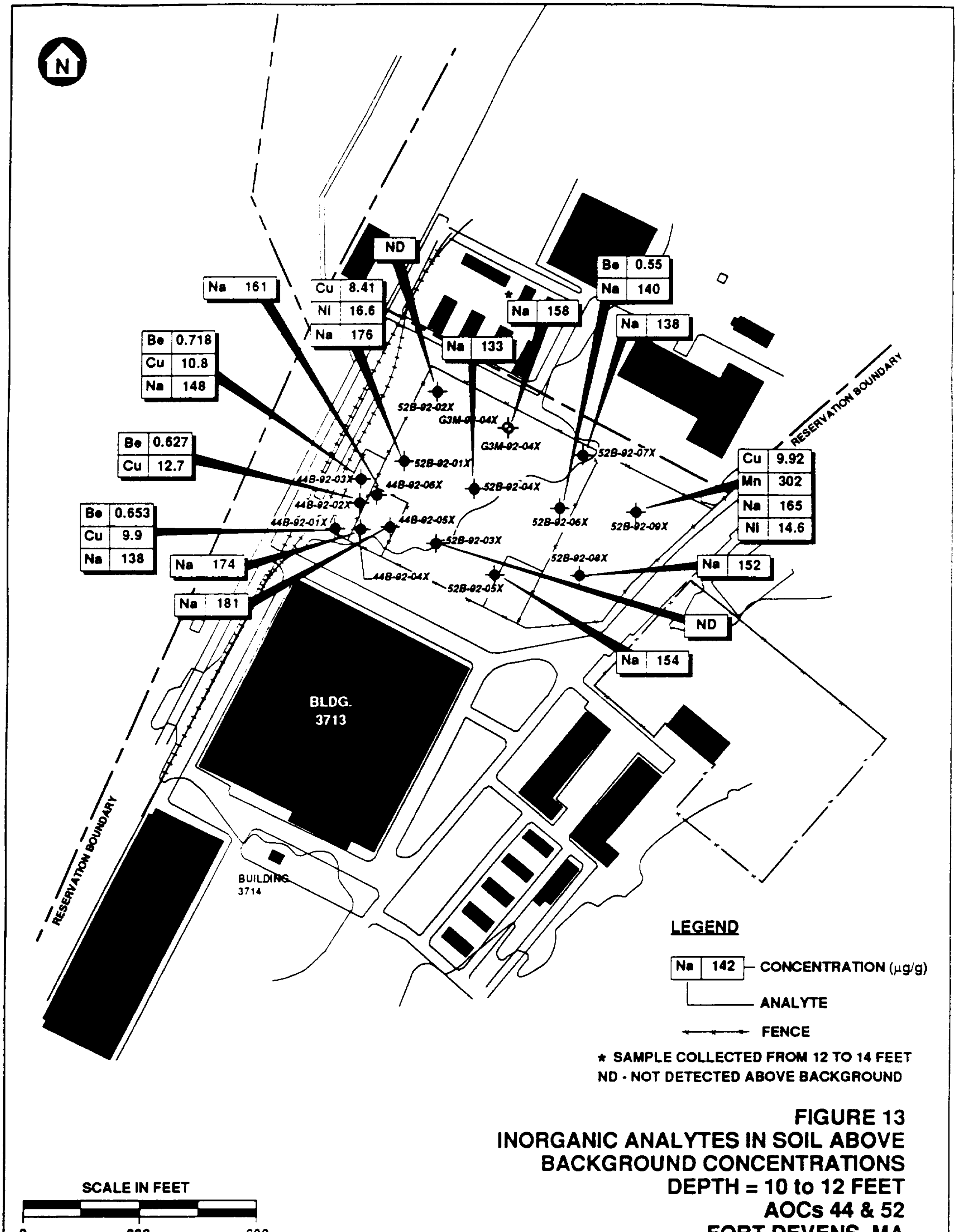

FIGURE 13
INORGANIC ANALYTES IN SOIL ABOVE BACKGROUND CONCENTRATIONS
DEPTH = 10 to 12 FEET
AOCs 44 & 52
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07(g) 7 0

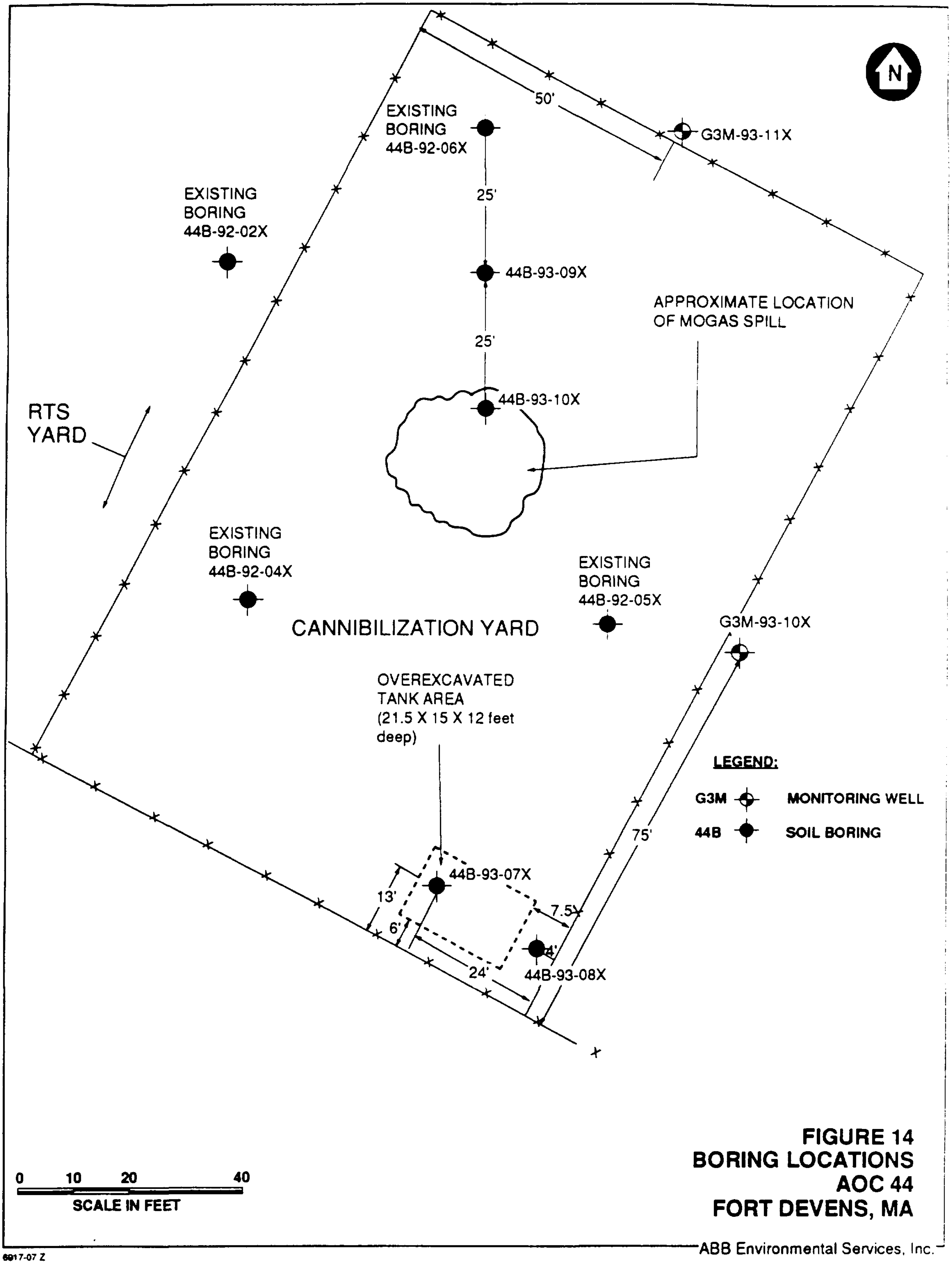

FIGURE 14
BORING LOCATIONS
AOC 44
FORT DEVENS, MA

ABB Environmental Services, Inc.

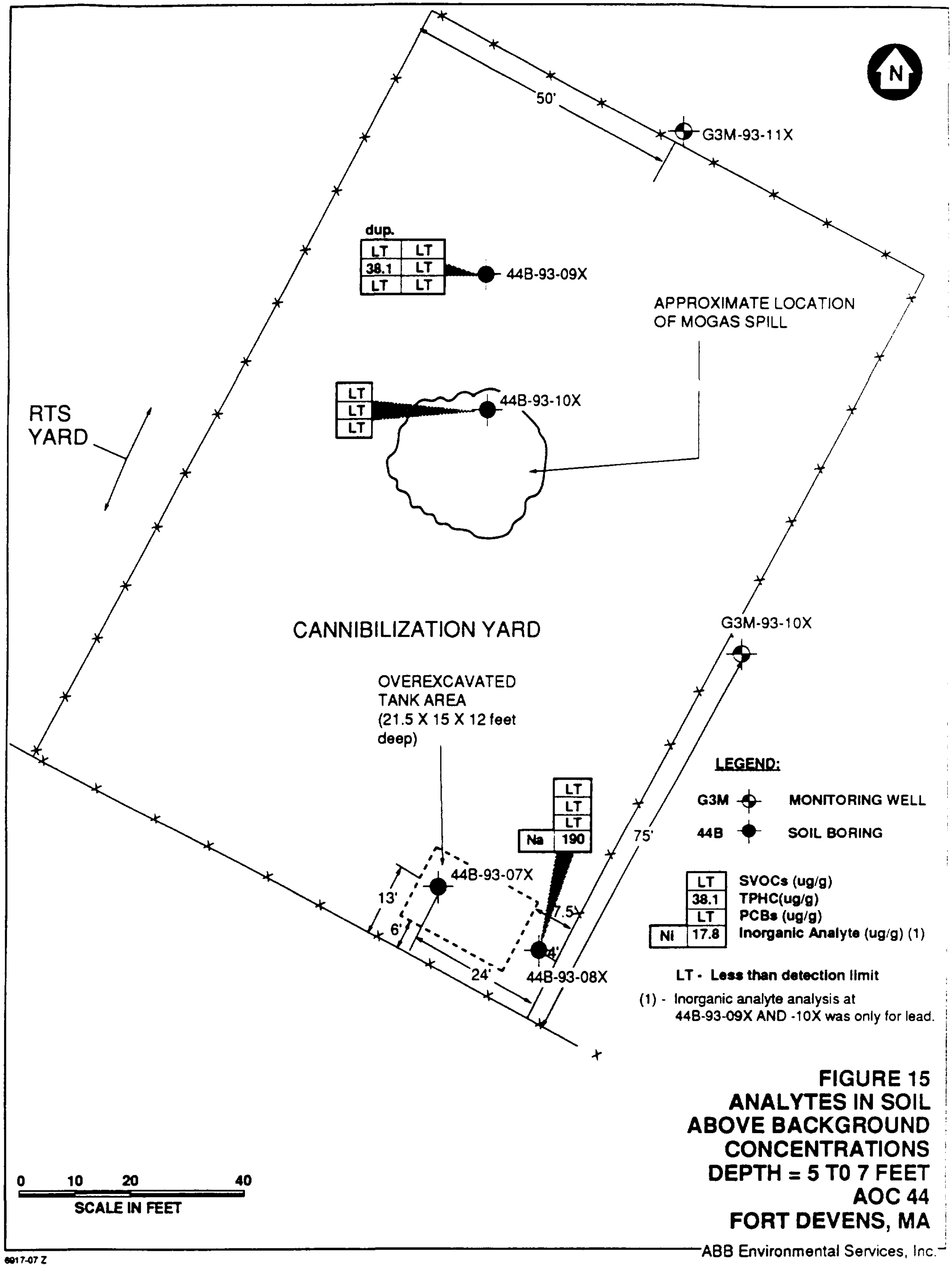

FIGURE 15
ANALYTES IN SOIL
ABOVE BACKGROUND
CONCENTRATIONS
DEPTH = 5 T0 7 FEET
AOC 44
FORT DEVENS, MA

ABB Environmental Services, Inc.

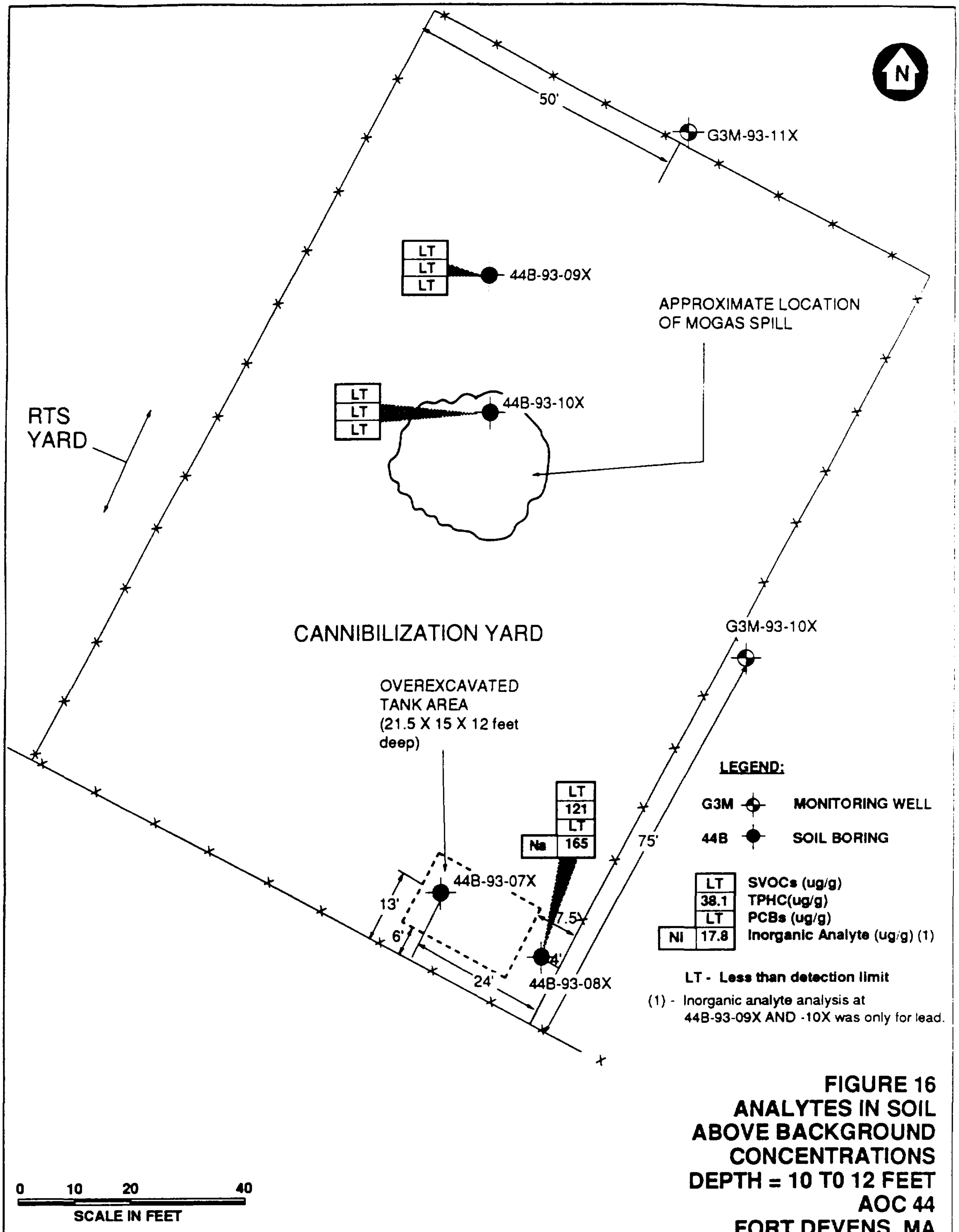

FIGURE 16
ANALYTES IN SOIL
ABOVE BACKGROUND
CONCENTRATIONS
DEPTH = 10 T0 12 FEET
AOC 44
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07 Z

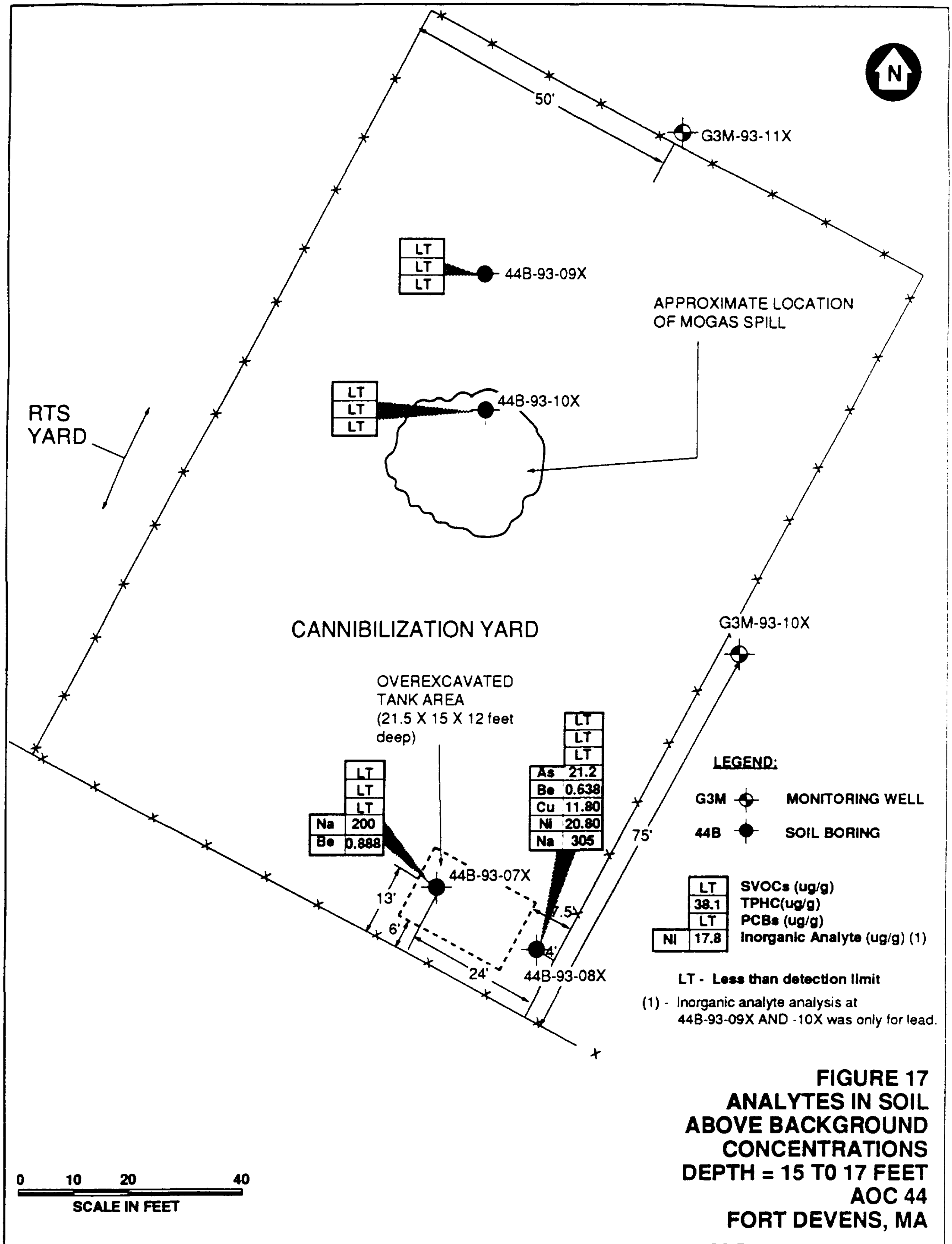

FIGURE 17
ANALYTES IN SOIL ABOVE BACKGROUND CONCENTRATIONS
DEPTH = 15 T0 17 FEET
AOC 44
FORT DEVENS, MA

ABB Environmental Services, Inc.

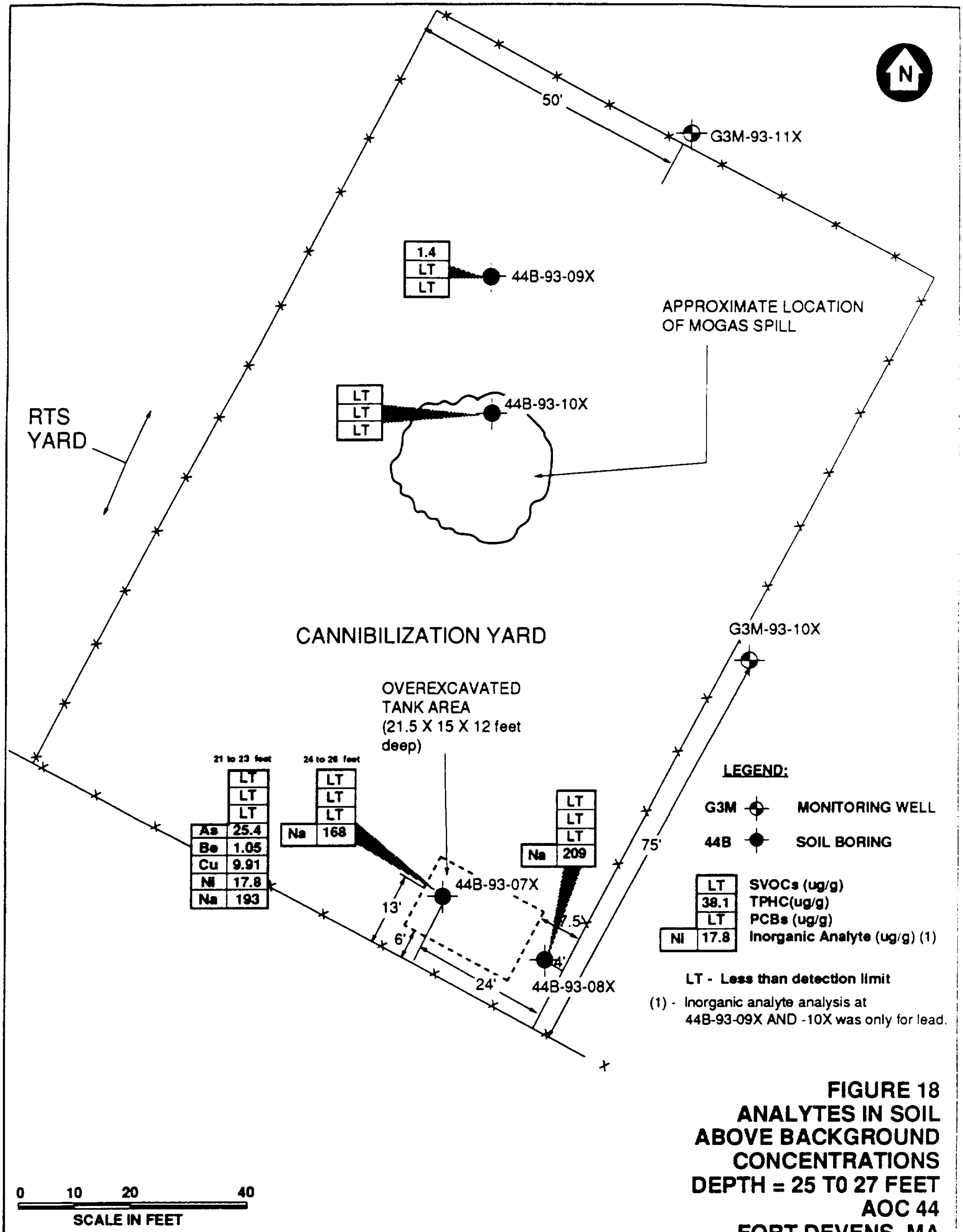

FIGURE 18
ANALYTES IN SOIL ABOVE BACKGROUND CONCENTRATIONS
DEPTH = 25 T0 27 FEET
AOC 44
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07 Z

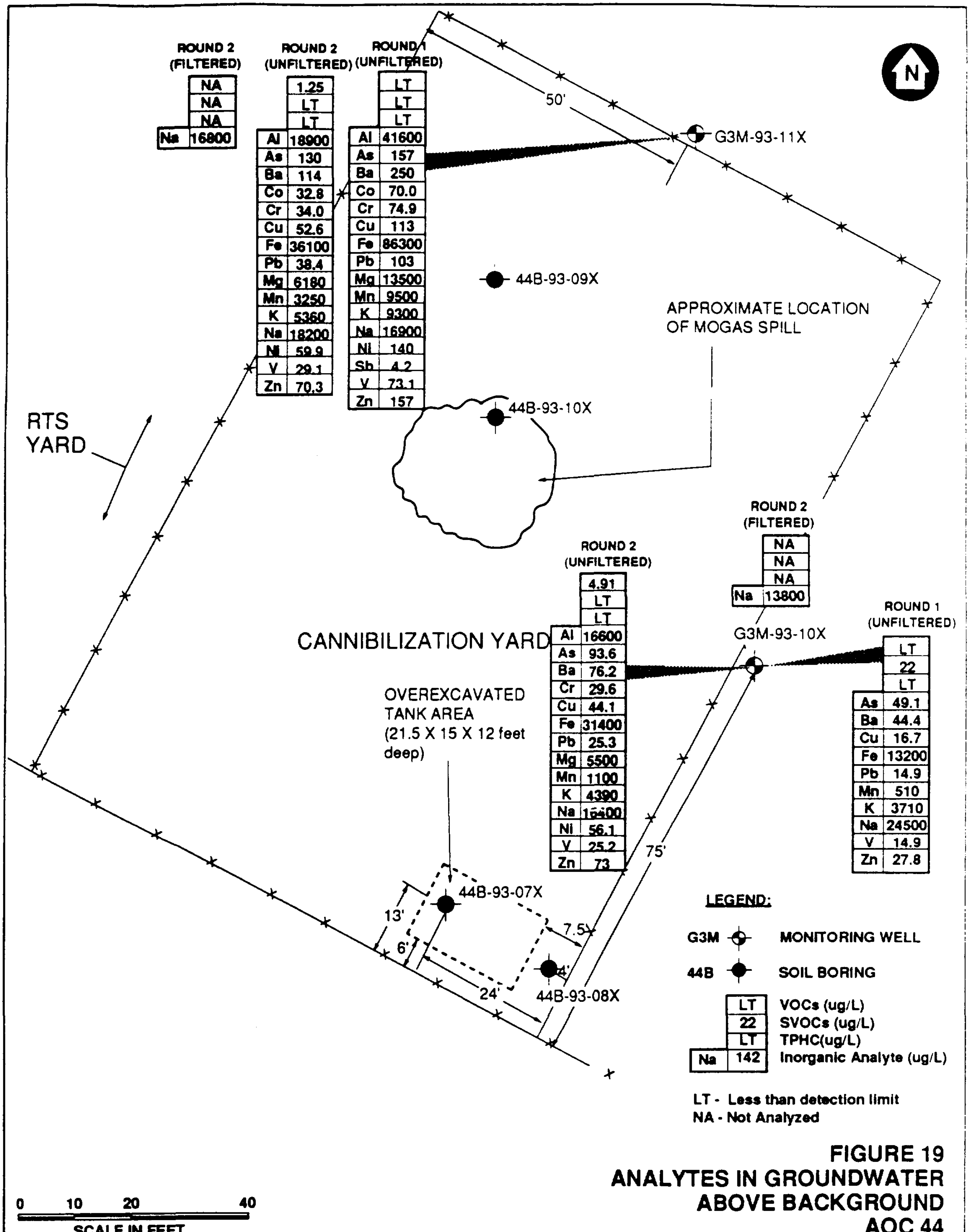

FIGURE 19
ANALYTES IN GROUNDWATER ABOVE BACKGROUND
AOC 44
FORT DEVENS, MA

ABB Environmental Services, Inc.

6917-07 Z

APPENDIX B

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY

APPENDIX B

TABLES

TABLE 1
ORGANIC COMPOUNDS IN SOIL
AOC 44 – CANNIBALIZATION YARD

FORT DEVENS, MASSACHUSETTS

ANALYTE / BORING	44B-92-01X			44B-92-02X			44B-92-03X			44B-92-04X			44B-92-05X			44B-92-06X			
DEPTH	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	5D	10
VOLATILES (ug/g)																			
ETHYLBENZENE	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0080	0.500	<0.0017
TOLUENE	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< .00078	< 0.0040	0.050	< .00078
XYLENES	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	< 0.0015	0.040	4.00	< 0.0015
SEMIVOLATILES (ug/g)																			
2-METHYLNAPHTHALENE	< 0.200	<0.100	< 0.049	< 0.049	< 0.049	< 0.049	< 0.049	< 0.049	< 0.049	< 1.00	< 0.049	< 0.200	6.00	< 0.049	< 0.049	0.700	30.0	30.0	3.00
ACENAPHTHENE	0.400	<0.070	< 0.036	< 0.036	< 0.036	< 0.036	< 0.036	< 0.036	< 0.036	< 0.700	< 0.036	< 0.200	6.00	< 0.036	< 0.036	< 0.400	< 0.400	< 0.400	< 0.200
ACENAPHTHYLENE	4.00	0.300	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.700	< 0.033	< 0.200	3.00	< 0.033	< 0.033	< 0.300	< 0.300	< 0.300	< 0.200
ANTHRACENE	5.00	0.700	< 0.036	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	1.00	< 0.033	< 0.200	20.0	< 0.033	< 0.033	< 0.300	< 0.300	< 0.300	< 0.200
BIS(2-ETHYLHEXYL)PHTHALAT	< 3.00	<1.00	< 0.620	< 0.620	< 0.620	< 0.620	< 0.620	< 0.620	< 0.620	< 10.0	< 0.620	< 3.00	< 30.0	< 0.620	1.10	< 6.00	< 6.00	< 6.00	< 3.00
BENZO[A]ANTHRACENE	20.0	2.00	< 0.170	< 0.170	< 0.170	< 0.170	< 0.170	< 0.170	< 0.170	< 3.00	< 0.170	< 0.800	40.0	< 0.170	< 0.170	< 2.00	< 2.00	< 2.00	< 0.800
BENZO[A]PYRENE	30.0	2.00	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 5.00	< 0.250	< 1.00	30.0	< 0.250	< 0.250	< 2.00	< 2.00	< 2.00	< 1.00
BENZO[B]FLUORANTHENE	20.0	3.00	< 0.210	< 0.210	< 0.210	< 0.210	< 0.210	< 0.210	< 0.210	< 4.00	< 0.210	<1.00	30.0	< 0.210	< 0.210	< 2.00	< 2.00	< 2.00	< 1.00
BENZO[G,H,I]PERYLENE	20.0	3.00	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 5.00	< 0.250	< 1.00	20.0	< 0.250	< 0.250	< 2.00	< 2.00	< 2.00	< 1.00
BENZO[K]FLUORANTHENE	20.0	2.00	0.110	< 0.066	< 0.066	< 0.066	0.170	< 0.066	< 0.066	4.00	< 0.066	< 0.300	30.0	< 0.066	< 0.066	< 0.700	< 0.700	< 0.700	< 0.300
CARBAZOLE	2.00	0.500	ND 0.033	ND 0.033	ND 0.033	ND 0.033	ND 0.033	ND 0.033	ND 0.033	ND 0.700	ND 0.033	ND 0.200	20.0	ND 0.033	ND 0.033	ND 0.033	ND 0.033	ND 0.300	ND 0.200
CHRYSENE	20.0	3.00	0.160	< 0.120	< 0.120	< 0.120	0.160	< 0.120	< 0.120	5.00	< 0.120	< 0.600	50.0	< 0.120	< 0.120	< 1.00	< 1.00	< 1.00	< 0.600
DIBENZO[A,H]ANTHRACENE	5.00	0.900	< 0.210	< 0.210	< 0.210	< 0.210	< 0.210	< 0.210	< 0.210	< 4.00	< 0.210	< 1.00	< 10.0	< 0.210	< 0.210	< 2.00	< 2.00	< 2.00	< 1.00
DIBENZOFURAN	0.400	0.200	< 0.035	< 0.035	< 0.035	< 0.035	< 0.035	< 0.035	< 0.035	< 0.700	< 0.035	<0.200	10.0	< 0.035	< 0.035	< 0.400	0.600	0.600	< 0.200
FLUORANTHENE	50.0	7.00	0.250	0.085	0.088	< 0.068	0.280	< 0.068	< 0.068	10.0	< 0.068	< 0.300	100	< 0.068	< 0.068	< 0.700	< 0.700	< 0.700	< 0.300
FLUORENE	1.00	0.300	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.033	< 0.700	< 0.033	< 0.200	20.0	< 0.033	< 0.033	< 0.300	1.00	1.00	0.300
INDENO[1,2,3-C,D]PYRENE	20.0	3.00	< 0.290	< 0.290	< 0.290	< 0.290	< 0.290	< 0.290	< 0.290	< 6.00	< 0.290	< 1.00	20.0	< 0.290	< 0.290	< 3.00	< 3.00	< 3.00	< 1.00
NAPHTHALENE	0.600	<0.070	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037	< 0.037	< 0.700	< 0.037	< 0.200	20.0	< 0.037	< 0.037	< 0.400	6.00	6.00	0.300
PHENANTHRENE	20.0	3.00	< 0.033	< 0.033	< 0.033	< 0.033	0.078	< 0.033	< 0.033	4.00	< 0.033	< 0.200	100	< 0.033	< 0.033	< 0.300	0.900	0.600	0.200
PYRENE	20.0	3.00	0.190	0.049	0.089	< 0.033	0.220	< 0.033	< 0.033	7.00	< 0.033	< 0.200	60.0	< 0.033	< 0.033	< 0.300	< 0.300	< 0.300	< 0.200
OTHER (ug/g)																			
TRICHLOROFLUOROMETHANE	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	<0.0059	< 0.0300	< 0.0059
TPHC	714	76.2	< 27.9	< 27.9	< 27.9	< 27.9	34.7	< 27.7	40.3	465	< 27.7	33.8	1210	<28.1	<27.7	8520	7680	7310	1560

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED

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07/15/94

TABLE 2
ORGANIC COMPOUNDS IN SOIL
AOC 52 – TDA MAINTENANCE YARD

FORT DEVENS, MASSACHUSETTS
FORT DEVENS

ANALYTE	BORING	52B-92-06X				52B-92-07X			52B-92-08X			52B-92-09X			G3M-92-04X		
	DEPTH	0	5	5D	10	0	5	10	0	5	10	0	5	10	0	12	26
VOLATILES (ug/g)																	
ETHYLBENZENE		< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	0.0049	< 0.00170	< 0.00170
TOLUENE		< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	0.00086	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	0.0023	< 0.00078	< 0.00078
XYLENES		< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	0.00510	<0.00510	< 0.00150	< 0.00150	< 0.00150	< 0.00150	0.0220	< 0.00150	< 0.00150
SEMIVOLATILES (ug/g)																	
ACENAPHTHENE		< 0.072	< 0.072	< 0.180	< 0.036	< 0.036	< 0.070	< 0.072	< 0.900	< 0.180	< 0.180	< 0.072	< 0.036	< 0.036	< 0.900	< 0.036	< 0.036
ACENAPHTHYLENE		0.168	< 0.066	< 0.165	< 0.033	0.144	< 0.070	< 0.066	< 0.825	< 0.165	< 0.165	0.469	< 0.033	< 0.033	< 0.825	< 0.033	< 0.033
ANTHRACENE		0.122	0.143	< 0.165	< 0.033	0.121	< 0.070	< 0.066	< 0.825	< 0.165	< 0.165	0.475	< 0.033	< 0.033	< 0.825	< 0.033	< 0.033
BIS(2-ETHYLHEXYL)PHTHALATE		< 1.24	< 1.24	< 3.10	< 0.620	< 0.620	< 1.00	< 1.24	< 15.5	< 3.10	< 3.10	< 1.24	0.974	< 0.620	< 15.5	< 0.620	< 0.620
BENZO[A]ANTHRACENE		0.399	0.391	< 0.800	< 0.170	0.239	< 0.300	< 0.340	< 4.25	< 0.800	< 0.800	0.780	< 0.170	< 0.170	4.95	< 0.170	< 0.170
BENZO[A]PYRENE		< 0.500	< 0.500	< 1.25	< 0.250	0.376	< 0.500	< 0.500	< 6.25	< 1.25	< 1.25	1.00	< 0.250	< 0.250	< 6.25	< 0.250	< 0.250
BENZO[B]FLUORANTHENE		1.08	< 0.420	< 1.05	< 0.210	0.980	0.800	< 0.420	< 5.25	2.04	< 1.05	1.32	< 0.210	< 0.210	10.0	< 0.210	< 0.210
BENZO[G,H,I]PERYLENE		0.622	< 0.500	< 1.25	< 0.250	0.682	< 0.500	< 0.500	< 6.25	< 1.25	< 1.25	1.01	< 0.250	< 0.250	< 6.25	< 0.250	< 0.250
BENZO[K]FLUORANTHENE		0.439	0.430	< 0.330	< 0.066	0.339	0.200	< 0.132	< 1.65	0.499	< 0.330	0.643	0.076	< 0.066	2.18	< 0.066	< 0.066
CARBAZOLE		ND 0.066	ND 0.066	ND 0.165	ND 0.033	0.063	ND 0.070	ND 0.066	ND 0.825	ND 0.165	ND 0.165	0.083	ND 0.033	ND 0.033	ND 0.825	ND 0.033	ND 0.033
CHRYSENE		0.777	0.761	< 0.600	< 0.120	0.581	0.500	< 0.240	3.41	1.31	1.29	1.52	< 0.120	< 0.120	10.0	< 0.120	< 0.120
DIBENZO[A,H]ANTHRACENE		< 0.420	< 0.420	< 1.05	< 0.210	< 0.210	< 0.420	< 0.420	< 5.25	< 1.05	< 1.05	< 0.420	< 0.210	< 0.210	< 5.25	< 0.210	< 0.210
DIBENZOFURAN		< 0.070	< 0.070	< 0.175	< 0.035	< 0.035	< 0.070	< 0.070	< 0.875	< 0.175	< 0.175	< 0.070	< 0.035	< 0.035	< 0.875	< 0.035	< 0.035
FLUORANTHENE		1.71	1.92	< 0.340	< 0.068	0.965	0.720	0.217	6.45	2.48	1.22	2.39	0.109	< 0.068	15.2	< 0.068	< 0.068
FLUORENE		< 0.066	< 0.066	< 0.165	< 0.033	< 0.033	< 0.066	< 0.066	< 0.825	< 0.165	< 0.165	0.169	< 0.033	< 0.033	< 0.825	< 0.033	< 0.033
INDENO[1,2,3-C,D]PYRENE		0.669	< 0.580	< 1.45	< 0.290	0.911	< 0.580	< 0.580	< 7.25	< 1.45	< 1.45	1.31	< 0.290	< 0.290	< 7.25	< 0.290	< 0.290
NAPHTHALENE		< 0.074	< 0.074	< 0.185	< 0.037	< 0.037	< 0.070	< 0.074	< 0.900	< 0.185	< 0.185	< 0.074	< 0.037	< 0.037	< 0.900	< 0.037	< 0.037
PHENANTHRENE		0.400	1.28	< 0.165	< 0.033	0.228	0.200	< 0.066	2.87	1.10	0.545	1.49	< 0.033	< 0.033	10.8	< 0.033	< 0.033
PYRENE		1.00	1.00	< 0.165	0.049	0.736	0.500	0.148	6.59	2.53	1.87	2.20	0.086	< 0.033	21.7	< 0.033	< 0.033
OTHER (ug/g)																	
TOTAL ORGANIC CARBON		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	283
TPHC		131	58.3	48.5	39.1	89.1	97.5	30.2	73.1	34.5	< 28.1	33.4	33.7	33.4	716	51.5	61.1

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED
NA = NOT ANALYZED

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TABLE 2 (continued)
ORGANIC COMPOUNDS IN SOIL
AOC 52 – TDA MAINTENANCE YARD

FORT DEVENS, MASSACHUSETTS

ANALYTE — BORING	52B-92-01X			52B-92-02X			52B-92-03X			52B-92-04X				52B-92-05X		
DEPTH	0	5	10	0	5	10	0	5	10	0	0D	5	10	0	5	10
VOLATILES (ug/g)																
ETHYLBENZENE	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170	< 0.00170
TOLUENE	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078	< 0.00078
XYLENES	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150	< 0.00150
SEMIVOLATILES (ug/g)																
ACENAPHTHENE	<0.900	< 0.036	< 0.036	< 0.900	< 0.900	< 0.180	0.315	< 0.200	< 0.036	< 0.072	< 0.900	< 0.036	< 0.036	< 0.070	< 0.072	< 0.072
ACENAPHTHYLENE	<0.825	< 0.033	< 0.033	< 0.825	< 0.825	< 0.165	1.18	< 0.200	< 0.033	0.193	< 0.825	< 0.033	< 0.033	0.500	0.142	0.090
ANTHRACENE	<0.825	< 0.033	< 0.033	< 0.825	< 0.825	< 0.165	2.99	< 0.200	< 0.033	0.171	< 0.825	< 0.033	< 0.033	0.500	0.143	0.100
BIS(2-ETHYLHEXYL)PHTHALATE	<15.5	< 0.620	< 0.620	< 15.5	< 15.5	< 3.10	< 3.10	< 3.00	< 0.620	< 1.24	< 15.5	< 0.620	< 0.620	< 1.00	< 1.24	< 1.24
BENZO[A]ANTHRACENE	<4.25	< 0.170	< 0.170	< 4.25	< 4.25	< 0.800	10.0	< 0.800	< 0.170	0.803	< 4.25	< 0.170	< 0.170	1.00	0.392	< 0.340
BENZO[A]PYRENE	< 6.25	< 0.250	< 0.250	< 6.25	< 6.25	< 1.25	12.4	< 1.00	< 0.250	1.01	< 6.25	< 0.250	< 0.250	2.00	0.743	< 0.500
BENZO[B]FLUORANTHENE	< 5.25	< 0.210	< 0.210	< 5.25	< 5.25	< 1.05	13.3	< 1.00	< 0.210	1.63	< 5.25	< 0.210	< 0.210	3.00	1.06	0.527
BENZO[G,H,I]PERYLENE	< 6.25	< 0.250	< 0.250	< 6.25	< 6.25	< 1.25	10.2	< 1.00	< 0.250	1.04	< 6.25	< 0.250	< 0.250	1.00	0.611	< 0.500
BENZO[K]FLUORANTHENE	< 1.65	0.085	< 0.066	< 1.65	< 1.65	< 0.330	6.48	0.500	< 0.066	0.883	< 1.65	< 0.066	0.087	1.00	0.647	0.430
CARBAZOLE	ND 0.825	ND 0.033	ND 0.033	ND 0.825	ND 0.825	ND 0.165	2.00	ND 0.200	ND 0.033	0.106	ND 0.825	ND 0.033	ND 0.033	0.500	0.104	ND 0.066
CHRYSENE	< 3.00	0.191	< 0.120	< 3.00	< 3.00	< 0.600	10.0	< 0.600	< 0.120	1.04	< 3.00	< 0.120	< 0.120	2.00	0.764	0.507
DIBENZO[A,H]ANTHRACENE	< 5.25	< 0.210	< 0.210	< 5.25	< 5.25	< 1.05	< 1.00	< 1.00	< 0.210	< 0.420	< 5.25	< 0.210	< 0.210	0.600	< 0.420	< 0.420
DIBENZOFURAN	< 0.875	< 0.035	< 0.035	< 0.875	< 0.875	< 0.175	0.600	< 0.200	< 0.035	< 0.070	< 0.875	< 0.035	< 0.035	< 0.070	< 0.070	< 0.070
FLUORANTHENE	< 1.70	0.288	< 0.068	< 1.70	< 1.70	< 0.340	20.0	1.00	0.200	2.22	< 1.70	< 0.068	0.230	4.85	1.69	1.20
FLUORENE	< 0.825	< 0.033	< 0.033	< 0.825	< 0.825	< 0.165	1.00	< 0.200	< 0.033	< 0.066	< 0.825	< 0.033	< 0.033	0.100	< 0.066	< 0.066
INDENO[1,2,3-C,D]PYRENE	< 7.25	< 0.290	< 0.290	< 7.25	< 7.25	< 1.45	11.0	< 1.00	< 0.290	1.57	< 7.25	< 0.290	< 0.290	2.21	0.658	< 0.580
NAPHTHALENE	< 0.900	< 0.037	< 0.037	< 0.900	< 0.900	< 0.185	0.243	< 0.200	< 0.037	< 0.074	< 0.900	< 0.037	< 0.037	< 0.074	< 0.074	< 0.074
PHENANTHRENE	< 0.825	0.092	< 0.033	< 0.825	< 0.825	< 0.165	20.0	0.500	0.074	0.659	< 0.825	< 0.033	0.076	1.51	0.429	0.400
PYRENE	2.18	0.282	< 0.033	< 0.825	< 0.825	< 0.165	20.0	1.00	0.109	1.51	< 0.825	< 0.033	0.150	2.48	1.00	0.700
OTHER (ug/g)																
TOTAL ORGANIC CARBON	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TPHC	142	65.1	51.5	304	129	60.8	98.0	30.2	29.8	79.8	80.4	39.9	<27.7	647	170	119

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED
NA = NOT ANALYZED

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TABLE 3
INORGANIC ANALYTES IN SOIL
AOC 44 – CANNIBALIZATION YARD

FORT DEVENS, MASSACHUSETTS

ANALYTE (ug/g)	BACK-GROUND	BORING DEPTH	44B-92-01X 0	44B-92-01X 5	44B-92-01X 10	44B-92-02X 0	44B-92-02X 5	44B-92-02X 10	44B-92-03X 0	44B-92-03X 5	44B-92-03X 10	44B-92-04X 0	44B-92-04X 5	44B-92-04X 10	44B-92-05X 0	44B-92-05X 5	44B-92-05X 10	44B-92-06X 0	44B-92-06X 5	44B-92-06X 5D	44B-92-06X 10
ALUMINUM	15000		7030	5270	3940	7070	3940	3090	9550	4240	3840	7270	3920	3630	9470	4000	2890	15800	5040	4820	3720
ANTIMONY	NA		< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	1.96	< 1.09	< 1.09	< 1.09
ARSENIC	21		7.34	14.2	16.0	7.42	9.76	8.88	10.6	9.51	8.54	15.0	10.8	15.0	16.0	9.33	12.0	30.0	11.5	10.3	9.51
BARIUM	42.5		48.1	18.1	18.4	15.0	13.9	14.6	34.6	13.2	17.5	31.2	16.0	16.0	30.7	18.1	12.9	79.0	14.7	15.9	18.4
BERYLLIUM	0.347		0.92	< 0.500	0.653	0.740	0.712	0.627	1.15	< 0.500	0.718	0.851	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	0.786	< 0.500	< 0.500	< 0.500
CADMIUM	2.00		2.14	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	<0.700	2.59	<0.700	<0.700	8.85	<0.700	<0.700	1.03	<0.700	<0.700	<0.700
CALCIUM	1400		922	307	334	140	141	304	404	130	378	724	546	342	1260	322	262	1690	214	249	362
CHROMIUM	31		37.2	13.3	12.2	8.20	9.15	8.90	22.2	7.47	12.3	33.0	7.72	8.73	28.6	10.3	5.92	63.9	10.1	10.6	9.06
COBALT	NA		5.26	4.68	3.97	2.15	3.12	3.27	5.44	2.09	3.46	5.17	3.36	2.79	6.58	3.69	2.50	9.82	2.70	3.33	3.20
COPPER	8.39		20.6	10.8	9.90	4.43	8.04	12.7	9.56	5.00	10.8	11.9	8.07	5.19	12.8	7.29	5.33	17.1	6.62	6.72	6.81
IRON	15000		11100	8830	7400	6400	6560	6290	11100	5240	6170	11800	7340	6410	14800	7340	6000	19900	8400	7560	6530
LEAD	34.4		53.0	15.2	4.96	4.44	7.45	3.23	6.87	3.70	3.81	73.0	3.73	6.41	21.0	4.21	3.09	22.0	5.12	4.40	3.83
MAGNESIUM	5600		3600	2010	1990	1030	1560	1460	3100	1100	1630	4240	1490	1510	5020	1860	1200	9670	1890	1840	1650
MANGANESE	300		181	173	162	57.3	106	147	187	68.3	159	211	140	114	247	142	129	423	148	118	138
NICKEL	14.0		21.5	13.4	11.4	7.91	9.40	10.5	21.8	7.02	11.7	25.5	10.9	9.16	26.1	10.5	7.59	44.6	9.52	9.93	10.8
POTASSIUM	1700		1480	551	1000	274	420	526	1260	346	779	1040	356	510	1130	424	319	4400	395	338	600
SODIUM	131		157	173	138	151	140	117	167	< 100	148	186	175	174	206	158	181	245	138	152	161
VANADIUM	28.7		19.3	8.39	8.56	7.42	6.54	5.40	15.5	5.83	6.88	15.1	5.24	5.84	18.0	6.34	4.07	37.6	6.75	7.64	6.66
ZINC	35.5		92.9	32.0	21.3	16.0	19.1	21.8	24.6	12.8	21.3	48.8	18.9	22.2	53.4	20.0	17.0	56.9	18.8	18.3	21.6

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
NA = NOT ANALYZED

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TABLE 4
INORGANIC ANALYTES IN SOIL
AOC 52 – TDA MAINTENANCE YARD

FORT DEVENS, MASSACHUSETTS

ANALYTE	BACK-	BORING	52B-92-06X				52B-92-07X			52B-92-08X			52B-92-09X			G3M-92-04X		
(ug/g)	GROUND	DEPTH	0	5	5D	10	0	5	10	0	5	10	0	5	10	0	12	26
ALUMINUM	15000		14200	5160	4390	3930	7010	5160	3550	6370	4210	2960	5410	3390	3900	7360	2690	4740
ARSENIC	21		21.0	16.0	19.0	15.0	9.04	10.7	14.0	5.81	6.80	6.78	7.03	8.21	15.0	11.2	7.11	7.54
BARIUM	42.5		80.7	21.0	19.5	15.2	19.0	16.1	15.2	20.6	16.6	12.6	11.3	12.0	17.8	19.6	14.2	19.9
BERYLLIUM	0.347		0.939	< 0.500	0.628	0.550	< 0.500	0.549	< 0.500	< 0.500	0.637	< 0.500	< 0.500	<0.500	< 0.500	0.674	< 0.500	1.13
CADMIUM	2.00		< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700
CALCIUM	1400		1280	439	386	358	196	326	426	292	361	365	< 100	178	450	304	322	446
CHROMIUM	31		47.7	15.2	13.3	11.5	12.5	12.9	11.6	9.52	7.07	5.17	7.49	7.01	10.7	18.3	5.15	12.3
COBALT	NA		8.66	4.35	3.9	3.65	3.68	4.00	3.59	2.74	2.25	2.26	2.50	2.30	3.80	4.54	2.60	4.22
COPPER	8.39		15.1	9.11	9.14	7.97	6.60	7.37	7.96	5.22	4.47	4.09	5.56	5.70	9.92	8.07	6.33	8.14
IRON	15000		16900	7910	6760	7580	8300	7790	6480	6410	5020	4280	6640	5220	8470	9280	5070	14600
LEAD	34.4		17.0	8.10	6.27	5.58	8.97	6.77	4.58	19.0	12.4	5.84	5.43	3.78	4.53	8.76	3.49	3.73
MAGNESIUM	5600		8190	2590	2130	1990	2240	2080	1790	1080	1010	789	1250	1150	1700	2900	1030	2570
MANGANESE	300		293	162	149	125	129	147	150	97.4	91.3	76.2	91.2	83.6	302	155	104	247
NICKEL	14.0		38.4	14.2	12.7	10.8	12.4	12.4	12.9	7.35	5.70	4.96	7.34	7.04	14.6	16.5	6.86	16.7
POTASSIUM	1700		4370	912	858	551	528	506	612	344	480	417	242	339	533	855	396	977
SODIUM	131		296	165	150	140	145	148	138	157	160	152	142	136	165	<100	158	192
VANADIUM	28.7		32.1	10.2	8.61	7.99	10.4	8.25	6.74	8.29	6.31	4.48	5.87	5.04	6.40	12.4	3.97	8.97
ZINC	35.5		41.3	21.4	19.2	19.8	22.0	21.0	21.2	24.1	17.7	14.5	18.0	14.1	21.0	20.9	14.9	28.4

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
ND = NOT DETECTED
NA = NOT ANALYZED

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TABLE 4 (continued)
INORGANIC ANALYTES IN SOIL
AOC 52 – TDA MAINTENANCE YARD

FORT DEVENS, MASSACHUSETTS

ANALYTE	BACK-	BORING	52B-92-01X			52B-92-02X			52B-92-03X			52B-92-04X				52B-92-05X		
(ug/g)	GROUND	DEPTH	0	5	10	0	5	10	0	5	10	0	0D	5	10	0	5	10
ALUMINUM	15000		14700	5070	5120	10200	8150	4540	11500	3130	2930	10400	11500	2870	4080	8210	4360	4300
ARSENIC	21		29.0	9.54	10.6	17.0	18.0	10.6	20.0	8.82	10.9	19.0	20.0	12.0	9.88	14.0	10.5	10.5
BARIUM	42.5		95.3	16.5	37.4	38.4	36.4	20.2	64.4	15.2	17.4	47.2	49.8	9.35	14.0	24.3	16.5	18.7
BERYLLIUM	0.347		0.879	< 0.500	< 0.500	0.92	1.01	< 0.500	0.821	< 0.500	< 0.500	0.638	0.795	< 0.500	< 0.500	1.06	0.569	< 0.500
CADMIUM	2.00		< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	1.23	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700	< 0.700
CALCIUM	1400		1690	689	583	659	727	557	871	220	312	603	659	396	237	594	282	483
CHROMIUM	31		58.7	13.1	25.5	32.6	30.1	15.7	46.2	9.20	8.68	36.3	42.0	<4.05	9.51	18.9	12.1	14.8
COBALT	NA		9.18	3.01	4.24	6.73	6.05	4.19	10.7	3.24	3.54	7.19	8.03	1.78	3.18	4.56	3.95	3.78
COPPER	8.39		16.4	6.72	8.41	10.6	11.8	6.76	18.7	6.54	8.24	10.3	12.0	4.53	6.72	10.8	7.78	8.13
IRON	15000		18900	7700	8880	13000	12300	7810	16300	5470	5670	12300	14400	3990	6500	11000	7030	6840
LEAD	34.4		13.0	4.00	8.38	10.4	6.45	3.67	16.0	3.35	3.68	8.84	9.18	2.65	3.63	20.0	19.0	8.36
MAGNESIUM	5600		9210	2210	2890	5440	4480	2360	7590	1420	1450	5040	6010	696	1740	3140	1710	2040
MANGANESE	300		313	128	203	273	260	163	268	137	234	202	220	48.5	118	172	142	134
NICKEL	14.0		41.8	11.6	16.6	28.0	24.1	13.1	36.5	9.77	10.6	28.6	35.0	4.76	10.5	18.5	12.4	12.0
POTASSIUM	1700		4820	619	1670	1830	1530	964	4000	564	690	2370	2820	229	528	878	530	1030
SODIUM	131		316	164	176	189	189	<100	166	<100	115	154	178	132	133	154	152	154
VANADIUM	28.7		34.9	7.61	10.8	20.3	18.0	8.74	32.3	5.86	6.07	21.2	25.3	<3.39	6.40	14.0	7.31	9.34
ZINC	35.5		46.4	18.8	25.5	35.5	34.3	21.0	62.9	17.7	16.2	37.0	43.3	11.2	18.1	35.6	20.8	21.1

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT FOR SUMMARY
NA = NOT ANALYZED

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TABLE 5
ANALYTES IN SOIL – SUPPLEMENTAL SITE INVESTIGATION
AOC 44 – CANNIBALIZATION YARD

FORT DEVENS, MASSACHUSETTS

ANALYTE (ug/g)	BACK-GROUND	BORING	44B–93–07X			44B–93–08X				44B–93–09X					44B–93–10X			
		DEPTH	15	21	24	5	10	15	25	5	5D	10	15	25	5	10	15	25
ORGANICS																		
BIS(2-E-H)PHTHALATE			< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	< 0.62	1.4	< 0.62	< 0.62	< 0.62	< 0.62
FLUORANTHENE			< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	0.25	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07	< 0.07
PHENANTHRENE			< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.09	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PYRENE			< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.12	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
TPHC			< 30	< 29.7	< 29.8	< 31.2	121	< 29.5	< 34.4	< 29.6	38.1	< 29.6	< 29.5	< 33.1	< 29.4	< 29.6	< 29.6	< 35.1
INORGANICS																		
ALUMINUM	15000		4280	5660	2840	2670	2690	5700	2690	NA	NA	NA	NA	NA	NA	NA	NA	NA
ANTIMONY	NA		< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	< 1.09	NA	NA	NA	NA	NA	NA	NA	NA	NA
ARSENIC	21		12.3	25.4	9.38	4.34	11.4	21.2	8.78	NA	NA	NA	NA	NA	NA	NA	NA	NA
BARIUM	42.5		10.4	18.6	11.4	16.1	9.8	18.1	9.28	NA	NA	NA	NA	NA	NA	NA	NA	NA
BERYLLIUM	0.347		0.888	1.05	0.633	< 0.5	< 0.50	0.638	< 0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA
CADMIUM	2.00		< 0.70	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70	NA	NA	NA	NA	NA	NA	NA	NA	NA
CALCIUM	1400		388	481	337	484	462	576	279	NA	NA	NA	NA	NA	NA	NA	NA	NA
CHROMIUM	31		12.5	17.5	7	5.27	5.04	20.5	6.73	NA	NA	NA	NA	NA	NA	NA	NA	NA
COBALT	NA		3.44	4.39	2.48	< 1.42	2.34	5.33	2.42	NA	NA	NA	NA	NA	NA	NA	NA	NA
COPPER	8.39		5.8	9.9	4.86	3.88	5.39	11.8	4.2	NA	NA	NA	NA	NA	NA	NA	NA	NA
IRON	15000		8930	10900	6230	6740	5030	10500	5260	NA	NA	NA	NA	NA	NA	NA	NA	NA
LEAD	34.4		3.28	5.63	2.33	4.36	3.01	2.94	4.91	3.14	4.19	8.69	5.11	4.63	2.78	9.51	6.34	2.65
MAGNESIUM	5600		2460	3640	1350	1200	1060	3910	1360	NA	NA	NA	NA	NA	NA	NA	NA	NA
MANGANESE	300		175	194	110	53	121	239	106	NA	NA	NA	NA	NA	NA	NA	NA	NA
NICKEL	14.0		12.8	17.8	7.61	< 1.71	6.76	20.8	7.11	NA	NA	NA	NA	NA	NA	NA	NA	NA
POTASSIUM	1700		485	993	470	1480	471	1020	450	NA	NA	NA	NA	NA	NA	NA	NA	NA
SODIUM	131		200	193	168	190	165	305	209	NA	NA	NA	NA	NA	NA	NA	NA	NA
VANADIUM	28.7		8.95	11.5	5.33	10.3	4.69	13.5	5.53	NA	NA	NA	NA	NA	NA	NA	NA	NA
ZINC	35.5		17.5	23.4	12.9	11.4	12.1	24.1	11.7	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES: TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT (ABB–ES, 1993)
NA = NOT ANALYZED

TABLE 6

ANALYTES IN GROUNDWATER – ROUND 1 (June 1993) AND ROUND 2 (September 1993)

AOC 44 GROUNDWATER – SUPPLEMENTAL SITE INVESTIGATION

FORT DEVENS, MASSACHUSETTS

ANALYTE	BACK-GROUND	ROUND 1 G3M-93-10X	ROUND 1 G3M-93-11X	ROUND 2 G3M-93-10X	ROUND 2 G3M-93-10X filtered	ROUND 2 G3M-93-11X	ROUND 2 G3M-93-11X filtered
ORGANICS (ug/L)							
BIS(2-ETHYLHEXYL)PHTHALATE		22	< 4.80	<4.8	NA	<4.8	NA
TETRACHLOROETHENE		<1.6	<1.6	2.6	NA	<1.6	NA
TOLUENE		<0.5	<0.5	2.31	NA	1.25	NA
TPHC		< 178	< 178	<173	NA	<178	NA
INORGANICS (ug/L)							
ALUMINUM	6870	6310	41600	16600	<141	18900	<141
ANTIMONY	3.03	<3.0	4.2	<3.0	<3.0	43.0	<3.0
ARSENIC	10.5	49.1	157	93.6	<2.54	130	<2.54
BARIUM	39.6	44.4	250	76.2	9.63	114	6.46
CALCIUM	14700	13000	13900	7630	6790	9220	7750
CHROMIUM	14.7	10.4	74.9	29.6	<6.02	34.0	<6.02
COBALT	25.0	<25.0	70.0	<25.0	<25.0	32.8	<25.0
COPPER	8.09	16.7	113	44.1	<8.09	52.6	<8.09
IRON	9100	13200	86300	31400	<38.8	36100	<38.8
LEAD	4.25	14.9	103	25.3	<1.3	38.4	<1.3
MAGNESIUM	3480	3030	13500	5500	716	6180	791
MANGANESE	291	510	9500	1100	25.6	3250	9.8
NICKEL	34.3	<34.3	140	56.1	<34.3	59.9	<34.3
POTASSIUM	2370	3710	9330	4390	1350	5360	1860
SODIUM	10800	24500	16900	16400	13800	18200	16800
VANADIUM	11.0	14.9	73.1	25.2	<11.0	29.1	<11.0
ZINC	21.1	27.8	157	73.0	<21.1	70.3	<21.1
ANIONS/CATIONS (ug/L)							
BICARBONATE		NA	NA	NA	NA	NA	NA
CHLORIDE		NA	NA	NA	NA	NA	NA
SULFATE		NA	NA	NA	NA	NA	NA
NITRATE/NITRITE		NA	NA	NA	NA	NA	NA
ALKALINITY		NA	NA	NA	NA	NA	NA
OTHER (mg/L)							
TSS		206	1110	569	NA	489	NA

NOTES:

TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST IN SI REPORT (ABB-ES, 1993).

NA = Not Analyzed

TABLE 7

SUMMARY OF CONTAMINANTS OF CONCERN IN SURFACE SOIL

AOCs 44 & 52 – MAINTENANCE YARDS

FORT DEVENS, MASSACHUSETTS

Analyte	Detected Concentration [a]		Frequency Of Detection
	Average	Maximum	
Organics (ug/g)			
ethylbenzene	0.0049	0.0049	1/15
toluene	0.0016	0.0023	2/15
xylenes	0.01355	0.022	2/15
2-methylnaphthalene	6.7	6.7	1/15
acenaphthene	2.238	6.0	3/15
acenapthylene	1.207	4.0	8/15
anthracene	3.38	20.0	9/15
benzo(a)anthracene	8.69	40.0	9/15
benzo(a)pyrene	10.97	30.0	7/15
benzo(b)fluoranthene	9.03	30.0	9/15
benzo(g,h,i)perylene	6.82	20.0	8/15
benzo(k)fluoranthene	6.01	30.0	11/15
carbazole	3.54	20.0	7/15
chrysene	8.71	50.0	12/15
dibenzo(a,h)anthracene	2.8	5.0	2/15
dibenzofuran	3.67	10.0	3/15
fluoranthene	16.5	100.0	13/15
fluorene	4.45	20.0	5/15
indeno(1,2,3-c,d)pyrene	7.21	20.0	8/15
naphthalene	6.95	20.0	3/15
phenanthrene	13.5	100.0	12/15
pyrene	10.4	60.0	14/15

Analyte	Detected Concentration [a]		Frequency Of Detection
	Average	Maximum	
Inorganics (ug/g)			
arsenic	14.0	19.0	15/15
barium	38.7	95.3	15/15
beryllium	0.872	1.15	11/15
cadmium	3.70	8.85	4/15
chromium	27.8	58.7	15/15
copper	11.1	20.6	15/15
iron	11615	18900	15/15
lead	19.0	73.0	15/15
magnesium	4204	9210	15/15
manganese	192	313	15/15
nickel	22.5	41.8	15/15
potassium	1695	4820	15/15
sodium	185	316	14/15
vanadium	17.8	34.9	15/15
zinc	38.6	92.9	15/15

Notes:

[a] Surface soil samples from sampling stations 44B-92-01X to 44B-92-05X, 52B-92-01X to 52B-92-09X, and G3M-92-04X.

TABLE 8
SUMMARY OF CONTAMINANTS OF CONCERN IN SUBSURFACE SOIL
AOCs 44 & 52 – MAINTENANCE YARDS

FORT DEVENS, MASSACHUSETTS

Analyte	Detected Concentration [a]		Frequency of Detection
	Average	Maximum	
Organics (ug/g)			
acenaphthylene	0.177	0.3	3/31
anthracene	0.272	0.7	4/31
bis(2-ethylhexyl)phthalate	1.04	1.1	2/31
benzo(a)anthracene	0.928	2.0	3/31
benzo(a)pyrene	1.37	2.0	2/31
benzo(b)fluoranthene	1.49	3.0	5/31
benzo(g,h,i)perylene	1.81	3.0	2//31
benzo(k)fluoranthene	0.460	2.0	11/31
carbazole	0.302	0.5	2/31
chrysene	0.943	3.0	9/31
dibenzo(a,h)anthracene	0.90	0.90	1/31
dibenzofuran	0.20	0.20	1/31
fluoranthene	1.24	7.0	15/31
fluorene	0.30	0.30	1/31
indeno(1,2,3-cd)pyrene	1.83	3.0	2/31
phenanthrene	0.70	3.0	11/31
pyrene	0.907	3.0	14/31

Analyte	Detected Concentration [a]		Frequency of Detection
	Average	Maximum	
Inorganics (ug/g)			
arsenic	11.3	19	31/31
barium	17	378.4	31/31
beryllium	0.708	1.13	11/31
chromium	11.5	30.1	30/31
copper	7.71	12.7	31/31
iron	7063	14600	31/31
lead	5.94	19.0	31/31
magnesium	1795	4480	31/31
manganese	147	302	31/31
nickel	11.2	24.1	31/31
potassium	650	1670	31/31
sodium	154	192	28/31
vanadium	7.34	18.0	30/31
zinc	20.1	34.3	31/31

Notes:
[a] Subsurface soil samples from sampling locations 44B-92-01X to 44B-92-05X, 52B-92-01X to 52B-92-09X, and G3M-92-04X.

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TABLE 9

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 - AVERAGE CONCENTRATIONS

FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	Average	mg/kg	
INGESTION RATE	IR	480	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%		
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²	USEPA, 1992
SURFACE AREA EXPOSED	SA	3,295	cm²/day	USEPA, 1989b (1)
CONVERSION FACTOR	CF	0.000001	kg/mg	
BODY WEIGHT	BW	70	kg	USEPA, 1989a
EXPOSURE FREQUENCY	EF	5	days/workweek	PRO.JUDGEMENT
EXPOSURE DURATION	ED	12	workweek(s)	PRO.JUDGEMENT
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1989a
NONCANCER	AT	12	workweek(s)	USEPA, 1989a

USEPA, 1991. "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors".

USEPA, 1992. Dermal Exposure Assessment: Principles and Applications, Interim report, EPA/600/8-91/011B, January 1992.

USEPA, 1989a. RAGs, Part A.

USEPA, 1989b. Exposure Factors Handbook.

(1) Arms and Hands

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg·day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

INTAKE-INGESTION (HQ) = $\frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 5 \text{ days/workweek}}$

INTAKE-INGESTION (CANCER RISK) = $\frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE-DERMAL (HQ) = $\frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 5 \text{ days/workweek}}$

INTAKE-DERMAL (CANCER RISK) = $\frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

For noncarcinogenic effects: AT = ED

TABLE 9 , continued

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DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 - AVERAGE CONCENTRATIONS

FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK
Bis(2-ethylhexyl)phthalate	1.941	1	3.1E-08	0.02	4.3E-09	0.014	4.4E-10	6.0E-11	5.0E-10
Benzo(a)anthracene	2.078	1	3.3E-08	0.2	4.6E-08	7.3	2.4E-07	3.4E-07	5.8E-07
Benzo(a)pyrene	2.241	1	3.6E-08	0.2	5.0E-08	7.3	2.6E-07	3.6E-07	6.3E-07
Benzo(b)fluoranthene	2.318	1	3.7E-08	0.2	5.1E-08	7.3	2.7E-07	3.7E-07	6.5E-07
Benzo(k)fluoranthene	1.658	1	2.7E-08	0.2	3.7E-08	7.3	1.9E-07	2.7E-07	4.6E-07
Carbazole	0.621	1	1.0E-08	1	6.9E-08	0.02	2.0E-10	1.4E-09	1.6E-09
Chrysene	2.581	1	4.2E-08	0.2	5.7E-08	7.3	3.0E-07	4.2E-07	7.2E-07
Dibenz(a,h)anthracene	0.782	1	1.3E-08	0.09	7.8E-09	7.3	9.2E-08	5.7E-08	1.5E-07
Indeno(1,2,3-cd)pyrene	2.001	1	3.2E-08	0.2	4.4E-08	7.3	2.4E-07	3.2E-07	5.6E-07
Arsenic	12.36	1	2.0E-07	0.03	4.1E-08	1.8	3.6E-07	7.4E-08	4.3E-07
Beryllium	0.514	1	8.3E-09	0.35	2.0E-08	4.3	3.6E-08	8.6E-08	1.2E-07
Lead	10.188	0.5	8.2E-08	NA		NA			
SUMMARY CANCER RISK							2E-06	2E-06	4E-06

TABLE 9 , continued | CONS-A-2 | 07-Jun-93

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 - AVERAGE CONCENTRATIONS

FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Ethylbenzene	0.000936	1	6.4E-09	0.2	8.8E-09	0.1	6.4E-08	8.8E-08	1.5E-07
Toluene	0.000441	1	3.0E-09	0.12	2.5E-09	2	1.5E-09	1.2E-09	2.8E-09
Xylenes	0.00129	1	8.8E-09	0.12	7.3E-09	4	2.2E-09	1.8E-09	4.0E-09
2-Methylnaphthalene	0.267	1	1.8E-06	0.1	1.3E-06	0.04	4.6E-05	3.1E-05	7.7E-05
Acenaphthene	0.235	1	1.6E-06	0.2	2.2E-06	0.6	2.7E-06	3.7E-06	6.4E-06
Acenaphthylene	0.297	0.91	1.9E-06	0.18	2.5E-06	0.04	4.6E-05	6.3E-05	1.1E-04
Anthracene	0.742	1	5.1E-06	0.29	1.0E-05	3	1.7E-06	3.4E-06	5.1E-06
Bis(2-ethylhexyl)phthalate	1.941	1	1.3E-05	0.02	1.8E-06	0.02	6.7E-04	9.1E-05	7.6E-04
Benzo(a)anthracene	2.078	0.91	1.3E-05	0.18	1.8E-05	0.04	3.2E-04	4.4E-04	7.6E-04
Benzo(a)pyrene	2.241	0.91	1.4E-05	0.18	1.9E-05	0.04	3.5E-04	4.7E-04	8.2E-04
Benzo(b)fluoranthene	2.318	0.91	1.4E-05	0.18	2.0E-05	0.04	3.6E-04	4.9E-04	8.5E-04
Benzo(g,h,i)perylene	1.839	0.91	1.1E-05	0.18	1.6E-05	0.04	2.9E-04	3.9E-04	6.8E-04
Benzo(k)fluoranthene	1.658	0.91	1.0E-05	0.18	1.4E-05	0.04	2.6E-04	3.5E-04	6.1E-04
Carbazole	0.621	1	4.3E-06	1	2.9E-05	NA			
Chrysene	2.581	0.91	1.6E-05	0.18	2.2E-05	0.04	4.0E-04	5.5E-04	9.5E-04
Dibenz(a,h)anthracene	0.782	0.91	4.9E-06	0.08	2.9E-06	0.04	1.2E-04	7.4E-05	2.0E-04
Dibenzofuran	0.327	NA		NA		NA			
Fluoranthene	5.044	1	3.5E-05	0.2	4.7E-05	0.4	8.6E-05	1.2E-04	2.1E-04
Fluorene	0.564	1	3.9E-06	0.2	5.3E-06	0.4	9.7E-06	1.3E-05	2.3E-05
Indeno(1,2,3-cd)pyrene	2.001	0.91	1.2E-05	0.18	1.7E-05	0.04	3.1E-04	4.2E-04	7.4E-04
Naphthalene	0.554	1	3.8E-06	0.1	2.6E-06	0.04	9.5E-05	6.5E-05	1.6E-04
Phenanthrene	3.658	0.91	2.3E-05	0.18	3.1E-05	0.04	5.7E-04	7.7E-04	1.3E-03
Pyrene	3.405	1	2.3E-05	0.2	3.2E-05	0.3	7.8E-05	1.1E-04	1.8E-04
Arsenic	12.36	1	8.5E-05	0.03	1.7E-05	0.0003	2.8E-01	5.8E-02	3.4E-01
Barium	24.907	1	1.7E-04	0.35	4.1E-04	0.07	2.4E-03	5.9E-03	8.3E-03

TABLE 9 , continued

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DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 - AVERAGE CONCENTRATIONS
FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Beryllium	0.514	1	3.5E-06	0.35	8.5E-06	0.005	7.0E-04	1.7E-03	2.4E-03
Cadmium	0.635	1	4.4E-06	0.14	4.2E-06	0.001	4.4E-03	4.2E-03	8.5E-03
Chromium	17.192	1	1.2E-04	0.09	7.3E-05	0.02	5.9E-03	3.6E-03	9.5E-03
Copper	8.885	1	6.1E-05	0.35	1.5E-04	NA			
Iron	8547.391	1	5.9E-02	0.35	1.4E-01	NA			
Lead	10.189	0.5	3.5E-05	0.006	2.9E-06	NA			
Magnesium	2504.574	1	1.7E-02	0.35	4.1E-02	NA			
Manganese	154.293	1	1.1E-03	0.35	2.5E-03	0.1	1.1E-02	2.5E-02	3.6E-02
Nickel	15.299	1	1.0E-04	0.35	2.5E-04	0.02	5.2E-03	1.3E-02	1.8E-02
Potassium	1008.659	1	6.9E-03	0.35	1.7E-02	NA			
Sodium	155.042	1	1.1E-03	0.35	2.6E-03	NA			
Vanadium	10.942	1	7.5E-05	0.35	1.8E-04	0.007	1.1E-02	2.6E-02	3.6E-02
Zinc	26.532	1	1.8E-04	0.02	2.5E-05	0.3	6.1E-04	8.3E-05	6.9E-04
						SUMMARY HAZARD INDEX	0.33	0.14	0.47

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TABLE 10

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS

FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	Maximum	mg/kg	
INGESTION RATE	IR	480	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%		
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²	USEPA, 1992
SURFACE AREA EXPOSED	SA	3,295	cm²/day	USEPA, 1989b (1)
CONVERSION FACTOR	CF	0.000001	kg/mg	
BODY WEIGHT	BW	70	kg	USEPA, 1989a
EXPOSURE FREQUENCY	EF	5	days/workweek	PRO JUDGEMENT
EXPOSURE DURATION	ED	12	workweek(s)	PRO JUDGEMENT
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1989a
NONCANCER	AT	12	workweek(s)	USEPA, 1989a

USEPA, 1991 "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors".

USEPA, 1992. Dermal Exposure Assessment: Principles and Applications, Interim report, EPA/600/8-91/011B, January 1992.

USEPA, 1989a. RAGs, Part A.

USEPA, 1989b. Exposure Factors Handbook.

(1) Arms and Hands

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

INTAKE-INGESTION (HQ) = $\frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 5 \text{ days/workweek}}$

INTAKE-INGESTION (CANCER RISK) = $\frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE-DERMAL (HQ) = $\frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 5 \text{ days/workweek}}$

INTAKE-DERMAL (CANCER RISK) = $\frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

For noncarcinogenic effects: AT = ED

TABLE 10, continued

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK
Bis(2-ethylhexyl)phthalate	7.75	1	1.2E-07	0.02	1.7E-08	0.014	1.7E-09	2.4E-10	2.0E-09
Benzo(a)anthracene	20	1	3.2E-07	0.2	4.4E-07	7.3	2.4E-06	3.2E-06	5.6E-06
Benzo(a)pyrene	30	1	4.8E-07	0.2	6.6E-07	7.3	3.5E-06	4.8E-06	8.4E-06
Benzo(b)fluoranthene	30	1	4.8E-07	0.2	6.6E-07	7.3	3.5E-06	4.8E-06	8.4E-06
Benzo(k)fluoranthene	30	1	4.8E-07	0.2	6.6E-07	7.3	3.5E-06	4.8E-06	8.4E-06
Carbazole	20	1	3.2E-07	1	2.2E-06	0.02	6.4E-09	4.4E-08	5.1E-08
Chrysene	50	1	8.1E-07	0.2	1.1E-06	7.3	5.9E-06	8.1E-06	1.4E-05
Dibenz(a,h)anthracene	5	1	8.1E-08	0.09	5.0E-08	7.3	5.9E-07	3.6E-07	9.5E-07
Indeno(1,2,3-cd)pyrene	20	1	3.2E-07	0.2	4.4E-07	7.3	2.4E-06	3.2E-06	5.6E-06
Arsenic	29	1	4.7E-07	0.03	9.6E-08	1.8	8.4E-07	1.7E-07	1.0E-06
Beryllium	1.15	1	1.9E-08	0.35	4.4E-08	4.3	8.0E-08	1.9E-07	2.7E-07
Lead	53	0.5	4.3E-07	NA		NA			
					SUMMARY CANCER RISK		2E-05	3E-05	5E-05

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TABLE 10, continued

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DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS
FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Ethylbenzene	0.0049	1	3.4E-08	0.2	4.6E-08	0.1	3.4E-07	4.6E-07	8.0E-07
Toluene	0.0023	1	1.6E-08	0.12	1.3E-08	2	7.9E-09	6.5E-09	1.4E-08
Xylenes	0.022	1	1.5E-07	0.12	1.2E-07	4	3.8E-08	3.1E-08	6.9E-08
2-Methylnaphthalene	6	1	4.1E-05	0.1	2.8E-05	0.04	1.0E-03	7.1E-04	1.7E-03
Acenaphthene	6	1	4.1E-05	0.2	5.6E-05	0.6	6.9E-05	9.4E-05	1.6E-04
Acenaphthylene	4	0.91	2.5E-05	0.18	3.4E-05	0.04	6.2E-04	8.5E-04	1.5E-03
Anthracene	20	1	1.4E-04	0.29	2.7E-04	3	4.6E-05	9.1E-05	1.4E-04
Bis(2-ethylhexyl)phthalate	7.75	1	5.3E-05	0.02	7.3E-06	0.02	2.7E-03	3.6E-04	3.0E-03
Benzo(a)anthracene	20	0.91	1.2E-04	0.18	1.7E-04	0.04	3.1E-03	4.2E-03	7.4E-03
Benzo(a)pyrene	30	0.91	1.9E-04	0.18	2.5E-04	0.04	4.7E-03	6.4E-03	1.1E-02
Benzo(b)fluoranthene	30	0.91	1.9E-04	0.18	2.5E-04	0.04	4.7E-03	6.4E-03	1.1E-02
Benzo(g,h,i)perylene	30	0.91	1.9E-04	0.18	2.5E-04	0.04	4.7E-03	6.4E-03	1.1E-02
Benzo(k)fluoranthene	30	0.91	1.9E-04	0.18	2.5E-04	0.04	4.7E-03	6.4E-03	1.1E-02
Carbazole	20	1	1.4E-04	1	9.4E-04	NA			
Chrysene	50	0.91	3.1E-04	0.18	4.2E-04	0.04	7.8E-03	1.1E-02	1.8E-02
Dibenz(a,h)anthracene	5	0.91	3.1E-05	0.08	1.9E-05	0.04	7.8E-04	4.7E-04	1.3E-03
Dibenzofuran	10	NA		NA		NA			
Fluoranthene	100	1	6.9E-04	0.2	9.4E-04	0.4	1.7E-03	2.4E-03	4.1E-03
Fluorene	20	1	1.4E-04	0.2	1.9E-04	0.4	3.4E-04	4.7E-04	8.1E-04
Indeno(1,2,3-cd)pyrene	20	0.91	1.2E-04	0.18	1.7E-04	0.04	3.1E-03	4.2E-03	7.4E-03
Naphthalene	20	1	1.4E-04	0.1	9.4E-05	0.04	3.4E-03	2.4E-03	5.8E-03
Phenanthrene	100	0.91	6.2E-04	0.18	8.5E-04	0.04	1.6E-02	2.1E-02	3.7E-02
Pyrene	60	1	4.1E-04	0.2	5.6E-04	0.3	1.4E-03	1.9E-03	3.3E-03
Arsenic	29	1	2.0E-04	0.03	4.1E-05	0.0003	6.6E-01	1.4E-01	8.0E-01
Barium	95.3	1	6.5E-04	0.35	1.6E-03	0.07	9.3E-03	2.2E-02	3.2E-02

TABLE 10, continued

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DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE AND SUBSURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS
FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Beryllium	1.15	1	7.9E-06	0.35	1.9E-05	0.005	1.6E-03	3.8E-03	5.4E-03
Cadmium	8.85	1	6.1E-05	0.14	5.8E-05	0.001	6.1E-02	5.8E-02	1.2E-01
Chromium	58.7	1	4.0E-04	0.09	2.5E-04	0.02	2.0E-02	1.2E-02	3.3E-02
Copper	20.6	1	1.4E-04	0.35	3.4E-04	NA			
Iron	18900	1	1.3E-01	0.35	3.1E-01	NA			
Lead	53	0.5	1.8E-04	0.006	1.5E-05	NA			
Magnesium	9210	1	6.3E-02	0.35	1.5E-01	NA			
Manganese	313	1	2.1E-03	0.35	5.2E-03	0.1	2.1E-02	5.2E-02	7.3E-02
Nickel	41.8	1	2.9E-04	0.35	6.9E-04	0.02	1.4E-02	3.4E-02	4.9E-02
Potassium	4820	1	3.3E-02	0.35	7.9E-02	NA			
Sodium	316	1	2.2E-03	0.35	5.2E-03	NA			
Vanadium	34.9	1	2.4E-04	0.35	5.7E-04	0.007	3.4E-02	8.2E-02	1.2E-01
Zinc	92.9	1	6.4E-04	0.02	8.7E-05	0.3	2.1E-03	2.9E-04	2.4E-03
					SUMMARY HAZARD INDEX		0.89	0.47	1.36

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TABLE 11

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: WORKER

AOCs 44 AND 52 - AVERAGE CONCENTRATIONS

FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	Average	mg/kg	
INGESTION RATE	IR	50	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%		
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²	USEPA, 1992
SURFACE AREA EXPOSED	SA	3,295	cm²/day	USEPA, 1989b (1)
CONVERSION FACTOR	CF	0.000001	kg/mg	
BODY WEIGHT	BW	70	kg	USEPA, 1989a
EXPOSURE FREQUENCY	EF	250	days/year	USEPA, 1991
EXPOSURE DURATION	ED	25	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1989a
NONCANCER	AT	25	years	USEPA, 1991

USEPA, 1991. "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors".

USEPA, 1992. Dermal Exposure Assessment: Principles and Applications, Interim report, EPA/600/8-91/011B, January 1992.

USEPA, 1989a. RAGs, Part A.

USEPA, 1989b. Exposure Factors Handbook.

(1) Arms and Hands

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

For noncarcinogenic effects: AT = ED

TABLE 11, continued
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL – USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: WORKER
AOCs 44 AND 52 – AVERAGE CONCENTRATIONS
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK
Bis(2-ethylhexyl)phthalate	ND	1		0.02		0.014			
Benzo(a)anthracene	5.74	1	1.0E-06	0.2	1.3E-05	7.3	7.3E-06	9.6E-05	1.0E-04
Benzo(a)pyrene	5.99	1	1.0E-06	0.2	1.4E-05	7.3	7.6E-06	1.0E-04	1.1E-04
Benzo(b)fluoranthene	6.09	1	1.1E-06	0.2	1.4E-05	7.3	7.8E-06	1.0E-04	1.1E-04
Benzo(k)fluoranthene	4.59	1	8.0E-07	0.2	1.1E-05	7.3	5.9E-06	7.7E-05	8.3E-05
Carbazole	1.79	1	3.1E-07	1	2.1E-05	0.02	6.3E-09	4.1E-07	4.2E-07
Chrysene	7.17	1	1.3E-06	0.2	1.7E-05	7.3	9.1E-06	1.2E-04	1.3E-04
Dibenz(a,h)anthracene	1.64	1	2.9E-07	0.09	1.7E-06	7.3	2.1E-06	1.2E-05	1.4E-05
Indeno(1,2,3-cd)pyrene	5.03	1	8.8E-07	0.2	1.2E-05	7.3	6.4E-06	8.5E-05	9.1E-05
Arsenic	13.96	1	2.4E-06	0.03	4.8E-06	1.8	4.4E-06	8.7E-06	1.3E-05
Beryllium	0.71	1	1.2E-07	0.35	2.9E-06	4.3	5.3E-07	1.2E-05	1.3E-05
Lead	19.05	0.5	1.7E-06	NA		NA			
					SUMMARY CANCER RISK		5E-05	6E-04	7E-04

TABLE 11, continued

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: WORKER

AOCs 44 AND 52 - AVERAGE CONCENTRATIONS

FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Ethylbenzene	0.0011	1	5.4E-10	0.2	7.1E-09	0.1	5.4E-09	7.1E-08	7.6E-08
Toluene	0.00055	1	2.7E-10	0.12	2.1E-09	0.2	1.3E-09	1.1E-08	1.2E-08
Xylenes	0.0025	1	1.2E-09	0.12	9.7E-09	2	6.1E-10	4.8E-09	5.4E-09
2-Methylnaphthalene	0.63	1	3.1E-07	0.1	2.0E-06	0.04	7.7E-06	5.1E-05	5.8E-05
Acenaphthene	0.6	1	2.9E-07	0.2	3.9E-06	0.06	4.9E-06	6.4E-05	6.9E-05
Acenaphthylene	0.78	0.91	3.5E-07	0.18	4.5E-06	0.04	8.7E-06	1.1E-04	1.2E-04
Anthracene	2.14	1	1.0E-06	0.29	2.0E-05	0.3	3.5E-06	6.7E-05	7.0E-05
Bis(2-ethylhexyl)phthalate	ND	1		0.02		0.02			
Benzo(a)anthracene	5.75	0.91	2.6E-06	0.18	3.3E-05	0.04	6.4E-05	8.3E-04	9.0E-04
Benzo(a)pyrene	5.99	0.91	2.7E-06	0.18	3.5E-05	0.04	6.7E-05	8.7E-04	9.4E-04
Benzo(b)fluoranthene	6.09	0.91	2.7E-06	0.18	3.5E-05	0.04	6.8E-05	8.8E-04	9.5E-04
Benzo(g,h,i)perylene	4.65	0.91	2.1E-06	0.18	2.7E-05	0.04	5.2E-05	6.7E-04	7.3E-04
Benzo(k)fluoranthene	4.59	0.91	2.0E-06	0.18	2.7E-05	0.04	5.1E-05	6.7E-04	7.2E-04
Carbazole	1.79	1	8.8E-07	1	5.8E-05	NA			
Chrysene	7.17	0.91	3.2E-06	0.18	4.2E-05	0.04	8.0E-05	1.0E-03	1.1E-03
Dibenz(a,h)anthracene	1.64	0.91	7.3E-07	0.08	4.2E-06	0.04	1.8E-05	1.1E-04	1.2E-04
Dibenzofuran	0.89	NA		NA		NA			
Fluoranthene	14.39	1	7.0E-06	0.2	9.3E-05	0.04	1.8E-04	2.3E-03	2.5E-03
Fluorene	1.63	1	8.0E-07	0.2	1.1E-05	0.04	2.0E-05	2.6E-04	2.8E-04
Indeno(1,2,3-cd)pyrene	5.03	0.91	2.2E-06	0.18	2.9E-05	0.04	5.6E-05	7.3E-04	7.9E-04
Naphthalene	1.57	1	7.7E-07	0.1	5.1E-06	0.04	1.9E-05	1.3E-04	1.5E-04
Phenanthrene	10.86	0.91	4.8E-06	0.18	6.3E-05	0.04	1.2E-04	1.6E-03	1.7E-03
Pyrene	9.74	1	4.8E-06	0.2	6.3E-05	0.03	1.6E-04	2.1E-03	2.3E-03
Arsenic	13.96	1	6.8E-06	0.03	1.4E-05	0.0003	2.3E-02	4.5E-02	6.8E-02
Barium	38.69	1	1.9E-05	0.35	4.4E-04	0.07	2.7E-04	6.2E-03	6.5E-03

TABLE 11, continued
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: WORKER
AOCs 44 AND 52 - AVERAGE CONCENTRATIONS
FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Beryllium	0.71	1	3.5E-07	0.35	8.0E-06	0.005	6.9E-05	1.6E-03	1.7E-03
Cadmium	1.24	1	6.1E-07	0.14	5.6E-06	0.001	6.1E-04	5.6E-03	6.2E-03
Chromium	27.83	1	1.4E-05	0.09	8.1E-05	0.02	6.8E-04	4.0E-03	4.7E-03
Copper	11.11	1	5.4E-06	0.35	1.3E-04	NA			
Iron	11615	1	5.7E-03	0.35	1.3E-01	NA			
Lead	19.05	0.5	4.7E-06	0.006	3.7E-06	NA			
Magnesium	4205	1	2.1E-03	0.35	4.7E-02	NA			
Manganese	192	1	9.4E-05	0.35	2.2E-03	0.1	9.4E-04	2.2E-02	2.3E-02
Nickel	22.55	1	1.1E-05	0.35	2.5E-04	0.02	5.5E-04	1.3E-02	1.3E-02
Potassium	1695	1	8.3E-04	0.35	1.9E-02	NA			
Sodium	176	1	8.6E-05	0.35	2.0E-03	NA			
Vanadium	17.81	1	8.7E-06	0.35	2.0E-04	0.007	1.2E-03	2.9E-02	3.0E-02
Zinc	38.63	1	1.9E-05	0.02	2.5E-05	0.3	6.3E-05	8.3E-05	1.5E-04
					SUMMARY HAZARD INDEX		0.03	0.14	0.16

TABLE 12
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: WORKER
AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	Maximum	mg/kg	
INGESTION RATE	IR	50	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%		
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2	USEPA, 1992
SURFACE AREA EXPOSED	SA	3,295	cm^2/day	USEPA, 1989b (1)
CONVERSION FACTOR	CF	0.000001	kg/mg	
BODY WEIGHT	BW	70	kg	USEPA, 1989a
EXPOSURE FREQUENCY	EF	250	days/year	USEPA, 1991
EXPOSURE DURATION	ED	25	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1989a
NONCANCER	AT	25	years	USEPA, 1991

USEPA, 1991. "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors".
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications, Interim report, EPA/600/8-91/011B, January 1992.
USEPA, 1989a. RAGs, Part A.
USEPA, 1989b. Exposure Factors Handbook.

(1) Arms and Hands

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

For noncarcinogenic effects: AT = ED

TABLE 12, continued

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: WORKER

AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS

FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK
Bis(2-ethylhexyl)phthalate	ND	1		0.02		0.014			
Benzo(a)anthracene	40	1	7.0E-06	0.2	9.2E-05	7.3	5.1E-05	6.7E-04	7.2E-04
Benzo(a)pyrene	30	1	5.2E-06	0.2	6.9E-05	7.3	3.8E-05	5.0E-04	5.4E-04
Benzo(b)fluoranthene	30	1	5.2E-06	0.2	6.9E-05	7.3	3.8E-05	5.0E-04	5.4E-04
Benzo(k)fluoranthene	30	1	5.2E-06	0.2	6.9E-05	7.3	3.8E-05	5.0E-04	5.4E-04
Carbazole	20	1	3.5E-06	1	2.3E-04	0.02	7.0E-08	4.6E-06	4.7E-06
Chrysene	50	1	8.7E-06	0.2	1.2E-04	7.3	6.4E-05	8.4E-04	9.0E-04
Dibenz(a,h)anthracene	5	1	8.7E-07	0.09	5.2E-06	7.3	6.4E-06	3.8E-05	4.4E-05
Indeno(1,2,3-cd)pyrene	20	1	3.5E-06	0.2	4.6E-05	7.3	2.6E-05	3.4E-04	3.6E-04
Arsenic	29	1	5.1E-06	0.03	1.0E-05	1.8	9.1E-06	1.8E-05	2.7E-05
Beryllium	1.15	1	2.0E-07	0.35	4.6E-06	4.3	8.6E-07	2.0E-05	2.1E-05
Lead	73	0.5	6.4E-06	NA		NA			
						SUMMARY CANCER RISK	3E-04	3E-03	4E-03

TABLE 12, continued

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL – USEPA REGION I B(a)P APPROACH FOR PAHS

RECEPTOR: WORKER

AOCs 44 AND 52 – MAXIMUM CONCENTRATIONS

FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Ethylbenzene	0.0049	1	2.4E-09	0.2	3.2E-08	0.1	2.4E-08	3.2E-07	3.4E-07
Toluene	0.0023	1	1.1E-09	0.12	8.9E-09	0.2	5.6E-09	4.4E-08	5.0E-08
Xylenes	0.022	1	1.1E-08	0.12	8.5E-08	2	5.4E-09	4.3E-08	4.8E-08
2-Methylnaphthalene	6	1	2.9E-06	0.1	1.9E-05	0.04	7.3E-05	4.8E-04	5.6E-04
Acenaphthene	6	1	2.9E-06	0.2	3.9E-05	0.06	4.9E-05	6.4E-04	6.9E-04
Acenaphthylene	4	0.91	1.8E-06	0.18	2.3E-05	0.04	4.5E-05	5.8E-04	6.2E-04
Anthracene	20	1	9.8E-06	0.29	1.9E-04	0.3	3.3E-05	6.2E-04	6.6E-04
Bis(2-ethylhexyl)phthalate	ND	1		0.02		0.02			
Benzo(a)anthracene	40	0.91	1.8E-05	0.18	2.3E-04	0.04	4.5E-04	5.8E-03	6.2E-03
Benzo(a)pyrene	30	0.91	1.3E-05	0.18	1.7E-04	0.04	3.3E-04	4.4E-03	4.7E-03
Benzo(b)fluoranthene	30	0.91	1.3E-05	0.18	1.7E-04	0.04	3.3E-04	4.4E-03	4.7E-03
Benzo(g,h,i)perylene	20	0.91	8.9E-06	0.18	1.2E-04	0.04	2.2E-04	2.9E-03	3.1E-03
Benzo(k)fluoranthene	30	0.91	1.3E-05	0.18	1.7E-04	0.04	3.3E-04	4.4E-03	4.7E-03
Carbazole	20	1	9.8E-06	1	6.4E-04	NA			
Chrysene	50	0.91	2.2E-05	0.18	2.9E-04	0.04	5.6E-04	7.3E-03	7.8E-03
Dibenz(a,h)anthracene	5	0.91	2.2E-06	0.08	1.3E-05	0.04	5.6E-05	3.2E-04	3.8E-04
Dibenzofuran	10	NA		NA		NA			
Fluoranthene	100	1	4.9E-05	0.2	6.4E-04	0.04	1.2E-03	1.6E-02	1.7E-02
Fluorene	20	1	9.8E-06	0.2	1.3E-04	0.04	2.4E-04	3.2E-03	3.5E-03
Indeno(1,2,3-cd)pyrene	20	0.91	8.9E-06	0.18	1.2E-04	0.04	2.2E-04	2.9E-03	3.1E-03
Naphthalene	20	1	9.8E-06	0.1	6.4E-05	0.04	2.4E-04	1.6E-03	1.9E-03
Phenanthrene	100	0.91	4.5E-05	0.18	5.8E-04	0.04	1.1E-03	1.5E-02	1.6E-02
Pyrene	60	1	2.9E-05	0.2	3.9E-04	0.03	9.8E-04	1.3E-02	1.4E-02
Arsenic	29	1	1.4E-05	0.03	2.8E-05	0.0003	4.7E-02	9.3E-02	1.4E-01
Barium	95.3	1	4.7E-05	0.35	1.1E-03	0.07	6.7E-04	1.5E-02	1.6E-02

TABLE 12, continued
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - USEPA REGION I B(a)P APPROACH FOR PAHS
RECEPTOR: WORKER
AOCs 44 AND 52 - MAXIMUM CONCENTRATIONS
FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Beryllium	1.15	1	5.6E-07	0.35	1.3E-05	0.005	1.1E-04	2.6E-03	2.7E-03
Cadmium	8.85	1	4.3E-06	0.14	4.0E-05	0.001	4.3E-03	4.0E-02	4.4E-02
Chromium	58.7	1	2.9E-05	0.09	1.7E-04	0.02	1.4E-03	8.5E-03	1.0E-02
Copper	20.6	1	1.0E-05	0.35	2.3E-04	NA			
Iron	18900	1	9.2E-03	0.35	2.1E-01	NA			
Lead	73	0.5	1.8E-05	0.006	1.4E-05	NA			
Magnesium	9210	1	4.5E-03	0.35	1.0E-01	NA			
Manganese	313	1	1.5E-04	0.35	3.5E-03	0.1	1.5E-03	3.5E-02	3.7E-02
Nickel	41.8	1	2.0E-05	0.35	4.7E-04	0.02	1.0E-03	2.4E-02	2.5E-02
Potassium	4820	1	2.4E-03	0.35	5.4E-02	NA			
Sodium	316	1	1.5E-04	0.35	3.6E-03	NA			
Vanadium	34.9	1	1.7E-05	0.35	3.9E-04	0.007	2.4E-03	5.6E-02	5.9E-02
Zinc	92.9	1	4.5E-05	0.02	6.0E-05	0.3	1.5E-04	2.0E-04	3.5E-04
SUMMARY HAZARD INDEX							0.07	0.36	0.42

TABLE 13

SOIL CONTAMINANT RELEASE ANALYSIS – FUGITIVE DUST
BASED ON NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS)
FOR RESPIRABLE PARTICLES (PM10) (1)

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

CONTAMINANT	SOIL CONCENTRATION (mg/kg)	FUGITIVE DUST NAAQS (ug/m^3)	FUGITIVE DUST CONCENTRATION (2) (mg/m^3)
Carcinogens			
Bis(2-ethylhexyl)phthalate	1.941	50	9.71E-08
Benzo(a)anthracene	2.078	50	1.04E-07
Benzo(a)pyrene	2.241	50	1.12E-07
Benzo(b)fluoranthene	2.318	50	1.16E-07
Benzo(k)fluoranthene	1.658	50	8.29E-08
Carbazole	0.621	50	3.11E-08
Chrysene	2.581	50	1.29E-07
Dibenz(a,h)anthracene	0.782	50	3.91E-08
Indeno(1,2,3-cd)pyrene	2.001	50	1.00E-07
Arsenic	12.36	50	6.18E-07
Beryllium	0.514	50	2.57E-08
Lead	10.188	50	5.09E-07
Cadmium	0.635	50	3.18E-08
Chromium VI (3)	1.719	50	8.60E-08
Nickel	15.299	50	7.65E-07
Noncarcinogens			
Ethylbenzene	0.000936	50	4.68E-11
Toluene	0.000441	50	2.21E-11
Xylenes	0.00129	50	6.45E-11
2-Methylnaphthalene	0.267	50	1.34E-08
Acenaphthene	0.235	50	1.18E-08
Acenaphthylene	0.297	50	1.49E-08
Anthracene	0.742	50	3.71E-08
Benzo(g,h,i)perylene	1.839	50	9.20E-08
Dibenzofuran	0.327	50	1.64E-08
Fluoranthene	5.044	50	2.52E-07
Fluorene	0.564	50	2.82E-08
Naphthalene	0.554	50	2.77E-08
Phenanthrene	3.658	50	1.83E-07
Pyrene	3.405	50	1.70E-07
Barium	24.907	50	1.25E-06
Copper	8.885	50	4.44E-07
Chromium III (3)	15.473	50	7.74E-07
Iron	8547.391	50	4.27E-04

DUST-NAQ.WK1

TABLE 13, continued

SOIL CONTAMINANT RELEASE ANALYSIS – FUGITIVE DUST
BASED ON NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS)
FOR RESPIRABLE PARTICLES (PM10) (1)

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

CONTAMINANT	SOIL CONCENTRATION (mg/kg)	FUGITIVE DUST NAAQS (ug/m^3)	FUGITIVE DUST CONCENTRATION (2) (mg/m^3)
Magnesium	2504.574	50	1.25E–04
Manganese	154.293	50	7.71E–06
Potassium	1008.659	50	5.04E–05
Sodium	155.042	50	7.75E–06
Vanadium	10.942	50	5.47E–07
Zinc	26.532	50	1.33E–06

(1) The National Ambient Air Quality Standard for respirable particulates (PM10) is 50 ug/m^3 (annual arithmetic mean concentration)

(2) Fugitive Dust Concentration (mg/m^3) = [Soil Concentration (mg/kg) x NAAQS for Fugitive Dust (mg/m^3)]/1 x 10^9 ug/kg

(3) The total chromium concentration (17.192 mg/kg) was divided into 90% chromium III and 10% chromium VI (a carcinogen via inhalation).

DUST–NAQ.WK1

TABLE 14
INHALATION EXPOSURE TO DUST– NAAQS OF 50 UG/M ^ 3 (PM10)
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION AIR	CA		mg/m^3	Modeled
INHALATION RATE	IR	2.5	m^3/hour	USEPA, 1991a
BODY WEIGHT	BW	70	kg	USEPA, 1989a
EXPOSURE TIME	ET	8	hours/day	USEPA, 1991a
EXPOSURE FREQUENCY	EF	5	days/workweek	PRO. JUDGEMENT
EXPOSURE DURATION	ED	12	weeks	PRO. JUDGEMENT
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1989a
	AT	12	weeks	USEPA, 1989a*

USEPA, 1991a. " STANDARD DEFAULT EXPOSURE FACTORS"
USEPA, 1989a RISK ASSESSMENT GUIDANCE FOR SUPERFUND, PART A.

EQUATIONS

CANCER RISK = INTAKE (mg/kg – day) x CANCER SLOPE FACTOR (mg/kg – day) ^ – 1

$$INTAKE = \frac{CA \times IR \times RAF \times ET \times EF \times ED}{BW \times AT \times 365\ days/year}$$

HAZARD QUOTIENT = INTAKE (mg/kg – day) / REFERENCE DOSE (mg/kg – day)

$$INTAKE = \frac{CA \times IR \times RAF \times ET \times EF \times ED}{BW \times AT \times 5\ days/workweek}$$

Note:
*For noncarcinogenic effects: AT = ED

000050

TABLE 14, continued
INHALATION EXPOSURE TO DUST- NAAQS OF 50 UG/M^3 (PM10)
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 - AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	AIR CONC. (mg/m³)	INHALATION RAF	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK
Bis(2-ethylhexyl)phthalate	9.71E-08	1	6.5E-11	1.40E-02	9.1E-13
Benzo(a)anthracene	1.04E-07	1	7.0E-11	6.10E+00	4.3E-10
Benzo(a)pyrene	1.12E-07	1	7.5E-11	6.10E+00	4.6E-10
Benzo(b)fluoranthene	1.16E-07	1	7.8E-11	6.10E+00	4.7E-10
Benzo(k)fluoranthene	8.29E-08	1	5.6E-11	6.10E+00	3.4E-10
Carbazole	3.11E-08	1	2.1E-11	2.00E-02	4.2E-13
Chrysene	1.29E-07	1	8.7E-11	6.10E+00	5.3E-10
Dibenz(a,h)anthracene	3.91E-08	1	2.6E-11	6.10E+00	1.6E-10
Indeno(1,2,3-cd)pyrene	1.00E-07	1	6.7E-11	6.10E+00	4.1E-10
Arsenic	6.18E-07	1	4.1E-10	5.00E+01	2.1E-08
Beryllium	2.57E-08	1	1.7E-11	8.40E+00	1.4E-10
Cadmium	3.18E-08	1	2.1E-11	6.10E+00	1.3E-10
Chromium VI	8.60E-08	1	5.8E-11	4.10E+01	2.4E-09
Nickel	7.65E-07	1	5.1E-10	8.40E-01	4.3E-10
Lead	5.09E-07	1	3.4E-10	NA	
			SUMMARY CANCER RISK		3E-08

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TABLE 14, continued
INHALATION EXPOSURE TO DUST - NAAQS OF 50 UG/M^3 (PM10)
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 - AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	AIR CONC. (mg/m^3)	INHALATION RAF	INTAKE (mg/kg-day)	SUBCHRONIC REFERENCE DOSE (mg/kg-day)	SUBCHRONIC HAZARD QUOTIENT
Bis(2-ethylhexyl)phthalate	9.71E-08	1	2.8E-08	0.02	1.4E-06
Benzo(a)anthracene	1.04E-07	1	3.0E-08	0.04	7.4E-07
Benzo(a)pyrene	1.12E-07	1	3.2E-08	0.04	8.0E-07
Benzo(b)fluoranthene	1.16E-07	1	3.3E-08	0.04	8.3E-07
Benzo(k)fluoranthene	8.29E-08	1	2.4E-08	0.04	5.9E-07
Carbazole	3.11E-08	1	8.9E-09	ND	
Chrysene	1.29E-07	1	3.7E-08	0.04	9.2E-07
Dibenz(a,h)anthracene	3.91E-08	1	1.1E-08	0.04	2.8E-07
Indeno(1,2,3-cd)pyrene	1.00E-07	1	2.9E-08	0.04	7.1E-07
Arsenic	6.18E-07	1	1.8E-07	0.0003	5.9E-04
Beryllium	2.57E-08	1	7.3E-09	0.005	1.5E-06
Lead	5.09E-07	1	1.5E-07	ND	
Ethylbenzene	4.68E-11	1	1.3E-11	0.29	4.6E-11
Toluene	2.21E-11	1	6.3E-12	0.11	5.7E-11
Xylenes	6.45E-11	1	1.8E-11	0.086	2.1E-10
2-Methylnaphthalene	1.34E-08	1	3.8E-09	0.04	9.5E-08
Acenaphthene	1.18E-08	1	3.4E-09	0.6	5.6E-09
Acenaphthylene	1.49E-08	1	4.2E-09	0.04	1.1E-07
Anthracene	3.71E-08	1	1.1E-08	3	3.5E-09
Benzo(g,h,i)perylene	9.20E-08	1	2.6E-08	0.04	6.6E-07
Dibenzofuran	1.64E-08	1	4.7E-09	ND	
Fluoranthene	2.52E-07	1	7.2E-08	0.4	1.8E-07
Fluorene	2.82E-08	1	8.1E-09	0.4	2.0E-08
Naphthalene	2.77E-08	1	7.9E-09	0.04	2.0E-07
Phenanthrene	1.83E-07	1	5.2E-08	0.04	1.3E-06
Pyrene	1.70E-07	1	4.9E-08	0.3	1.6E-07

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TABLE 14, continued

INHALATION EXPOSURE TO DUST– NAAQS OF 50 UG/M^3 (PM10)

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS

FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	AIR CONC. (mg/m³)	INHALATION RAF	INTAKE (mg/kg–day)	SUBCHRONIC REFERENCE DOSE (mg/kg–day)	SUBCHRONIC HAZARD QUOTIENT
Barium	1.25E–06	1	3.6E–07	0.001	3.6E–04
Cadmium	3.18E–08	1	9.1E–09	0.001	9.1E–06
Chromium VI	8.60E–08	1	2.5E–08	0.0000057	4.3E–03
Chromium III	7.74E–07	1	2.2E–07	0.0000057	3.9E–02
Copper	4.44E–07	1	1.3E–07	ND	
Iron	4.27E–04	1	1.2E–04	ND	
Magnesium	1.25E–04	1	3.6E–05	ND	
Manganese	7.71E–06	1	2.2E–06	0.14	1.6E–05
Nickel	7.65E–07	1	2.2E–07	0.02	1.1E–05
Potassium	5.04E–05	1	1.4E–05	ND	
Sodium	7.75E–06	1	2.2E–06	ND	
Vanadium	5.47E–07	1	1.6E–07	0.007	2.2E–05
Zinc	1.33E–06	1	3.8E–07	0.3	1.3E–06
			SUMMARY HAZARD INDEX		4E–02

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TABLE 15

SOIL CONTAMINANT RELEASE ANALYSIS – FUGITIVE DUST
BASED ON NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS)
FOR TOTAL RESPIRABLE PARTICLES – 24 HOUR MAXIMUM/ONCE PER YEAR (1)

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

CONTAMINANT	SOIL CONCENTRATION (mg/kg)	FUGITIVE DUST NAAQS (ug/m^3)	FUGITIVE DUST CONCENTRATION (2) (mg/m^3)
Carcinogens			
Bis(2-ethylhexyl)phthalate	1.941	150	2.91E-07
Benzo(a)anthracene	2.078	150	3.12E-07
Benzo(a)pyrene	2.241	150	3.36E-07
Benzo(b)fluoranthene	2.318	150	3.48E-07
Benzo(k)fluoranthene	1.658	150	2.49E-07
Carbazole	0.621	150	9.32E-08
Chrysene	2.581	150	3.87E-07
Dibenz(a,h)anthracene	0.782	150	1.17E-07
Indeno(1,2,3-cd)pyrene	2.001	150	3.00E-07
Arsenic	12.36	150	1.85E-06
Beryllium	0.514	150	7.71E-08
Lead	10.188	150	1.53E-06
Cadmium	0.635	150	9.53E-08
Chromium VI (3)	1.719	150	2.58E-07
Nickel	15.299	150	2.29E-06
Noncarcinogens			
Ethylbenzene	0.000936	150	1.40E-10
Toluene	0.000441	150	6.62E-11
Xylenes	0.00129	150	1.94E-10
2-Methylnaphthalene	0.267	150	4.01E-08
Acenaphthene	0.235	150	3.53E-08
Acenaphthylene	0.297	150	4.46E-08
Anthracene	0.742	150	1.11E-07
Benzo(g,h,i)perylene	1.839	150	2.76E-07
Dibenzofuran	0.327	150	4.91E-08
Fluoranthene	5.044	150	7.57E-07
Fluorene	0.564	150	8.46E-08
Naphthalene	0.554	150	8.31E-08
Phenanthrene	3.658	150	5.49E-07
Pyrene	3.405	150	5.11E-07
Barium	24.907	150	3.74E-06
Copper	8.885	150	1.33E-06
Chromium III (3)	15.473	150	2.32E-06
Iron	8547.391	150	1.28E-03

DST-NAQT.WK1

TABLE 15, continued

SOIL CONTAMINANT RELEASE ANALYSIS – FUGITIVE DUST
BASED ON NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS)
FOR TOTAL RESPIRABLE PARTICLES – 24 HOUR MAXIMUM/ONCE PER YEAR (1)

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

CONTAMINANT	SOIL CONCENTRATION (mg/kg)	FUGITIVE DUST NAAQS (ug/m^3)	FUGITIVE DUST CONCENTRATION (2) (mg/m^3)
Magnesium	2504.574	150	3.76E-04
Manganese	154.293	150	2.31E-05
Potassium	1008.659	150	1.51E-04
Sodium	155.042	150	2.33E-05
Vanadium	10.942	150	1.64E-06
Zinc	26.532	150	3.98E-06

(1) The National Ambient Air Quality Standard for the concentration of total respirable particulates (PM10) in a 24-hour period not to be exceeded more than once per year is 150 ug/m^3

(2) Fugitive Dust Concentration (mg/m^3) = [Soil Concentration (mg/kg) x NAAQS for Fugitive Dust (mg/m^3)]/1 x 10^9 ug/kg

(3) The total chromium concentration (17.192 mg/kg) was divided into 90% chromium III and 10% chromium VI (a carcinogen via inhalation).

DST-NAQT.WK1

DST-FTD3 | 03-Aug-93

TABLE 16

INHALATION EXPOSURE TO DUST– NAAQS OF 150 UG/M^3 (24 HOUR MAXIMUM – NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR)
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION AIR	CA		mg/m^3	Modeled
INHALATION RATE	IR	2.5	m^3/hour	USEPA, 1991a
BODY WEIGHT	BW	70	kg	USEPA, 1989a
EXPOSURE TIME	ET	8	hours/day	USEPA, 1991a
EXPOSURE FREQUENCY	EF	5	days/workweek	PRO. JUDGEMENT
EXPOSURE DURATION	ED	12	weeks	PRO. JUDGEMENT
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1989a
	AT	12	weeks	USEPA, 1989a *

USEPA, 1991a "STANDARD DEFAULT EXPOSURE FACTORS"
USEPA, 1989a RISK ASSESSMENT GUIDANCE FOR SUPERFUND, PART A.

EQUATIONS

CANCER RISK = INTAKE (mg/kg – day) x CANCER SLOPE FACTOR (mg/kg – day) ^ – 1

$$\text{INTAKE} = \frac{CA \times IR \times RAF \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

HAZARD QUOTIENT = INTAKE (mg/kg – day) / REFERENCE DOSE (mg/kg – day)

$$\text{INTAKE} = \frac{CA \times IR \times RAF \times ET \times EF \times ED}{BW \times AT \times 5 \text{ days/workweek}}$$

Note:
*For noncarcinogenic effects: AT = ED

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TABLE 16, continued

DST-FTD3 | 03-Aug-93

INHALATION EXPOSURE TO DUST– NAAQS OF 150 UG/M^3 (24 HOUR MAXIMUM – NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR)
RECEPTOR: CONSTRUCTION WORKER
AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	AIR CONC. (mg/m³)	INHALATION RAF	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK
Bis(2-ethylhexyl)phthalate	2.91E-07	1	2.0E-10	1.40E-02	2.7E-12
Benzo(a)anthracene	3.12E-07	1	2.1E-10	6.10E+00	1.3E-09
Benzo(a)pyrene	3.36E-07	1	2.3E-10	6.10E+00	1.4E-09
Benzo(b)fluoranthene	3.48E-07	1	2.3E-10	6.10E+00	1.4E-09
Benzo(k)fluoranthene	2.49E-07	1	1.7E-10	6.10E+00	1.0E-09
Carbazole	9.32E-08	1	6.3E-11	2.00E-02	1.3E-12
Chrysene	3.87E-07	1	2.6E-10	6.10E+00	1.6E-09
Dibenz(a,h)anthracene	1.17E-07	1	7.9E-11	6.10E+00	4.8E-10
Indeno(1,2,3-cd)pyrene	3.00E-07	1	2.0E-10	6.10E+00	1.2E-09
Arsenic	1.85E-06	1	1.2E-09	5.00E+01	6.2E-08
Beryllium	7.71E-08	1	5.2E-11	8.40E+00	4.3E-10
Cadmium	9.53E-08	1	6.4E-11	6.10E+00	3.9E-10
Chromium VI	2.58E-07	1	1.7E-10	4.10E+01	7.1E-09
Nickel	2.29E-06	1	1.5E-09	8.40E-01	1.3E-09
Lead	1.53E-06	1	1.0E-09	NA	
			SUMMARY CANCER RISK		8E-08

000057

TABLE 16, continued

DST-FTD3 | 03-Aug-93

INHALATION EXPOSURE TO DUST– NAAQS OF 150 UG/M^3 (24 HOUR MAXIMUM – NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR)

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS

FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	AIR CONC. (mg/m^3)	INHALATION RAF	INTAKE (mg/kg-day)	SUBCHRONIC REFERENCE DOSE (mg/kg-day)	SUBCHRONIC HAZARD QUOTIENT
Bis(2-ethylhexyl)phthalate	2.91E-07	1	8.3E-08	0.02	4.2E-06
Benzo(a)anthracene	3.12E-07	1	8.9E-08	0.04	2.2E-06
Benzo(a)pyrene	3.36E-07	1	9.6E-08	0.04	2.4E-06
Benzo(b)fluoranthene	3.48E-07	1	9.9E-08	0.04	2.5E-06
Benzo(k)fluoranthene	2.49E-07	1	7.1E-08	0.04	1.8E-06
Carbazole	9.32E-08	1	2.7E-08	ND	
Chrysene	3.87E-07	1	1.1E-07	0.04	2.8E-06
Dibenz(a,h)anthracene	1.17E-07	1	3.3E-08	0.04	8.4E-07
Indeno(1,2,3-cd)pyrene	3.00E-07	1	8.6E-08	0.04	2.1E-06
Arsenic	1.85E-06	1	5.3E-07	0.0003	1.8E-03
Beryllium	7.71E-08	1	2.2E-08	0.005	4.4E-06
Lead	1.53E-06	1	4.4E-07	ND	
Ethylbenzene	1.40E-10	1	4.0E-11	0.29	1.4E-10
Toluene	6.62E-11	1	1.9E-11	0.11	1.7E-10
Xylenes	1.94E-10	1	5.5E-11	0.086	6.4E-10
2-Methylnaphthalene	4.01E-08	1	1.1E-08	0.04	2.9E-07
Acenaphthene	3.53E-08	1	1.0E-08	0.6	1.7E-08
Acenaphthylene	4.46E-08	1	1.3E-08	0.04	3.2E-07
Anthracene	1.11E-07	1	3.2E-08	3	1.1E-08
Benzo(g,h,i)perylene	2.76E-07	1	7.9E-08	0.04	2.0E-06
Dibenzofuran	4.91E-08	1	1.4E-08	ND	
Fluoranthene	7.57E-07	1	2.2E-07	0.4	5.4E-07
Fluorene	8.46E-08	1	2.4E-08	0.4	6.0E-08
Naphthalene	8.31E-08	1	2.4E-08	0.04	5.9E-07
Phenanthrene	5.49E-07	1	1.6E-07	0.04	3.9E-06
Pyrene	5.11E-07	1	1.5E-07	0.3	4.9E-07

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TABLE 16, continued

INHALATION EXPOSURE TO DUST– NAAQS OF 150 UG/M^3 (24 HOUR MAXIMUM – NOT TO BE E

RECEPTOR: CONSTRUCTION WORKER

AOCs 44 AND 52 – AVERAGE SOIL CONCENTRATIONS

FORT DEVENS, MA

NONCARCINOGENIC EFFECTS

COMPOUND	AIR CONC. (mg/m³)	INHALATION RAF	INTAKE (mg/kg–day)	SUBCHRONIC REFERENCE DOSE (mg/kg–day)	SUBCHRONIC HAZARD QUOTIENT
Barium	3.74E–06	1	1.1E–06	0.001	1.1E–03
Cadmium	9.53E–08	1	2.7E–08	0.001	2.7E–05
Chromium VI	2.58E–07	1	7.4E–08	0.0000057	1.3E–02
Chromium III	2.32E–06	1	6.6E–07	0.0000057	1.2E–01
Copper	1.33E–06	1	3.8E–07	ND	
Iron	1.28E–03	1	3.7E–04	ND	
Magnesium	3.76E–04	1	1.1E–04	ND	
Manganese	2.31E–05	1	6.6E–06	0.14	4.7E–05
Nickel	2.29E–06	1	6.5E–07	0.02	3.3E–05
Potassium	1.51E–04	1	4.3E–05	ND	
Sodium	2.33E–05	1	6.7E–06	ND	
Vanadium	1.64E–06	1	4.7E–07	0.007	6.7E–05
Zinc	3.98E–06	1	1.1E–06	0.3	3.8E–06
			SUMMARY HAZARD INDEX		1E–01

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Table 17
Remedial Alternative Development (as defined in the Feasibility Study)
AOCs 44 & 52 - Maintenance Yards

Response Action/ Technology	Alternative[a]																					
	1		2		3		4		5		6		7		8		9		10		11	
	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C	M	C
No Action	X	X																				
Limited Action																						
Environmental Monitoring	X		X		X		X		X		X		X		X		X		X		X	
Access Controls (Fencing)			X																			
Institutional Controls (Deeds)			X		X		X															
Containment																						
Asphalt Capping					X		X						X	X								
Collection/Removal																						
Excavation				X	X[b]	X	X[b]	X[c]	X	X	X	X[c]	X[c]	X[c]		X	X	X	X	X	X	X
In-situ Treatment																						
Bioventing								X				X	X	X								
Landfarming															X	X						
Treatment																						
Screening															X		X		X			
Composting																	X	X				
On-Site Asphalt Batching				X		X			X	X	X						X[e]	X[e]				
Thermal Desorption																			X	X		
Disposal																						
On-Base																						
Off-Base Landfill															X[d]				X[d]		X	X

Alternative Description ((shaded) indicates the alternatives that were retained for detailed analysis in the FS)

(1) No Action - No Remedial Work; Only Environmental Monitoring (shaded)
(2) Fencing/Asphalt Batch Hot Spot Areas (shaded)
(3) Capping Site/Asphalt Batch Hot Spot Areas (shaded)
(4) Capping Site/Bioventing Hot Spot Areas
(5) Asphalt Batch Site/Asphalt Batch Hot Spot Areas (shaded)
(6) Asphalt Batch Site/Biovent Hot Spot Areas
(7) Bioventing Site and Hot Spot Areas (shaded)
(8) Landfarming Site/Excavating and Landfarming Hot Spot Areas (shaded)
(9) Treatment of Site & Hot Spot Areas at a Central Soil Treatment Facility (shaded)
(10) Thermal Desorption of Site and Hot Spot Areas
(11) Excavate Site and Hot Spot Areas and Dispose Off-Site

[a] NOTE: C = Action taken on Cannibalization Yard Mogas and Leaking Underground Storage Tank Soils (Hot Spot Areas)
M = Action taken on entire Maintenance Yards
X = Indicates use of a Technology for the Alternative

[b] Excavation required for stormwater system expansion
[c] Excavation required for installing bioventing system
[d] Disposal of screened pavement and stone
[e] Batching performed at central treatment facility

Table 18
Selected Remedy
Cost Estimate
Alternative 5: Asphalt Batch Site/Asphalt Batch Hot Spot Areas

AOCS 44 & 52 - Maintenance Yards
Fort Devens, Massachusetts

Item	Cost	Present Worth
Capital Costs		
Asphalt Batch Site and Hot Spot Areas		
Excavation	$ 134,000	
Asphalt Batching	$1,072,000	
Analytical	$ 116,000	
Site Restoration (includes pavement wearing course)	$ 327,000 $1,649,000	$1,649,000
Expansion of Stormwater Collection System (see Table 6-7)	$145,000	$145,000
Air Monitoring	$71,000	$71,000
Total Capital Costs	$1,865,000	$1,865,000
Annual Operation and Maintenance Costs		
Groundwater Monitoring (See Table 6-3)	$19,000	$72,000[1]
Total Operation and Maintenance Cost	$19,000	$72,000
Total Present Worth Cost		$1,937,000

NOTE:
Costs include 25% contingency. Costs rounded to nearest $1,000.
[1] Present worth based on 10% interest rate and duration of 5 years.

TABLE 19
SYNOPSIS OF FEDERAL AND STATE ARARS
ALTERNATIVE 5: ASPHALT BATCHING SITE/ASPHALT BATCHING HOT SPOT AREAS

AOCS 44 AND 52 SOILS
FORT DEVENS, MASSACHUSETTS

AUTHORITY	LOCATION CHARACTERISTIC AND ARAR TYPE	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN ARAR
Federal Regulatory Authority	Wetland Location-Specific	National Environmental Policy Act; [40 CFR Part 6]	Applicable	Requires that Federal agencies minimize the degradation, loss, or destruction of wetlands, and preserve and enhance natural and beneficial values of wetlands under Executive Orders 11990 and 11988.	Wetlands adjacent to AOCs 44 and 52 may currently be impacted by surface water runoff via the storm water system. This alternative covers the site with pavement, thus reducing potential off-site runoff of contaminants in surface water from AOCs 44 and 52 soils to the wetlands. The remedy will also be designed and constructed to manage the increased flow from the paved surface in a manner that will minimize impact to adjacent wetlands.
State Regulatory Requirements	Air Action-Specific	Massachusetts Air Pollution Control Regulations; [310 CMR 6.00 - 7.00]	Applicable	Establishes the standards and requirements for air pollution control in the Commonwealth. Specifically, Section 6.04 provides ambient air quality criteria such as particulate matter standards which is pertinent to AOCs 44 and 52 activity. As a minimum, respirable particulate matter (PM_{10}) for treatment and excavation activities must be maintained at an annual mean arithmetic concentration of $50 \mu g/m^3$ and a maximum 24-hour concentration of $150 \mu g/m^3$. Section 7.02 provides emissions limitations from facilities and operations and requires BACT. Additionally, the Massachusetts toxic air pollutant (TAP) control program requirements will be considered in limiting fugitive emissions (VOCs) and total suspended particulates during treatment and excavation activities.	The emissions limits for particulate matter and fugitive emissions will be managed through engineering controls during excavation and treatment activities.
	Soil Action-Specific	Massachusetts Hazardous Waste Management Rules (MHWMR) Identification and Listing of Hazardous Wastes [310 CMR 30.100]	Applicable	Waste oil is a listed as a hazardous waste under this rule and is therefore subject to 310 CMR 30.000 (i.e., the Massachusetts Hazardous Waste Management Rules).	The wastes found at this site were determined not to be characteristic hazardous wastes; however, waste oil is a listed hazardous waste under this rule.

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TABLE 6-8 (continued)
SYNOPSIS OF LOCATION-SPECIFIC FEDERAL AND STATE ARARS
ALTERNATIVE 5: ASPHALT BATCHING SITE/ASPHALT BATCHING HOT SPOT AREAS

AOCS 44 AND 52 SOILS
FORT DEVENS, MASSACHUSETTS

AUTHORITY	LOCATION CHARACTERISTIC AND ARAR TYPE	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN ARAR
State Regulatory Requirements	Soil Action-Specific	MHWMR Provisions for Recyclable Materials and for Waste Oil [310 CMR 30.200]	Applicable	This regulation contains procedural and substantive requirements for handling regulated recyclable materials. The substantive requirements include preventing and reporting releases to the environment, proper maintenance of treatment and control systems, and handling of regulated recyclable materials.	Asphalt batching of soil on site will comply with the substantive requirements of this regulation.
	Soil Action-Specific	MHWMR - Waste Piles; [310 CMR 30.640 - 30.649]	Applicable	A waste pile facility must install a liner, provide a leachate collection system, provide a run-on/run-off control system, comply with the groundwater monitoring requirements, perform inspections, and close the facility properly.	These requirements will be addressed in the design of an area for stockpiling of wastes for on-site treatment.
	Ground-water Action-Specific	MHWMR Groundwater Protection; [310 CMR 30.660 - 30.679]	Relevant and Appropriate	Groundwater monitoring should be conducted during and following remedial actions. Concentration limits for the hazardous constituents are specified in 310 CMR 30.667.	Although cleanup of groundwater, if required, will be handled as a separate operable unit, groundwater monitoring will be conducted as a component of the remedy.
	All Chemical-Specific	Standards for Analytical Data for Remedial Response Action [WSC-300-89]	To Be Considered	This policy describes the minimum standards for analytical data submitted to the Department.	All sampling plans will be designed with consideration of the analytical methods provided in this policy.

APPENDIX C

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY

APPENDIX C

RESPONSIVENESS SUMMARY

United States Department of the Army

S U P E R F U N D

Responsiveness Summary
Barnum Road Maintenance Yards Site - AOCs 44 & 52

March 1995

INTRODUCTION

The United States Department of the Army (Army) held a 30-day comment period from May 25 to June 24, 1994. This comment period provided an opportunity for interested parties to comment on the Proposed Plan, the Feasibility Study (FS) and other documents (included in the Administrative Record), which have been developed to address the cleanup of the unsaturated soils at the Barnum Road Maintenance Yards - Areas of Contamination (AOCs) 44 & 52 at Fort Devens, Massachusetts. The Proposed Plan specifically addresses cleanup of the surface soils and two subsurface "hot spot" areas. The FS examined and evaluated various options (referred to as remedial alternatives), which address human health risk from exposure to these soils and potential migration of substances present in the soil at AOCs 44 & 52. The Army identified its preferred alternative for AOCs 44 & 52 in the Proposed Plan issued on May 16, 1994. All supporting documentation for the decision regarding AOCs 44 & 52 is placed in the Administrative Record for review. The Administrative Record is a collection of all the documents considered by the Army in choosing the remedy for AOCs 44 & 52. It was made available at the Fort Devens Base Realignment and Closure (BRAC) Environmental Office, Building P12, Fort Devens, and at the Ayer Town Hall, Main Street, Ayer. An index to the Administrative Record was made available at the United States Environmental Protection Agency (USEPA) Records Center, 90 Canal Street, Boston MA and is provided as Appendix E to the Record of Decision.

The purpose of this Responsiveness Summary is to document Army responses to the questions and comments raised during the public comment period on the FS, Proposed Plan, and other documents in the Administrative Record. The Army and USEPA reviewed and considered the comments prior to selecting the remedy for AOCs 44 & 52 which is documented in this Record of Decision.

The comments received by the community and local governments are summarized and responded to in this Responsiveness Summary. Comments from the public were received from a merchant and two town officials from the town of Ayer and a representative of the Fort Devens Reuse Center. Comments were also received from the Massachusetts Department of Environmental Protection (MADEP). Comments generally supported the Army's choice of the selected remedy. Concern was also expressed over the proximity of AOCs 44 & 52 to the Grove Pond drinking water wells.

This Responsiveness Summary is organized into the following sections:

I. **Overview of Remedial Alternatives Considered in the FS Including the Selected Remedy -** This section briefly outlines the remedial alternatives evaluated in detail in the FS and the Proposed Plan, including the Army's selected remedy.

II. **Background on Community Involvement -** This section provides a brief history of community involvement and Army initiatives in apprising the community of Site activities.

III. **Summary of Comments Received During the Public Comment Period and Army Responses -** This section provides Army responses to the verbal and written comments received from the public and not formally responded to during the public meeting. A transcript of the public meeting consisting of all comments received during this meeting and the Army's responses to these comments are provided in Attachment A of this Responsiveness Summary.

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I. Overview of Remedial Alternatives Considered in the Feasibility Study Including the Selected Remedy

Eleven alternatives were initially developed in the FS Report. Of the eleven alternatives, seven were retained in the FS screening step and were evaluated in detail. The seven alternatives are:

- Alternative 1: No Action (as required by the National Contingency Plan)
  The No Action Alternative includes sampling of groundwater monitoring wells and stormwater catch basins located within and downgradient of the Maintenance Yards for up to five years. The No Action Alternative does not involve remedial actions to control migration of substances or institutional controls to prevent exposure to affected soils within the Maintenance Yards.

- Alternative 2: Fencing/Asphalt Batching Hot Spot Areas
  This alternative includes preventing access by maintaining fencing around the site that would limit potential exposure pathways. Deed and land use restrictions would be implemented to ensure that the

fence remained intact in the future. Excavating and asphalt batching the hot spot area soils using an on-site cold-mix process would reduce the volume of compounds present in the highest concentrations at the AOCs. Asphalt batched material from the hot spots would be used as paving base material at the site. Sampling and analysis of groundwater, stormwater and sediments within or downgradient of the Maintenance Yards would also be performed to monitor for off-site migration of compounds.

- <u>Alternative 3: Capping Site/Asphalt Batching Hot Spot Areas</u>
  This alternative entails excavating and asphalt batching the hot spot area soils, expanding the existing stormwater collection system including construction of detention pond(s), capping the entire site with asphalt pavement, and groundwater monitoring. Deed and land use restrictions would be implemented to ensure that the cap remained intact in the future to minimize exposure to surface soils. Excavating and asphalt batching hot spot area soils in the Cannibalization Yard would reduce the volume of compounds present in the highest concentrations at the AOCs. Asphalt batched material from the hot spots would be used as paving base material at the site. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would also be performed to monitor for migration of compounds to the groundwater.

The Army's Selected Remedy is Alternative 5.

- <u>Alternative 5: Asphalt Batching Site/Asphalt Batching Hot Spot Areas</u>
  Alternative 5 involves excavating the top two feet of soil across the site and the two hot spot areas; placing excavated soils in piles at the site for sampling and analysis; cold mix asphalt batching these soils which exceed (do not meet) site cleanup levels; backfilling site excavations with stockpiled soil having compound concentrations below cleanup levels, followed by placement of the cold mix asphalt batched material; expanding the existing stormwater collection system including construction of detention pond(s); applying a pavement wearing course for a vehicle parking surface over the Maintenance Yards; and performing groundwater monitoring. Alternative 5 will

immobilize the petroleum substances in the top two feet of soil which exceed (do not meet) cleanup levels, thus minimizing direct contact/ingestion and inhalation of the soils. Excavating and asphalt batching hot spot areas in the Cannibalization Yard will reduce the mobility of organic compounds present in the highest concentrations at the site. Additionally, Alternative 5 minimizes the potential of petroleum substances migrating off-site.

The proposed pavement wearing course is not a required component of the Alternative 5 that is evaluated in the FS Report. The Army has chosen to add this component to Alternative 5 as part of the preferred alternative to ensure the integrity of the asphalt batched material as a parking lot base for current and future property use.

Also, as discussed in the ROD, deed restrictions will be instituted to prohibit residential development, minimize the possibility of long-term (working lifetime) exposure to subsurface soils, and require management of soils resulting from construction related activities.

- Alternative 7: Bioventing Site and Hot Spot Areas
  This alternative involves bioventing the entire site and the hot spot areas, and performing groundwater monitoring. This alternative includes initial nutrient injection in the areas by tractor and installation of approximately 20 bioventing wells, with associated piping, blower, and humidifier. An asphalt pavement cap would be installed over the entire area of the AOCs to prevent short circuiting of air. Bioventing would reduce the compounds present in the top two feet, thus minimizing direct contact/ingestion and inhalation of the surface soils. Additionally, the concentration of the compounds would be reduced in depths down to approximately 10 feet over the site area. Sampling and analysis of groundwater within or downgradient of the Maintenance Yards would also be performed to monitor for any migration of substances to the groundwater. As detailed in the ROD, a deed restriction would be instituted to prohibit residential development within the Maintenance Yards.

- Alternative 8: Landfarming Site/Excavating and Landfarming Hot Spot Areas
  This alternative includes mechanically screening out the asphalt pavement pieces from surface soil, landfarming the entire area of the AOCs, excavating and landfarming the hot spot area soils that exceed (do not meet) cleanup levels, and performing groundwater monitoring. The landfarming process involves applying nutrients and moisture to the soil. The soil is tilled using disk plows or rototillers to mix and aerate the soil which encourages naturally occurring soil bacteria to degrade and stabilize the petroleum compounds. Landfarming will reduce the compounds present in the top two feet of soil, thus minimizing direct contact/ingestion and inhalation of the soils. Additionally, the concentration of compounds could be reduced in depths below 2 feet over the site area by applying excess nutrients and water to the soil surface. Deed restrictions would also be applied as described in Alternative 5.

- Alternative 9: Treatment of Site and Hot Spot Area Soils at a Central Soil Treatment Facility
  Alternative 9 entails excavating the top two feet of soil across the site and the two hot spot areas; placing excavated soils in piles at the site for sampling and analysis; transporting soils which exceed (do not meet) site cleanup levels to a central soil treatment facility on base; and performing groundwater monitoring at the Maintenance Yards. As a pre-treatment process, surface soil in areas of the site containing bituminous pavement pieces would be screened mechanically to remove large sized fragments. The treatment methods to be used at the central soil treatment facility would be windrow composting and cold mix asphalt batching. Alternative 9 would reduce the compounds present in the top two feet of soil and hot spot areas excavated. Deed restrictions would also be applied as described in Alternative 5.

It will take approximately four months to clean-up the site once construction activities on-site have started.

II. Background on Community Involvement

Throughout the Site's history, community concern and involvement has generally centered around the fact that the Maintenance Yards are located in close proximity to the town of Ayer Grove Pond wells. The Army has kept the community and other interested parties apprised of site activities through regular and frequent informational meetings, fact sheets, press releases and public meetings.

The Army released a community relations plan in February 1992, that had been submitted earlier for public review, outlining a program to address community concerns, and to keep citizens informed about and involved in activities during remedial activities. As part of this plan, the Army established a Technical Review Committee (TRC) in early 1992. The TRC, as required by SARA Section 211 and Army Regulation 200-1, includes representatives from USEPA, USAEC, Fort Devens, MADEP, local officials and the community. The committee generally met quarterly (until January 1994, when it was replaced by the Restoration Advisory Board [RAB]) to review and provide technical comments on work products, schedules, work plans and proposed activities for the SAs at Fort Devens. The SI and FS Reports, Proposed Plan and other related support documents were all submitted to the TRC for their review and comment. Additionally, AOCs 44 & 52 activity was specifically discussed at TRC meetings held March 24, 1992, January 5, 1993, August 2, 1993 and January 26, 1994.

As part of the Army's commitment to involving the affected communities, a RAB is formed when an installation closure involves transfer of property to the community. The RAB was formed in February 1994 to add members of the Citizen's Advisory Committee (CAC) with current TRC members. The CAC was previously established to address Massachusetts Environmental Policy Act (MEPA)/Environmental Assessment issues concerning the reuse of property at Fort Devens. The RAB consists of 28 members (15 original TRC members plus 13 new members) who are representatives from the Army, USEPA Region I, MADEP, local governments and citizens of the local communities. It meets monthly and provides advice to the installation and regulatory agencies on Fort Devens cleanup programs. Specific responsibilities include: addressing cleanup issues such as land use and cleanup goals; reviewing plans and documents; identifying proposed requirements and priorities; and conducting regular meetings which are open to the public. The proposed plan for AOCs 44 & 52 was presented at the June 2, 1994 RAB meeting.

On May 16, 1994, the Army issued a fact sheet to more than 100 citizens and organizations, providing the public with a brief explanation of the preferred alternative for cleanup of the Maintenance Yards. It described the opportunities for public participation, and provided details on the public comment period and public meetings to be held.

On May 16, the Army issued a press release concerning the proposed cleanup at the Maintenance Yards, to the Lowell Sun, Worcester Telegram, Fitchburg-Leominster Sentinel & Enterprise, Harvard Post, Public Spirit (Ayer) and Fort Devens Dispatch. During the week of June 6, 1994, the Army published a public notice concerning the Proposed Plan and public hearing in the Public Spirit, the Fitchburg-Leominster Sentinel & Enterprise, the Lowell Sun, and the Fort Devens Dispatch. The Army also made the plan available to the public at the information repositories located at the libraries in Ayer, Shirley, Lancaster, Harvard and at Fort Devens.

On May 24, 1994, the Army held an informal informational meeting at Fort Devens to discuss the results of the field investigation and the cleanup alternatives presented in the FS and to present the Army's Proposed Plan. This meeting also provided the opportunity for open discussion concerning the proposed cleanup. From May 25 to June 24, 1994, the Army held a 30-day public comment period to accept public comments on the alternatives presented in the FS and the Proposed Plan and on other documents released to the public. On June 15, 1994 the Army held a formal public meeting at Fort Devens to discuss the Proposed Plan and to accept any verbal comments from the public. A transcript of this meeting and the comments and the Army's response to comments are included in this responsiveness summary.

All supporting documentation for the decision regarding the Maintenance Yards is placed in the Administrative Record for review. The Administrative Record is a collection of all the documents considered by the Army in choosing the remedy for the Maintenance Yards. On May 27, 1994 the Army made the Administrative Record available for public review at the Fort Devens BRAC Environmental Office, and at the Ayer Town Hall, Ayer, Massachusetts. An index to the Administrative Record was available at the USEPA Records Center, 90 Canal Street, Boston, Massachusetts and is provided as Appendix E.

III. Summary of Comments Received During the Public Comment Period and Army Responses

Comments 1a through 1d: The current chairman of the Ayer Board of Selectmen expressed her belief that proper notification was not received by the town of Ayer regarding the Proposed Plan for remediation of the Barnum Road Maintenance Yards. Also, she had heard that to save money there was a change in plans for cleanup of the site from what was proposed many months ago, or maybe a year ago. The chairman specifically stressed the importance of the town's involvement due to the recent vote by the people of Ayer to reconstruct a well at Grove Pond downgradient of the Maintenance Yards. Specific questions relating to the above general concerns were:

- **Comment 1a:** How many feet from the Grove Pond well is this hot spot that you're talking about?

  Army Response: During the public hearing the Army responded that it was over 2,000 feet but an exact figure was not available. A more precise distance between the Grove Pond wells and the Maintenance Yards is approximately 2,200 feet. The proposed cleanup of the Maintenance Yards, as detailed in the FS and Proposed Plan, focuses on surface soils (0 to 2 feet below ground surface) which have been affected by releases of gasoline, motor oil, and other automotive fluids and includes two "hot spots": 1) surface and subsurface (below 2 feet) soils associated with a reported release of "mogas" (motor vehicle gasoline) in 1985, and 2) subsurface soils associated with leakage from a 1,000-gallon underground waste oil storage tank which was removed in May 1992.

- **Comment 1b:** Were you aware when you [selected the remedy] that the Grove Pond wells were going to be reused?

  Army Response: The Army was aware that the town of Ayer was considering returning its potable water supply wells on Grove Pond to regular service. Protection of this aquifer was a major consideration in developing remedial alternatives, proposing a preferred alternative for public comment, and selecting the remedy. The FS and Proposed Plan discuss the potential redevelopment of these wells and delineate the Zone II area of influence (zone of contribution to the wells under the most severe pumping and recharge conditions that can be anticipated realistically). AOCs 44 & 52 are located within this Zone II area as defined in a report prepared for the town of Ayer entitled "Town of Ayer, Massachusetts Grove Pond Wells Hydrogeologic Investigation and Zone II Aquifer Mapping" by the town of Ayer's consultant, Camp, Dresser & McKee, Inc. (1993).

- **Comment 1c:** How much conversation has there been with the town of Ayer about what you have contemplated doing, and who have you been talking to in Ayer?

  Army Response: Section II of this Responsiveness Summary describes the Army's actions taken to inform the public about the environmental restoration of the Maintenance Yards. The SI and FS Reports, Proposed Plan and other related support documents were all submitted to the TRC for review and comment. TRC members from the town of Ayer have included the former and current Superintendent of Public Works, and Nashoba Associated Boards of Health, Environmental Health Division representative. The Fact Sheet (issued to the public to describe the preferred alternative and opportunities for public participation in the cleanup plan) was mailed to more than 100 citizens and organizations. Included in this mailing were the following officials and/or affiliations for the town of Ayer: the above TRC members, the Executive Director of the Ayer Chamber of Commerce, the Ayer Board of Health, the Chairman of the Board of Selectmen, the Executive Secretary, the Conservation Commission, the Water Bylaw Commission Chairperson, the Joint Boards of Selectmen, and six other citizens/merchants of the town of Ayer.

- **Comment 1d:** The town needs an explanation of why there has been a change [in plans for cleanup of the site from what was proposed many months ago or maybe a year ago].

- **Army Response:** At least two other remedial alternatives detailed in the FS Report were evaluated as a possible preferred alternative and then changed or eliminated in favor of another alternative, prior to officially issuing the final Proposed Plan to the public. At one time in the evaluation process, Alternative 8 - Landfarming the Site and Excavating and Landfarming Hot Spot Areas, was considered a possible preferred alternative. This alternative was eliminated principally due to the proximity of the Grove Pond water supply wells and recommendation by the MADEP Central Regional Office Water Supply Section. Landfarming requires applying nutrients to the soil and there was concern of nitrate/nitrites and phosphates migrating to the groundwater. Later in the evaluation and review process, Alternative 9 - Treatment of Site and Hot Spot Area Soils at a Central Soil Treatment

Facility was considered a possible preferred alternative. This alternative was also eventually eliminated because of the difficulty in reusing compost-treated soils at AOCs 44 & 52 or elsewhere at Fort Devens in a manner that would be considered adequately regulated in accordance with the Massachusetts Contingency Plan (MCP). Alternative 5 - Asphalt Batching the Site and Asphalt Batching the Hot Spot Areas was eventually selected as the preferred alternative in the final Proposed Plan which was issued to the public in May 1994. Alternative 5 was considered to be more protective by forming a low-permeable (asphalt batched) layer, thus further protecting the groundwater from the potential migration of compounds and further preventing any possible exposure to affected subsurface soil (if any). Alternative 5 is less expensive than Alternative 9, but more expensive than Alternative 8.

Comment 2: The MADEP Central Regional Office Fort Devens Section Chief expressed that the MADEP believes that Alternative 5 is the most protective of the proposed alternatives. She added that the MADEP would like to state that it is their understanding that the Army will excavate any "grossly contaminated" soil encountered, besides the top two feet and the two hot spot areas. They would like to make sure that these include areas where previous sampling has shown that soil below 2 feet contained compounds above the cleanup levels, especially in the spill containment pad area.

Army Response: The Army proposes to excavate any highly affected soil encountered in addition to the top two feet of soil and the two hot spot areas as the MADEP has requested. This was stated in the Final Excavated Soils Management Plan (ESMP) dated May 1994 (Page 2-4). Except for the two hot spot areas, previous sampling below 2 feet has not shown soil to be affected above established cleanup levels.

SI samples collected from 15 borings at depths of 5 to 7 feet and 10 to 12 feet revealed total petroleum hydrocarbon compound (TPHC) concentrations that meet the cleanup level (500 ppm). The cleanup level for carcinogenic polynuclear aromatic hydrocarbons (cPAHs) (an average total cPAH concentration of 7 ppm) was derived based on a surface soil exposure scenario and is not applicable to subsurface soils. Risk evaluation for subsurface soils indicate that human health risks are within the acceptable USEPA target risk range. However, even if the cPAH cleanup concentration for surface soil was applied to the subsurface soil, only one of 31 subsurface soil samples exceeds (does not meet) the cleanup level of 7 ppm (16.4 ppm from boring 44B-92-01X at the 5- to 7-foot depth). The average concentration of total cPAHs is below 7 ppm.

Exploratory test pits were excavated for construction of a concrete spill-containment basin in the southeast corner of the TDA Maintenance Yard, in July 1991. These initial test pits revealed zones of contaminated soil below the surface (TPHC was found at 420 to 700 μg/g concentrations in surface soil samples). However, following removal of approximately 1,200 tons of soil for construction of the basin, confirmation samples collected from the proposed basin's subgrade at the bottom of the excavation contained TPHC concentrations ranging from nondetect to only 7 ppm.

Comment 3: The MADEP also requested that the Army review their spill management plan with the DOL to ensure, that prior to remediation, there is a good management plan for spills and that the spill containment pad is utilized to minimize the likelihood of further impacting soils. This concern is raised due to the MADEP's interpretation that there were new spills detected during the supplemental site investigations last year.

Army Response: The Army will review the spill management plan to ensure that approved procedures are being followed. However, the MADEP's comment warrants clarification. The "spills" referred to in the MADEP's comment was actually <u>one</u> drip spot, of the size commonly found in public parking areas or residence driveways and far less than the MADEP reportable quantity of 10 gallons.

Comment 4: The Environmental Outreach Coordinator for the Fort Devens Reuse Center asked what the general depth of groundwater is at the site and generally how far have the contaminants migrated through the soil in the yard?

Army Response: The approximate depth of the water table is 26 to 28 feet. Groundwater sampling conducted in July 1992, October 1992, June 1993, and September 1993 in the area, shows no evidence that substances found in the soils of the Maintenance Yards have migrated to the groundwater table and are affecting groundwater quality.

Based on the SI soil sampling results, the average TPHC concentrations across the site at the 0- to 2-foot, 5- to 7-foot and 10- to 12-foot ranges are 315 ppm, 52 ppm and 33 ppm respectively. Maximum TPHC concentrations are 1210 ppm, 170 ppm and 119 ppm respectively. These values exclude the TPHC concentrations at boring 44B-92-06X (that may be associated with the mogas spill) and TPHC concentrations associated with the waste oil underground storage tank (UST). Excluding these two areas, TPHC concentrations that exceed (do not meet) the 500 ppm target level are found only in the top 2-foot sampling level. Average cPAH concentrations across the site at the 0- to 2-foot, 5- to 7-foot and 10-to 12-foot ranges are 31 ppm, 2 ppm, and 0.2 ppm. Maximum cPAH concentrations are 220 ppm, 16.4 ppm and 1.5 ppm respectively. Risk evaluations indicate that human health risks exceed the acceptable USEPA Superfund target risk range only from exposure to cPAHs in the top 2 feet of soil.

TPHC concentrations exceed (do not meet) the 500 ppm cleanup level below 2 feet in the hot spot areas. TPHC concentrations were detected at 1560 ppm down to the 10- to 12-foot range in boring 44B-92-06X (mogas spill hot spot area). Soil samples collected from the sidewalls (9 feet below ground surface [bgs]) of overexcavated soils surrounding the removed waste oil UST, revealed TPHC concentrations ranging from 1,110 to 2,740 ppm. However TPHC was detected in only two of 16 additional samples collected from supplemental SI borings in the UST area. Concentrations were 121 ppm (10 feet bgs) and 38 ppm (5 feet bgs) which meet the cleanup level. Subsurface soils in both hot spot areas will be excavated to remove TPHC contaminated soils that exceed (do not meet) the cleanup level.

Comment 5: The current chairman of the Ayer Board of Selectmen asked if the groundwater monitoring wells sampled included the town of Ayer Grove Pond well. She also asked if it is important that the Grove Pond well also be sampled.

Army Response: During the public hearing the Army responded that the Grove Pond wells have been sampled by USEPA but not concurrently with the Army's sampling efforts at AOCs 44 & 52. (The specifics of these sampling events were not recalled during the meeting). Specifically, both Grove Pond wells were sampled between 7/3/90 and 8/21/91. Tetrachloroethene, a cleaning solvent, was detected in one sample from Well #2 in 1991 at a concentration of 1.2 μg/l which is below (better than) state and federal Maximum Contaminant Levels (MCLs) for drinking water. No tetrachloroethene has been detected in AOCs 44 & 52 soils. Sampling of the Grove Pond wells was also performed by the town of Ayer's consultant in 1992. Sampling was conducted in conjunction with the extended pumping tests to examine the quality of water produced by the wells in accordance with Massachusetts Drinking Water Regulations. There were no volatile organics, pesticides or semivolatile organics detected during this sampling event. As with any drinking water supply, the

MADEP will require the town of Ayer to sample the Grove Pond wells if they are to be used as a potable water source.

Comment 6: The current Superintendent of the town of Ayer Department of Public Works also expressed his concern about the cleanup, since AOCs 44 & 52 are located within the Zone II for the Grove Pond drinking water wells. He stated that wells have historically served the town of Ayer as the main source of drinking water but over the last few years have not been used except for emergency situations because of high iron and manganese content in the water. The Superintendent stated that this situation is about to change due to plans for construction of a new filter plant. Once this plant is constructed, Ayer proposes to pump 1 million gallons per day (mgd) from the Grove Pond well source. He stated that the proposed cleanup of the Barnum Road Maintenance Yards sounds adequate, provided a strong monitoring program is in place and that if a problem develops, quick remedial action will be taken.

Army Response: The Proposed Plan includes sampling groundwater for a period of five years following remediation of the soils at the Barnum Road Maintenance Yards. Details of this monitoring program will be specified in the forthcoming remedial design. The Army does not expect that the groundwater will ever be impacted by the past Maintenance Yards activities, after soil remediation. In addition to soil treatment by asphalt batching, the Proposed Plan provides greater aquifer protection through the construction of the low-permeable pavement barrier at the site. However, should groundwater become affected, Alternative 5 does not impede the ability to quickly conduct further remedial actions.

Comment 7: A merchant in the town of Ayer stated that the Army needs to start addressing contamination in Plow Shop Pond. He has not heard much lately on this issue and would like to keep informed.

Army Response: The Army has made Plow Shop Pond a separate operable unit from the remediation being performed at the Barnum Road Maintenance Yards. Sites are broken into separate operable units so that the substances present at each site can be more comprehensively addressed. Additional analytical sampling in Plow Shop Pond is proposed this summer. The sampling is being performed to investigate water quality of the pond and to evaluate potential remedial alternatives. Current and proposed activities at Plow Shop Pond will follow the remedial investigation and feasibility study (RI/FS) process established by the USEPA Superfund program which encourages public involvement. The Army will be keeping the community and other interested parties apprised of Plow Shop Pond activities through TRC meetings, public informational meetings, fact sheets, press releases and public hearings as was done for the Barnum Road Maintenance Yards.

ATTACHMENT A

PUBLIC HEARING TRANSCRIPT

Volume I
Pages 1 to 11

FORMAL PUBLIC HEARING

FINAL PROPOSED PLAN

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52

FORT DEVENS, MASSACHUSETTS

Held at:
Fort Devens, Massachusetts
Wednesday, June 15, 1994

(Robin Gross, Registered Professional Reporter)

* * * *

P R O C E E D I N G S

MR. CHAMBERS: It's now about 7:30, I'd like to commence the formal public comment period. My name is James Chambers, I'm the BRAC Environmental Coordinator here at Fort Devens. As I say, the public comment period began May 25, 1994, and ends June 24, 1994. Comments may be either made this evening or submitted in writing to the following address, and I'll announce that right now: Send that to AFZD-BEC, Post Office Box 1, Fort Devens, Massachusetts, 01433. And you may call me also at area code 508-796-3114.

Comments received during this period will be responded to in a document known as a Responsiveness Summary that we anticipate will issue on or before August 9, depending on the number of comments we receive. We anticipate a draft Record of Decision being made at that time, with a final Record of Decision being made on September 12.

And with that, I'd like to invite public comment. If you submit on cards, I will read those. Once again, if you submit it on cards, please write your name and your affiliation; and if you elect to stand and make your announcement, please announce your name and your affiliation.

MS. HAMEL: Do you want me to start? I'm Pauline Hamel. I'm chairman of the Ayer Board of Selectmen. My problem with this is I don't believe proper notification was received by the town of the work that's going to be done in that yard, and our concern is that last night at town meeting the people of the Town of Ayer voted to I guess you might say reconstruct a well that's at the bottom of this site. This is going to be our major water supply for the Town of Ayer. It was our major water supply several years ago; then we went to wells at Spectacle Pond, which is on the other side of town, but found they're not sufficient to our needs.

After considerable consultation with other people by our DPW superintendent it was decided that we would go back to the Grove Pond wells, to reconstruct and put a considerable amount of money with the future construction, even after the initial work on the wells to clear the magnesium and whatever else is in there; that there will be additional capacity later on, and it will be built so that we can use it for many, many years because of the aquifer that runs under that.

My problem is this: Many months ago, when Mr. Doney was head of the Reuse Center, he informed me that there was an extensive cleanup proposed for this particular area. It was not the cleanup, as he described it to me, it was not the cleanup that has recently been described to me. Only accidentally did I find out about this cleanup. We were interviewing, strangely enough, for Mr. Doney's position at the Reuse Center about three weeks ago when a gentleman made a remark about a change that the government had in the cleanup of this particular area. And when Eric Knapp, who represents Massachusetts Land Bank, said to him, "Where did you get that information? That's not public knowledge," I just listened; he would not state.

The next day I tried to find out more information, and all I was told was that I didn't have to worry about it; it was and had changed, but I didn't have to worry, that it was a procedure, process for cleaning that was acceptable to the Massachusetts Land Bank. We are naturally not the Massachusetts Land Bank, we are the town, and we have to look for many years to that for a water source.

I would like to ask one question here before I go further, perhaps you can tell me: How many feet from the Grove Pond well is this hot spot that you're talking about?

CAPTAIN PEASE: It's over 2,000 feet. I'm not sure of the exact figure.

MS. HAMEL: Were you aware when you did that that the Grove Pond wells were going to be reused? How much conversation has there been with the Town of Ayer about what you have contemplated doing, and who have you been talking to in Ayer?

MR. CHAMBERS: We'll respond to that in the responsiveness summary.

MS. HAMEL: All right. These are my questions. My concern, naturally, is that all of a sudden there's a change in the plans for the cleanup of that area. I know nothing about -- it certainly isn't within my knowledge to know whether this is a good or a bad plan. I was told of a meeting that was to take place in Sudbury which I attended last Friday at which some of these people were present, and they explained to me that they thought it was probably a better plan than the initial one, but I'm certainly not convinced that it is.

And due to the fact that millions of dollars were voted on last night to build this well at Grove Pond, I think the Town of Ayer and the people there need some explanation as to why the extensive cleanup that was proposed many months ago, maybe a year ago, is no longer planned. I was told it was to save money. Whether that's true or not, I don't know. But I certainly feel the town needs an explanation as to why there has been a change.

And also I'd like to know who here has been talking to people in the Town of Ayer, and who those people are, and why we didn't receive -- I certainly didn't know anything about a March 25 meeting, and only by accident did I learn about it, because these people who I saw on Friday told me about this meeting tonight. And then I had to call around today to find out -- I'm sorry that I didn't write down the time and the place, and I had to call around today several places to find out about the time and the place. So I think that's a disservice to the town, really.

As an individual who's elected to watch out for the welfare of the people in the town, I feel that the military certainly has not fulfilled its obligation to the Town of Ayer in advising it what is being done down there or above our contemplated wells. That's all I have to say.

MS. WELSH: My name is Lynne Welsh, I'm from the Massachusetts Department of Environmental Protection, and I will be submitting written comments during the comment period but I wanted to take this opportunity to state that we have viewed the plan which recommends Alternative 5, with cleanup levels of 7 parts per million of carcinogenic PAHs and 500 parts per million TPH, and believe that this is the most protective of the proposed alternatives.

As we have stated to you and a group of other people last Friday, we do have two concerns which we have talked to the Army about and just wanted to state that our understanding is that besides the excavation of the top two feet and the hot spots there also be excavation of grossly contaminated soil. And we'd like to make sure that these include the areas where previous sampling has shown that soil was contaminated above the cleanup levels in areas below two feet, especially the cleanup levels in the spill containment pad; that if these are grossly contaminated, they should be excavated also.

During the investigation which the Army was doing last year, the supplemental investigation, sampling by ABB showed new spills in the yards, and we'd like the Army to review their spill management plan with the DOL, Division of Labor -- whoever runs the TDA yards -- to make sure that during the time when study and when the design is going on that there's a good management plan out there for the spills and that the spill containment pad is utilized so there's less likelihood of more grossly contaminated soils that need to be remediated.

Thank you.

MR. CHAMBERS: More comments?

MS. KOHN: My name is Judith Kohn, K-o-h-n, and I am the Environmental Outreach Coordinator for the Fort Devens Reuse Center. I just have a general question: What's the general depth of groundwater in this site, 44, 52?

CAPTAIN PEASE: 26 feet.

MS. KOHN: I guess a follow-up question to that, how far generally have the contaminants migrated through the soil in the yard?

MR. CHAMBERS: We'll respond to that in the responsiveness summary.

MS. KOHN: Thank you. That's all I have.

MR. CHAMBERS: More comments?

MS. HAMEL: I have one additional one that I'd like to ask. You mentioned that there were eight wells checked. Was one of them the Grove Pond well?

CAPTAIN PEASE: That was sampled but not concurrently. That was sampled at another time by -- I'm going to have use the EPA for help. The EPA sampled that well.

MS. HAMEL: It's not important that well be checked or that area? By someone?

MR. CHAMBERS: We'll respond to that in the responsiveness summary.

(Pause)

MS. HAMEL: Can I ask one other question? Does the Army still use their well which is right besides Ayer's Grove Pond well? There's a well that sits right beside the Grove Pond well or, you know, it's relatively close, it's just down, I don't know, I have no idea 2,000 feet or 200 feet, but it's right adjacent to the Grove Pond well, and does the Army still use that well?

CAPTAIN PEASE: Yes, the Army uses that well.

MS. HAMEL: Has that well been tested?

CAPTAIN PEASE: Yes, it has.

MR. CHAMBERS: Okay. I'd like to ask once again if there are more comments. Okay. With that, we'd like to close this public comment meeting. Thank you.

(Whereupon, the proceedings were closed at 7:46 p.m.)

CERTIFICATE

I, Robin Gross, Registered Professional Reporter, do hereby certify that the foregoing transcript, Volume I, is a true and accurate transcription of my stenographic notes taken on Wednesday, June 15, 1994.

Robin Gross

Robin Gross
Registered Professional Reporter

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APPENDIX D

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY

APPENDIX D

DECLARATION OF STATE CONCURRENCE

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection
Central Regional Office

William F. Weld
Governor
Trudy Coxe
Secretary, EOEA
Thomas B. Powers
Acting Commissioner

March 7, 1995

Mr. John De Villars
Regional Administrator
U.S. Environmental Protection Agency
Region I
JFK Federal Building
Boston, MA 02203

RE: Barnum Road Maintenance Yards (BRMY), AOCs 44 and 52, Fort Devens, MA, ROD Concurrence

Dear Mr. De Villars:

The Massachusetts Department of Environmental Protection (MADEP) has reviewed the preferred remedial alternative recommended by the Army and the EPA for the final cleanup of the Barnum Road Maintenance Yards, the core provisions of which are summarized below. The MADEP has worked closely with the Army and EPA in the development of the preferred alternative and is pleased to concur with the Army's choice of the remedial alternative.

The MADEP has evaluated the preferred alternative for consistency with M.G.L. c. 21E (21E) and the Massachusetts Contingency Plan (MCP). The remedial alternative addresses the entire BRMY as one operable unit and includes the following components:

- Excavate the top two feet of surface soil across the site;
- Excavate the two hot spot areas;
- Stockpile soils for sampling and analysis;
- Cold mix asphalt batch soils exceeding site cleanup levels;
- Backfill excavations with uncontaminated stockpiled soil and with asphalt batched material;
- Apply a pavement wearing course;

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- Expand the existing stormwater collection system;

- Perform groundwater monitoring;
- As a precautionary measure, institute deed restrictions to preclude receptor contact with subsurface soils. These deed restrictions include:

  1) prohibit residential development/use,

  2) minimize the possibility of long term (working lifetime) exposure to subsurface soils,

  3) require management of soils resulting from future construction related activities that may temporarily disturb the cap.

The MADEP's concurrence with the preferred remedial alternative is based upon the expectation that it will result in a permanent solution as defined in 21E and the MCP and that contaminant concentrations achieved during the implementation of the remedial alternative will meet the MCP standards.

The MADEP would like to thank EPA, in particular the Fort Devens Remedial Project Manager, Jim Byrne, for their efforts to ensure that the requirements of the MADEP were met in the selection of the remedial alternative. We look forward to continuing to work with EPA in the implementation of the remedial alternative. If you have any questions, please contact Lynne Welsh at (508) 792-7653, ext. 3851.

Sincerely,

Cornelius O'Leary
Regional Director
MADEP, CERO

cc: Fort Devens Mailing List (Cover Letter Only)
Edward Kunce, MADEP
Jay Naparstek, MADEP
Informational Repositories
Jim Byrne, EPA
Charles George, AEC
Mark Applebee, ACOE
Judy Kohn, Mass Land Bank

APPENDIX E

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY

APPENDIX E

ADMINISTRATIVE RECORD INDEX

Fort Devens

Group 3, 5, & 6 Sites

Administrative Record File for

Fort Devens Barnum Road Maintenance Yard

Areas of Concern 44/52

Index

Prepared for
New England Division
Corps of Engineers

by
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Introduction

This document is the Index to the Administrative Record File for the Fort Devens Barnum Road Maintenance Yard - Areas of Concern (AOCs) 44/52. Section I of the Index cites site-specific documents and Section II cites guidance documents used by U.S. Army staff in selecting a response action at the site. Some documents in this Administrative Record File Index have been cited but not physically included. If a document has been cross-referenced to another Administrative Record File Index, the available corresponding comments and responses have been cross-referenced as well.

The Administrative Record File is available for public review at EPA Region I's Office in Boston, Massachusetts, at the Fort Devens Environmental Management Office, Fort Devens, Massachusetts, and at the Ayer Town Hall, 1 Main Street, Ayer, Massachusetts. Supplemental/Addendum volumes may be added to this Administrative Record File. Questions concerning the Administrative Record should be addressed to the Fort Devens Base Realignment and Closure Office (BRAC).

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Section I

Site-Specific Documents

ADMINISTRATIVE RECORD FILE INDEX

for

Fort Devens Barnum Road Maintenance Yard
Areas of Concern 44/52
Compiled: March 1995

1.0 Pre-Remedial

Cross Reference: The following Reports, Comments, and Responses to Comments (entries 1 through 6) are filed and cited as entries 1 through 6 in minor break 1.2 Preliminary Assessment of the Fort Devens Group 1A Administrative Record File Index.

Reports

1. "Final Master Environmental Plan for Fort Devens," Argonne National Laboratory (April 1992).
2. "Preliminary Zone II Analysis for the Production Wells at Fort Devens, MA, Draft Report", ETA Inc. (January 1994).

Comments

3. Comments Dated May 1, 1992 from Walter Rolf, Montachusett Regional Planning Commission on the April 1992 "Final Master Environmental Plan for Fort Devens," Argonne National Laboratory.
4. Comments Dated May 7, 1992 from James P. Byrne, EPA Region I on the April 1992 "Final Master Environmental Plan for Fort Devens," Argonne National Laboratory.
5. Comments Dated May 23, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the January 1994 "Preliminary Zone II Analysis for the Production Wells at Fort Devens, MA, Draft Report", ETA Inc.

Responses to Comments

6. Response Dated June 29, 1992 from Carrol J. Howard, Fort Devens to the May 7, 1992 Comments from James P. Byrne, EPA Region I. Reports

1.3 Site Inspection

Cross-Reference: The following Reports, Comments, Responses to Comments, Responses to Responses to Comments, and Meeting Notes (entries 1 through 25) are filed and cited as entry numbers 1 through 25 in minor break 1.3 Site Inspection Reports of the Fort Devens Groups 3, 5, & 6 Sites Administrative Record Index.

Reports

1. "Final Task Order (Site Investigation) Work Plan," ABB Environmental Services, Inc. (September 1992).
2. "SI Data Packages," ABB Environmental Services, Inc. (December 1992).
3. "Final Site Investigation Report - Groups 3, 5, & 6, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (April 1993).
4. "Supplemental Site Investigation - Groups 3, 5, and 6, Fort Devens, Massachusetts, Task Order Work Plan," ABB Environmental Services, Inc. (rev. July 1993).
5. "Supplemental Site Investigation - Data Package," ABB Environmental Services, Inc. (September 1993).

Comments

6. Comments Dated April 15, 1992 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the March 1992 "Draft SI Work Plan for Groups 3, 5, & 6," ABB Environmental Services, Inc.
7. Comments Dated May 1, 1992 from James P. Byrne, EPA Region I on the "Draft SI Work Plan for Groups 3, 5, & 6, and Project Operations Plan" ABB Environmental Services, Inc.
8. Comments Dated July 21, 1992 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the June 1992 "Draft Final Work Plan for Groups 3, 5, & 6," ABB Environmental Services, Inc.
9. Comments Dated July 28, 1992 from James P. Byrne, EPA Region I on the June 1992 "Draft Final Work Plan for Groups 3, 5, & 6," ABB Environmental Services, Inc.
10. Comments Dated October 26, 1992 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the September 1992 "Final Task Order (Site Investigation) Work Plan," ABB Environmental Services, Inc.

11. Comments Dated October 29, 1992 from James P. Byrne, EPA Region I on the September 1992 "Final Task Order (Site Investigation) Work Plan," ABB Environmental Services, Inc.
12. Comments Dated January 19, 1993 from James P. Byrne, EPA Region I on the December 1992 "SI Data Packages," ABB Environmental Services, Inc.
13. Comments Dated February 3, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the December 1992 "SI Data Packages," ABB Environmental Services, Inc.
14. Comments Dated May 6, 1993 from James P. Byrne, EPA Region I on the April 1993 "Final SI Report, Fort Devens Site Investigation, Groups 3, 5, and 6," ABB Environmental Services, Inc.
15. Comments Dated May 20, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the April 1993 "Final SI Report, Fort Devens Site Investigation, Groups 3, 5, and 6," ABB Environmental Services, Inc.
16. Comments Dated August 26, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the July 1993 "Final Work Plan for the Supplemental Site Investigation, Groups 3, 5, & 6," ABB Environmental Services, Inc.
17. Comments Dated October 25, 1993 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the September 1993 "Supplemental SI Data Package for Fort Devens SI Groups 3, 5, & 6," ABB Environmental Services, Inc.
18. Comments Dated November 8, 1993 from James P. Byrne, EPA Region I on the September 1993 "Supplemental SI Data Package for Fort Devens SI Groups 3, 5, & 6," ABB Environmental Services, Inc.

Responses to Comments

19. Responses Dated June 4, 1992 from U.S. Army Toxic and Hazardous Materials Agency on the April 15, 1992 Comments from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection and the May 1, 1992 Comments from James P. Byrne, EPA Region I.
20. Responses Dated September 24, 1992 from U.S. Army Toxic and Hazardous Materials Agency on the July 21, 1992 Comments from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection and the July 28, 1992 Comments from James P. Byrne, EPA Region I.
21. Responses Dated July 7, 1993 from U.S. Army Environmental Center on the May 6, 1993 Comments from James P. Byrne, EPA

Region I and the May 20, 1993 Comments from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection.

Responses to Responses to Comments

22. Responses Dated July 28, 1992 from James P. Byrne, EPA Region I on the June 4, 1992 Comments from U.S. Army Toxic and Hazardous Materials Agency.
23. Responses Dated August 26, 1993 from D. Lynne Chappell-Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the July 7, 1993 Comments from U.S. Army Environmental Center.

Meeting Notes

24. Meeting Notes, ABB Environmental Services, Inc., EPA Region I, Commonwealth of Massachusetts Department of Environmental Protection, Fort Devens Environmental Management Office, U.S. Army Environmental Center, and CDM Federal Programs Corp. (January 20, 1993). Concerning SI Data Package.
25. Meeting Notes, ABB Environmental Services, Inc., EPA Region I, Commonwealth of Massachusetts Department of Environmental Protection, Fort Devens Environmental Management Office, U.S. Army Environmental Center, and CDM Federal Programs Corp. (September 27, 1993). Concerning Supplemental SI Data Package.

2.0 Removal Response

2.2 Removal Response Reports

1. "Post-Removal Report Underground Storage Tank Closure, 1,000 Gallon Waste Oil UST No. 0058, Building 3713, Fort Devens, Massachusetts," ATEC Environmental Consultants (October 1993).

2.3 Sampling and Analysis Data

1. "Technical Report Related to the Field Screening of Soil Samples at the Site of the Proposed Spill Containment Basin, Project No. EQ-1902109P, Fort Devens, Massachusetts," Lincoln Environmental, Inc. (February 1992).

2.4 Pollution Reports (POLREPs)

1. Memorandum from R. Spelfogel, U.S. Dept. of the Army to File (May 1, 1985). Concerning inspection of Cannibalization Point - TDA Maintenance Yard, Fort Devens.

3.0 Remedial Investigation (RI)

3.2 Sampling and Analysis Data

1. Cross-Reference: "Method for Determining Background Concentrations - Inorganic Analytes in Soil and Groundwater - Fort Devens," ABB Environmental Services, Inc. (January 20, 1993) [Filed and cited as entry number 1 in minor break 3.2 Sampling and Analysis Data of the Fort Devens Group 1A Sites Administrative Record Index].

3.4 Interim Deliverables

Reports

1. Cross Reference: "Final Ground Water Flow Model at Fort Devens," Engineering Technologies Associates, Inc. (May 24, 1993) [Filed and cited as entry number 1 in minor break 3.4 Interim Deliverables of the Fort Devens Group 1A Sites Administrative Record Index].
2. Cross Reference: "Final Projects Operations Plan - Volume I of III," ABB Environmental Services, Inc. (December 1992). [Filed and cited as entry number 2 in minor break 3.4 Interim Deliverables of the Fort Devens Group 2 & 7 Administrative Record File Index].
3. Cross Reference: "Final Projects Operations Plan - Volume II of III - Appendix A: Health and Safety Plan," ABB Environmental Services, Inc. (December 1992). [Filed and cited as entry number 3 in minor break 3.4 Interim Deliverables of the Fort Devens Group 2 & 7 Administrative Record File Index].
4. Cross Reference: "Final Projects Operations Plan - Volume III of III - Appendix B: Laboratory QA Plan; Appendix C: USATHAMA-Certified Analytical Methods," ABB Environmental Services, Inc. (December 1992). [Filed and cited as entry number 4 in minor break 3.4 Interim Deliverables of the Fort Devens Group 2 & 7 Administrative Record File Index].

Comments

5. Cross Reference: Comments Dated January 12, 1993 from James P. Byrne, EPA Region I on the December 1992 "Final Projects Operations Plan," ABB Environmental Services, Inc. [Filed and cited as entry number 5 in minor break 3.4 Interim Deliverables of the Fort Devens Group 2 & 7 Administrative Record File Index].
6. Cross Reference: Comments Dated February 1, 1993 from James P. Byrne, USEPA Region I and D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the October 30, 1992 "Draft Final Ground Water Flow Model at Fort Devens," Engineering Technologies Associates, Inc. [Filed and cited as entry number 2 in minor break 3.4 Interim Deliverables of the Fort Devens Group 1A Sites Administrative Record File Index].
7. Cross Reference: Comments Dated February 17, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the December 1992 "Final Project Operations Plan," ABB Environmental Services, Inc. [Filed and cited as entry number 7 in minor break 3.4 Interim Deliverables of the Fort Devens Group 2 & 7 Administrative Record File Index].

3.5 Applicable or Relevant and Appropriate Requirements (ARARs)

Cross-Reference: The following reports (entries 1 and 2) are filed and cited as entries 1 and 2 in minor break 3.5 Applicable or Relevant and Appropriate Requirements of the Fort Devens Groups 3, 5, & 6 Sites Administrative Record Index.

Reports

1. "Draft Applicable or Relevant and Appropriate Requirements (ARARs) for CERCLA Remedial Actions," U.S. Army Toxic and Hazardous Materials Agency (June 1992).
2. "Draft Assessment of Location-Specific Applicable or Relevant and Appropriate Requirements (ARARs) for Fort Devens, Massachusetts," U.S. Army Toxic and Hazardous Materials Agency (September 1992).

4.0 Feasibility Study (FS)

4.4 Interim Deliverables

Reports

1. "Feasibility Evaluation Bioremediation of Maintenance Yard Soils, Biological Treatability Study Report," ABB Environmental Services, Inc. (September 1993).

2. "Final Siting Study Report for Central Soil Treatment Facility," ABB Environmental Services, Inc. (January 1994).

Comments

3. Comments Dated November 5, 1993 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the September 1993 "Feasibility Evaluation Bioremediation of Maintenance Yard Soils, Biological Treatability Study Report," ABB Environmental Services, Inc.
4. Comments Dated December 27, 1993 from James P. Byrne, EPA Region I on the November 1993 "Draft General Management Procedures, Excavated Waste Site Soils, Draft Siting Study Report for Central Soil Treatment Facility and the Feasibility Study Report for Unsaturated Soils at the Maintenance Yards (New Alternative 9)" ABB Environmental Services, Inc.
5. Comments Dated January 13, 1994 from Molly Elder, Commonwealth of Massachusetts Department of Environmental Protection on the November 1993 "Draft Siting Study Report for Central Soil Treatment Facility," ABB Environmental Services, Inc.
6. Comments Dated March 11, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the September 1993 "Feasibility Evaluation Bioremediation of Maintenance Yard Soils, Biological Treatability Study Report," ABB Environmental Services, Inc.

Responses to Comments

7. U.S. Army Environmental Center Responses to Comments on the following documents: Feasibility Study Report, Biological Treatability Study Report, Feasibility Study Report - New Alternative 9, Draft General Management Procedures Excavated Waste Site Soils, and Draft Siting Study Report, dated January 25, 1994.

8. U.S. Army Environmental Center Responses to Comments on the following documents: Final Feasibility Study Report, Draft Proposed Plan, Revised Draft Proposed Plan, Draft Excavated Soils Management Plan, Final General Management Procedures Excavated Waste Site Soils, and Biological Treatability Study Report, dated May 1994.

4.6 Feasibility Study (FS) Reports

Reports

1. "Final Feasibility Study Report for Unsaturated Soils at the Maintenance Yards (Areas of Contamination 44 and 52) Fort Devens," ABB Environmental Services, Inc. (January 1994).
2. "Final Feasibility Study Addendum for Unsaturated Soils at Maintenance Yards AOCs 44/52, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (May 1994).

Comments

3. Comments Dated July 9 and July 15, 1993 from James P. Byrne, EPA Region I on the June 1993 "Draft Focused Feasibility Study Report AOCs 44 & 52," ABB Environmental Services, Inc.
4. Comments Dated July 29, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the June 1993 "Draft Focused Feasibility Study Report AOCs 44 & 52," ABB Environmental Services, Inc.
5. Comments Dated October 13, 1993 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the August 1993 "Feasibility Study Report for Unsaturated Soils at Maintenance Yards AOCs 44/52, Fort Devens, Massachusetts," ABB Environmental Services, Inc.
6. Comments Dated December 16, 1993 from Molly J. Elder, Commonwealth of Massachusetts Department of Environmental Protection on the November 1993 "Feasibility Study Report for Unsaturated Soils at Maintenance Yards AOCs 44/52, Fort Devens, Massachusetts," ABB Environmental Services, Inc.
7. Cross-Reference: Comments Dated December 27, 1993 from James P. Byrne, EPA Region I on the November 1993 "Draft General Management Procedures, Excavated Waste Site Soils, Draft Siting Study Report for Central Soil Treatment Facility and Feasibility Study Report for Unsaturated Soils at Maintenance Yards - New Alternative 9," ABB Environmental Services, Inc. [These comments are filed and cited as a part of entry number 4 in the comments section 4.4 Interim Deliverables of this minor break.

8. Comments Dated February 28, 1994 from James P. Byrne, EPA Region I on the "Draft Proposed Plan and Final Feasibility Study for AOCs 44 & 52 (TDA Yard)," ABB Environmental Services, Inc.
9. Comments Dated March 11, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the January 1994 "Final Feasibility Study Report, Fort Devens Feasibility Study AOCs 44 & 52," ABB Environmental Services, Inc.

Responses to Comments

10. U. S. Army Environmental Center Responses to Comments on the following documents: Fort Devens Focused Feasibility Study (FFS) for AOCs 44 and 52; Draft Feasibility Study Work Plan, FFS Initial Screening Document; and Supplemental Field Investigations and Data Gathering Maintenance Yard Soils Work Plan, dated June 25, 1993.
11. U. S. Army Environmental Center Responses to Comments on the following document: Draft Feasibility Study Report AOCs 44 and 52 Fort Devens, dated August 27, 1993.
12. Cross-Reference: U. S. Army Environmental Center Responses to Comments on the following documents: Feasibility Study Report; Biological Treatability Study Report; Feasibility Study Report - New Alternative 9; Draft General Management Procedures Excavated Waste Site Soils; and Draft Siting Study Report, dated January 25, 1994. [These Responses to Comments are filed and cited as a part of entry number 7 in the Responses to Comments section 4.4 in this minor break].
13. U. S. Army Environmental Center Responses to Comments on the following documents: Final Feasibility Study Report, Draft Proposed Plan, Revised Draft Proposed Plan, Draft Excavated Soils Management Plan, Final General Management Procedures Excavated Waste Site Soils, and Biological Treatability Study Report, dated May 1994.

4.7 Work Plans and Progress Reports

Reports

1. "Final Focused Feasibility Study Work Plan," ABB Environmental Services, Inc. (June 1993).
2. "Final Excavated Soils Management Plan for AOCs 44 & 52," ABB Environmental Services, Inc. (May 1994).

Comments

3. Comments Dated June 8, 1993 from James P. Byrne, EPA Region I on the June 1993 "Fort Devens Supplemental Field Investigations and Data Gathering Maintenance Yard Soils; Fort Devens Focused Feasibility Study Work Plan; Fort Devens Focused Feasibility Study Initial Screening Document," ABB Environmental Services, Inc.
4. Comments Dated June 9, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the "Draft Feasibility Study Work Plan," ABB Environmental Services, Inc.
5. Comments Dated June 10, 1993 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the "Supplemental Field Investigations and Data Gathering, Maintenance Yards Soils, AOCs 44 & 52," ABB Environmental Services, Inc.
6. Comments Dated June 15, 1993 from James P. Byrne, EPA Region I on the June 1993 "Treatability Study Work Plan, Supplemental Field Investigations and Data Gathering Maintenance Yard Soils, Fort Devens," ABB Environmental Services, Inc.
7. Comments Dated March 11, 1994 from D. Lynne Chappell, Commonwealth of Massachusetts Department of Environmental Protection on the January 1994 "Draft Excavated Soils Management Plan, AOCs 44 and 52," ABB Environmental Services, Inc.

Responses to Comments

8. Cross-Reference: U. S. Army Environmental Center Responses to Comments on the following documents: Fort Devens Focused Feasibility Study (FFS) for AOCs 44 and 52; Draft Feasibility Study Work Plan, FFS Initial Screening Document; Supplemental Field Investigations and Data Gathering Maintenance Yard Soils Work Plan, dated June 25, 1993.[These Responses to Comments are filed and cited as a part of entry # 10 in section 4.6].
9. Cross-Reference: U. S. Army Environmental Center Responses to Comments on the following documents: Final Feasibility Study Report; Draft Proposed Plan; Revised Draft Proposed Plan; Draft Excavated Soils Management Plan; Final General Management Procedures Excavated Waste Site Soils and Biological Treatability Study Report, dated May 1994. [These Responses to Comments are filed and cited as a part of entry number 8 in minor break 4.4 Interim Deliverables of the Fort Devens AOC 44/52 Administrative Record File Index].

4.9 Proposed Plans for Selected Remedial Action

1. Cover letter from James C. Chambers, BRAC Environmental Coordinator to James P. Byrne, EPA Region I (April 11, 1994). Concerning transmittal of a new draft Proposed Plan, and including rationale for change in the Army's preferred alternative.
2. "Final Proposed Plan, Fort Devens Barnum Road Maintenance Yards, AOCs 44 & 52," ABB Environmental Services, Inc. (May 1994).

Comments

3. Cross-Reference: Comments Dated February 28, 1994 from James P. Byrne, EPA Region I on the January 1994 "Draft Proposed Plan, Fort Devens Barnum Road Maintenance Yards, AOCs 44 & 52," ABB Environmental Services, Inc. [These Comments are filed and cited as a part of entry number 8 in the Comments section 4.6 of this minor break].
4. Comments Dated March 11, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the January 1994 "Draft Proposed Plan, Fort Devens Barnum Road Maintenance Yards, AOCs 44 & 52," ABB Environmental Services, Inc.
5. Comments Dated March 18, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the January 1994 "Draft Proposed Plan, Fort Devens Barnum Road Maintenance Yards, AOCs 44 & 52," ABB Environmental Services, Inc.
6. Comments Dated May 5, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the April 1994 "Revised Draft Proposed Plan for Barnum Road Maintenance Yards, AOCs 44 & 52," ABB Environmental Services, Inc.
7. Comments Dated May 9, 1994 from James P. Byrne, EPA Region I on the April 1994 "Revised Draft Proposed Plan for Barnum Road Maintenance Yards, AOCs 44 & 52," ABB Environmental Services, Inc.

Responses to Comments

8. Cross-Reference: U. S. Army Environmental Center Responses to Comments on the following documents: Final Feasibility Study Report; Draft Proposed Plan; Revised Draft Proposed Plan; Draft Excavated Soils Management Plan; Final General Management Procedures Excavated Waste Site Soils; and Biological Treatability

Study Report, dated May 1994 [These Responses to Comments are filed and cited as a part of entry number 8 in the Responses to Comments section 4.4 of this minor break].

9. Cross-Reference: U. S. Army Environmental Center Responses to Comments on the following documents: Fort Devens Focused Feasibility Study (FFS) for AOCs 44 and 52; Draft Feasibility Study Work Plan, FFS Initial Screening Document; Supplemental Field Investigations and Data Gathering Maintenance Yard Soils Work Plan, dated June 25, 1993. [These Responses to Comments are filed and cited as a part of entry number 10 in the Responses to Comments section 4.6 of this minor break].

5.0 Record of Decision (ROD)

5.4 Record of Decision

Reports

1. "Revised Draft Record of Decision Barnum Road Maintenance Yards, Fort Devens, Massachusetts", ABB Environmental Services, Inc. (September 7, 1994).
2. "Record of Decision Barnum Road Maintenance Yards, Fort Devens, Massachusetts", ABB Environmental Services, Inc. (September 13, 1994).
3. "Record of Decision Barnum Road Maintenance Yards, Fort Devens, Massachusetts (Final)," ABB Environmental Services, Inc. (March 1995).

Comments

4. Comments Dated August 19, 1994 from James P. Byrne, USEPA Region I on the August 1994 " Draft Record of Decision Barnum Road Maintenance Yards, Fort Devens, Massachusetts," ABB Environmental Services, Inc.
5. Comments Dated August 25, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the August 1994 "Draft Record of Decision Barnum Road Maintenance Yards, Fort Devens, Massachusetts," ABB Environmental Services, Inc.
6. Comments Dated September 16, 1994 from John Regan, Commonwealth of Massachusetts Department of Environmental Protection on the review of the activity and use limitation (AUL).
7. Comments Dated September 16, 1994 from Cornelius O'Leary, Commonwealth of Massachusetts Department of Environmental Protection on the Barnum Road Maintenance Yards (AOCs 44 & 52), Fort Devens, Massachusetts, ROD Concurrence.

8. Comments Dated February 17, 1995 from James P. Byrne, USEPA, on the Draft Radiological Report for the Cannibalization Yard and TDA Maintenance Yard and the Proposed Section XII (Documentation of No Significant Changes) Revisions to the Barnum Road Maintenance Yards Record of Decision.

Responses to Comments

9. Responses Dated September 7, 1994 from U.S. Army Environmental Center on the following document: Draft Record of Decision, Barnum Road Maintenance Yards, Fort Devens, Massachusetts.

5.5 Work Plans and Progress Reports

Reports

1. "Draft Radiological Survey Work Plan, Area of Contamination (AOCs) 44 & 52, Barnum Road Maintenance Yards, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (October 1994).
2. "Final Radiological Survey Work Plan, Area of Contamination (AOCs) 44 & 52, Barnum Road Maintenance Yards, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (December 1994).
3. "Draft Radiological Status Report for Cannibalization Yard and TDA Maintenance Yard, Area of Contamination 44 & 52, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (February 1995).
4. "Final Radiological Status Report for Cannibalization Yard and TDA Maintenance Yard, Area of Contamination 44 & 52, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (March 1995).

Comments

5. Comments Dated November 15, 1994 from James P. Byrne, USEPA, on the "Draft Radiological Survey Work Plan for the Barnum Road Maintenance Yard," ABB Environmental Services, Inc.
6. Comments Dated November 16, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Services on the October 1994 "Draft Radiological Survey Work Plan, Areas of Contamination (AOCs) 44 & 52, Barnum Road Maintenance Yards, Fort Devens, MA," ABB Environmental Services, Inc.
7. Comments Dated November 29, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the October 1994 "Draft Radiological Survey Work

Plan, Areas of Contamination (AOCs) 44 & 52, Barnum Road Maintenance Yards, Fort Devens, Massachusetts," ABB Environmental Services, Inc.

8. Comments Dated December 16, 1994 from James P. Byrne, USEPA, on the Final Radiological Survey Work Plan and Response to Comments for the Barnum Road Maintenance Yards, (ABB Environmental Services, Inc.).
9. Comments Dated December 27, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the Draft Radiological Survey Work Plan, Areas of Contamination (AOC) 44 & 52, and Final Radiological Work Plan, Areas of Contamination (AOCs) 44 & 52, Fort Devens, Massachusetts.
10. Cross Reference: Comments Dated February 17, 1995 from James P. Byrne, USEPA, on the Draft Radiological Report for the Cannibalization Yard and TDA Maintenance Yard and the Proposed Section XII (Documentation of No Significant Changes) Revisions to the Barnum Road Maintenance Yards Record of Decision. [Filed and cited as entry number 8 in minor break 5.4 Record of Decision in this index.]
11. Comments Dated March 3, 1995 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection the February 1995 "Draft Radiological Status Report for Cannibalization Yard and TDA Maintenance Yard, Areas of Contamination 44 & 52, Fort Devens, Massachusetts," (ABB Environmental Services, Inc.).

Responses to Comments

12. Responses Dated December 13, 1994 from U.S. Army Environmental Center on the following document: Draft Radiological Survey Work Plan, Areas of Contamination (AOCs) 44 & 52, Fort Devens, Massachusetts.
13. Responses Dated March 1995 from U.S. Army Environmental Center on the following document: Draft Radiological Status Report for Cannibalization Yard and TDA Maintenance Yard, Areas of Contamination 44 & 52, Fort Devens, Massachusetts.

Responses to Responses to Comments

14. Cross Reference: Comments Dated December 16, 1994 from James P. Byrne, USEPA, on the Final Radiological Survey Work Plan and Response to Comments for the Barnum Road Maintenance Yards, (ABB Environmental Services, Inc.). [Filed and cited as entry number 8 in minor break 5.5 Work Plans and Progress Reports in this index.]

10.0 Enforcement

10.16 Federal Facility Agreements

1. Cross-Reference: "Final Federal Facility Agreement Under CERCLA Section 120," EPA Region I and U.S. Department of the Army (November 15, 1991) with attached map [Filed and cited as entry number 1 in minor break 10.16 Federal Facility Agreements of the Fort Devens Group 1A Sites Administrative Record Index].

13.0 Community Relations

13.2 Community Relations Plans

1. Cross-Reference: "Final Community Relations Plan," Ecology and Environment, Inc. (February 1992) [Filed and cited as entry number 1 in minor break 13.2 Community Relations Plans of the Fort Devens Group 1A Sites Administrative Record Index].

13.5 Fact Sheets

1. Barnum Road Maintenance Yards Fact Sheet, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (May 1994).

13.11 Technical Review Committee Documents

Cross-Reference: The following documents cited below as entries number 1 through 8 are filed and cited as entries number 1 through 8 in minor break 13.11 Technical Review Committee Documents of the Fort Devens Group 1A Sites Administrative Record Index.

1. Technical Review Committee Meeting Agenda and Summary (March 21, 1991).
2. Technical Review Committee Meeting Agenda and Summary (June 27,1991).
3. Technical Review Committee Meeting Agenda and Summary (September 17, 1991).
4. Technical Review Committee Meeting Agenda and Summary (December 11, 1991).
5. Technical Review Committee Meeting Agenda and Summary (March 24, 1992).
6. Technical Review Committee Meeting Agenda and Summary (June 23, 1992).

7. Technical Review Committee Meeting Agenda and Summary (September 29, 1992).
8. Technical Review Committee Meeting Agenda and Summary (January 5, 1993).

17.0 Site Management Records

17.6 Site Management Plans

Cross-Reference: The following Reports, Comments, and Responses to Comments (entries 1 through 9) are filed and cited in minor break 17.6 Site Management Records of the Groups 3, 5, & 6 Administrative Record Index unless otherwise noted below.

Reports

1. "Final Quality Assurance Project Plan," Ecology and Environment, Inc. (November 1991).
2. "General Management Procedures, Excavated Waste Site Soils, Fort Devens, Massachusetts," ABB Environmental Services, Inc. (January 1994).

Comments

3. Cross Reference: Comments from James P. Byrne, EPA Region I on the November 1991 "Final Quality Assurance Project Plan," Ecology and Environment, Inc. [These Comments are filed and cited as a part of entry number 8 in the Responses to Comments section of this minor break].
4. Comments Dated December 16, 1993 from Molly J. Elder, Commonwealth of Massachusetts Department of Environmental Protection on the November 1993 "Draft General Management Procedures, Excavated Waste Site Soils, Fort Devens, Massachusetts," ABB Environmental Services, Inc.
5. Comments Dated December 27, 1993 from James P. Byrne, EPA Region I on the November 1993 "Draft General Management Procedures, Excavated Waste Site Soils, Fort Devens, Massachusetts," ABB Environmental Services, Inc. [Filed and cited as entry number 4 in minor break 4.4 Interim Deliverables of the AOCs 44/52 Administrative Record Index.]
6. Comments Dated March 11, 1994 from D. Lynne Welsh, Commonwealth of Massachusetts Department of Environmental Protection on the January 1994 "General Management Procedures, Excavated Waste Site Soils, Fort Devens, Massachusetts," ABB Environmental Services, Inc.

7. Cross-Reference: U. S. Army Environmental Center Responses to Comments on the following documents: Feasibility Study Report; Biological Treatability Study Report; Feasibility Study Report - New Alternative 9; Draft General Management Procedures Excavated Waste Site Soils; and Draft Siting Study Report, dated January 25, 1994. [These Responses to Comments are filed and cited as a part of entry number 7 in the Responses to Comments section of minor break 4.4 Interim Deliverables of the AOCs 44/52 Administrative Record Index.]
8. Response from Fort Devens to Comments from James P. Byrne, EPA Region I on the November 1991 "Final Quality Assurance Project Plan," Ecology and Environment, Inc.
9. Cross-Reference: U.S. Army Environmental Center Responses to Comments for the following documents: Final Feasibility Study Report; Draft Proposed Plan; Revised Draft Proposed Plan; Draft Excavated Soils Management Plan; Final General Management Procedures Excavated Waste Site Soils; and Biological Treatability Study Report, dated May 1994. [These Responses to Comments are filed and cited as entry number 8 in the Responses to Comments section of minor break 4.4 Interim Deliverables of the AOCs 44/52 Administrative Record Index.]

17.9 Site Safety Plans

Cross Reference: The following documents (entries 1 through 3) are filed and cited in minor break 17.9 Site Safety Plans of the Fort Devens Group 1A Administrative Record File Index unless otherwise noted below.

Reports

1. "Final Health and Safety Plan," Ecology and Environment, Inc. (November 1991).

Comments

2. Cross Reference: Comments from James P. Byrne, EPA Region I on the November 1991 "Final Health and Safety Plan," Ecology and Environment, Inc. [These Comments are filed and cited as a part of entry number 8 in minor break 17.6 Site Management Plans of the Group 1A Sites Administrative Record File Index].

3. Response from Fort Devens to Comments from James P. Byrne, EPA Region I on the November 1991 "Final Health and Safety Plan," Ecology and Environment, Inc.

Section II

Guidance Documents

GUIDANCE DOCUMENTS

The following guidance documents were relied upon during the Fort Devens cleanup. These documents may be reviewed, by appointment only, at the Environmental Management Office at Fort Devens, Massachusetts.

1. Occupational Safety and Health Administration (OSHA). Hazardous Waste Operation and Emergency Response (Final Rule, 29 CFR Part 1910, Federal Register. Volume 54, Number 42) March 6, 1989.
2. USATHAMA. Geotechnical Requirements for Drilling Monitoring Well, Data Acquisition, and Reports, March 1987.
3. USATHAMA. IRDMIS User's Manual, Version 4.2, April 1991.
4. USATHAMA. USATHAMA Quality Assurance Program: PAM-41, January 1990.
5. USATHAMA. Draft Underground Storage Tank Removal Protocol - Fort Devens, Massachusetts, December 4, 1992.
6. U.S. Environmental Protection Agency. Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring: OWRS QA-1, May 1984.
7. U.S. Environmental Protection Agency. Office of Research and Development Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans: QAMS-005/80, 1983.
8. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, (OSWER Directive 9355.3-01, EPA/540/3-89/004, 1986.
9. U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Waste: EPA SW-846 Third Edition, September 1986.
10. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), (EPA/540/1-89/002), 1989.
11. U.S. Environmental Protection Agency. Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristic Revisions, (Final Rule, 40 CFR Part 261 et al., Federal Register Part V), June 29, 1990.

APPENDIX F

BARNUM ROAD MAINTENANCE YARDS
AOCs 44 & 52
ROD SUMMARY

APPENDIX F

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
AOCs	Areas of Contamination
ARAR	Applicable or Relevant and Appropriate Requirements
AREE	Area Requiring Environmental Evaluation
B2EHP	bis(2-ethylhexyl)phthalate
B(a)P	benzo(a)pyrene
bgs	below ground surface
BRAC	Base Realignment and Closure Act
BTEX	benzene, toluene, ethylbenzene, and xylene
CAC	Citizen's Advisory Committee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMR	Code of Massachusetts Regulations
cPAHs	carcinogenic polynuclear aromatic hydrocarbons
cy	cubic yard
DoD	Department of Defense
EPCs	Exposure Point Concentrations
FS	Feasibility Study
GC/FID	gas chromatograph/flame ionization detector
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
IAG	Federal Facilities Interagency Agreement
IRIS	Integration Risk Information System
IRP	Installation Restoration Program
m^3	cubic meter
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MEPA	Massachusetts Environmental Policy Act
MEP	Master Environmental Plan
mg/l	milligrams per liter
MHWMR	Massachusetts Hazardous Waste Management Rules
NAAQS	National Ambient Air Quality Standard
NPL	National Priority List
NCP	National Contingency Plan
NDIR	Non-dispersive Infrared

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

O&M	Operation and Maintenance
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PAL	Project Analyte List
PCB	polychlorinated biphenyl
PCL	protective contaminant level
PID	Photoionization Detector
ppm	parts per million
RAB	Restoration Advisory Board
RfD	Reference Dose
ROD	Record of Decision
RTS	Regional Training Site
SA	Study Area
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Investigations
SSI	Supplemental Site Investigation
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leachate Procedure
TDA	Table of Distribution and Allowances
TEF	Toxic Equivalency Factor
TPHC	total petroleum hydrocarbon compound
TRC	Technical Review Committee
TSP	total suspended particulate
TSS	total suspended solids
$\mu g/l$	micrograms per liter
USAEC	United States Army Environmental Center
USAEHA	United States Army Environmental Hygiene Agency
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound