

**U.S. Army Corps
of Engineers
New England Division
Waltham, Massachusetts**

**FORT DEVENS SUDBURY TRAINING ANNEX
SUDBURY, MASSACHUSETTS**

**Contract No. DACW33-95-D-0004
Delivery Order No. 0005
DCN: SAL-041497-AAFE**

**CONTAMINATED SOIL REMOVAL
STUDY AREA P16, P23, & P41**

FINAL ACTION MEMORANDUM

APRIL 1997

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April 1997

Prepared for

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TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
EXECUTIVE SUMMARY		vii
1	INTRODUCTION	1-1
1.1	General	1-1
1.2	Purpose	1-1
1.3	Background	1-1
2	STUDY AREA P16	2-1
2.1	Site Description	2-1
2.1.1	Physical Location and Description	2-1
2.1.2	Study Area Background	2-1
2.1.3	Removal Site Evaluation	2-1
2.2	Other Actions to Date	2-4
2.3	State and Local Authorities' Role	2-4
2.4	Threats to Human Health or Public Welfare	2-4
2.4.1	Actual or Potential Exposure to Hazardous Substances, Pollutants or Contaminants by Nearby Populations or the Food Chain	2-4
2.4.2	Actual or Potential Contamination of Drinking Water Supplies	2-4
2.4.3	Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release	2-4
2.4.4	High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate	2-5
2.4.5	Weather Conditions that may Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released	2-5
2.4.6	Threat of Fire or Explosion	2-5
2.5	Threats to the Environment	2-5
2.5.1	Actual or Potential Exposure to Hazardous Substances, Pollutants or Contaminants by Nearby Populations or the Food Chain	2-5
2.5.2	Actual or Potential Contamination of Sensitive Ecosystems	2-5
2.5.3	Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release	2-6
2.5.4	High Levels of Hazardous Substances, Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate	2-6
2.5.5	Weather Conditions that may Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released	2-6
2.5.6	Threat of Fire or Explosion	2-6

<u>Section</u>	<u>Title</u>	<u>Page</u>
2.6	Endangerment Determination	2-6
2.7	Proposal Action	2-6
2.7.1	Proposed Action Description	2-6
2.7.1.1	Mobilization/Site Preparation	2-7
2.7.1.2	Soil Excavation and Disposal	2-7
2.7.1.3	Confirmation Soil Sampling	2-7
2.7.1.4	Demobilization	2-7
2.7.1.5	Project Schedule	2-8
2.7.2	Contribution to Remedial Performance	2-8
2.7.3	Description of Alternative Technologies	2-8
2.7.4	Engineering Evaluation/Cost Analysis	2-8
2.7.5	Applicable or Relevant and Appropriate Requirements	2-9
2.7.6	Estimated Project Cost	2-9
2.8	Expected Change in the Situation Should Action be Delayed or Not Taken	2-9
2.9	Outstanding Policy Issues	2-9
2.10	Enforcement	2-9
2.11	Recommendation	2-9
3	STUDY AREA P23	3-1
3.1	Site Description	3-1
3.1.1	Physical Location and Description	3-1
3.1.2	Study Area Background	3-1
3.1.3	Removal Site Evaluation	3-1
3.2	Other Actions to Date	3-4
3.3	State and Local Authorities' Role	3-4
3.4	Threats to Human Health or Public Welfare	3-4
3.4.1	Actual or Potential Exposure to Hazardous Substances, Pollutants or Contaminants by Nearby Populations or the Food Chain	3-4
3.4.2	Actual or Potential Contamination of Drinking Water Supplies	3-4
3.4.3	Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release	3-5
3.4.4	High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate	3-5
3.4.5	Weather Conditions that may Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released	3-5
3.4.6	Threat of Fire or Explosion	3-5
3.5	Threats to the Environment	3-5
3.5.1	Actual or Potential Exposure to Hazardous Substances, Pollutants or Contaminants by Nearby Populations or the Food Chain	3-5

<u>Section</u>	<u>Title</u>	<u>Page</u>
3.5.2	Actual or Potential Contamination of Sensitive Ecosystems	3-6
3.5.3	Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release	3-6
3.5.4	High Levels of Hazardous Substances, Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate	3-6
3.5.5	Weather Conditions that may Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released	3-6
3.5.6	Threat of Fire or Explosion	3-6
3.6	Endangerment Determination	3-7
3.7	Proposal Action	3-7
3.7.1	Proposed Action Description	3-7
3.7.1.1	Mobilization/Site Preparation	3-7
3.7.1.2	Soil Excavation and Disposal	3-7
3.7.1.3	Confirmation Soil Sampling	3-7
3.7.1.4	Demobilization	3-8
3.7.1.5	Project Schedule	3-8
3.7.2	Contribution to Remedial Performance	3-8
3.7.3	Description of Alternative Technologies	3-8
3.7.4	Engineering Evaluation/Cost Analysis	3-8
3.7.5	Applicable or Relevant and Appropriate Requirements	3-9
3.7.6	Estimated Project Cost	3-9
3.8	Expected Change in the Situation Should Action be Delayed or Not Taken	3-9
3.9	Outstanding Policy Issues	3-9
3.10	Enforcement	3-9
3.11	Recommendation	3-9
4	STUDY AREA P41	4-1
4.1	Site Description	4-1
4.1.1	Physical Location and Description	4-1
4.1.2	Study Area Background	4-1
4.1.3	Removal Site Evaluation	4-1
4.2	Other Actions to Date	4-4
4.3	State and Local Authorities' Role	4-4
4.4	Threats to Human Health or Public Welfare	4-4
4.4.1	Actual or Potential Exposure to Hazardous Substances, Pollutants or Contaminants by Nearby Populations or the Food Chain	4-4
4.4.2	Actual or Potential Contamination of Drinking Water Supplies	4-4
4.4.3	Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release	4-4

<u>Section</u>	<u>Title</u>	<u>Page</u>
4.4.4	High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate	4-5
4.4.5	Weather Conditions that may Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released	4-5
4.4.6	Threat of Fire or Explosion	4-5
4.5	Threats to the Environment	4-5
4.4.1	Actual or Potential Exposure to Hazardous Substances, Pollutants or Contaminants by Nearby Populations or the Food Chain	4-5
4.5.2	Actual or Potential Contamination of Sensitive Ecosystems	4-5
4.5.3	Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release	4-4
4.5.4	High Levels of Hazardous Substances, Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate	4-6
4.5.5	Weather Conditions that may Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released	4-6
4.5.6	Threat of Fire or Explosion	4-6
4.6	Endangerment Determination	4-6
4.7	Proposal Action	4-6
4.7.1	Proposed Action Description	4-6
	4.7.1.1 Mobilization/Site Preparation	4-6
	4.7.1.2 Soil Excavation and Disposal	4-7
	4.7.1.3 Confirmation Soil Sampling	4-7
	4.7.1.4 Demobilization	4-7
	4.7.1.5 Project Schedule	4-7
4.7.2	Contribution to Remedial Performance	4-8
4.7.3	Description of Alternative Technologies	4-8
4.7.4	Engineering Evaluation/Cost Analysis	4-8
4.7.5	Applicable or Relevant and Appropriate Requirements	4-8
4.7.6	Estimated Project Cost	4-9
4.8	Expected Change in the Situation Should Action be Delayed or Not Taken	4-9
4.9	Outstanding Policy Issues	4-9
4.10	Enforcement	4-9
4.11	Recommendation	4-9
5	REFERENCES	5-1

LIST OF FIGURES

<u>Title</u>	<u>Page</u>
2-1 Exploration Locations, Study Area P16	2-2
2-2 Excavation Locations, Study Area P16	2-3
3-1 Exploration Locations, Study Area P23	3-2
3-2 Excavation Locations, Study Area P23	3-3
4-1 Exploration Locations, Study Area P41	4-2
4-2 Excavation Locations, Study Area P41	4-3

EXECUTIVE SUMMARY

This Action Memorandum summarizes the removal action at Study Areas P16, P23, and P41 located at the Fort Devens Sudbury Training Annex, Sudbury, Massachusetts. Soils from P16 and P41, contaminated with DDD, DDT, and DDE, and soils from P23, contaminated with TPH, were removed to eliminate associated potential human health and ecological risks. This removal action and development of this document were conducted by Roy F. Weston, Inc. in coordination with the New England Division of the Army Corps of Engineers (CENED), the Massachusetts Department of Environmental Protection (MADEP) and the U.S. Environmental Protection Agency (EPA).

A site investigation revealed a presence of DDD, DDT, DDE, and TPH above background levels at the study areas. The areas of contamination were delineated through sampling. P16 has two areas: area E5 which is 5'x5'x5' and area E6 which is 30'x10'x3' from which contaminated soils were removed. P23 has three areas: area E2 which is 5'x5'x3', area E3 which is 10'x10'x5', and area E4 which is 5'x5'x3' from which contaminated soils were removed. P41 has one area E1 which is 40'x20'x3' from which contaminated soils were removed. The excavation and removal was performed by Roy F. Weston, Inc. in August 1996.

The contaminated soil was removed and consolidated as part of the subgrade at A7 where a landfill cap was being constructed as part of another. The placement of the soil at the site landfill was appropriate in that it allowed for a timely removal, saved costs associated with typical disposal scenarios, and it decreased the need for additional fill required for the construction of the landfill cap. The RCRA-Subtitle C (double-barrier) landfill cap was completed in November 1996.

Confirmation sampling at P16, P23, and P41 revealed no concentrations of pesticides and TPH above the site clean-up levels. Therefore, the excavation was successful in eliminating the human health and ecological risk associated with Study Areas P16, P23, and P41.

Based on confirmatory sampling results, no further action is recommended at the P16, P23, and P41.

Section 1

SECTION 1 INTRODUCTION

1.1 General

This memorandum documents the removal action for contaminated soils at Study Area (SA) P16, P23, and P41 located at the Fort Devens Sudbury Training Annex. The Removal Action and Action Memorandum were completed by Roy F. Weston, Inc. (WESTON®) under a delivery order from the U.S. Army Corps of Engineers New England Division (CENED).

1.2 Purpose

The purpose of this Action Memorandum is to document the removal of contaminated soils at the specified locations of SA P16, P23, and P41 at the Fort Devens Sudbury Training Annex. In addition, this document presents background information related to the site, details on the removal action and confirmatory samples, and recommendations on further actions. This Action Memorandum was prepared in accordance with current U.S. Environmental Protection Agency (USEPA) guidance (USEPA, 540/P-90/004, December 1990).

1.3 Background

The Fort Devens Sudbury Annex is a military installation located in the towns of Sudbury, Maynard, Stow, and Hudson in the Commonwealth of Massachusetts. The annex occupies approximately 2,750 acres.

Former uses at the site include use as an ammunitions depot in the 1940s and storage and training in the 1950s. Other activities included use for ammunitions and explosives testing, fire-fighting exercises, and laboratory waste and debris disposal. The area was also used as a railroad classification yard for inspections and switching operations. The tracks were removed in 1967. Some unauthorized activities, such as camping, biking, walking, and municipal dumping occurred over the years.

Fort Devens took custody of the annex from the Natick Research Laboratories in 1982 and has maintained the facility for storage and training. In 1980, environmental studies began at the annex. These studies were performed according to the Installation Restoration Program (IRP) developed by the Department of Defense (DOD).

A Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Preliminary Assessment of the annex was performed by NUS Corporation in 1985. A CERCLA Site Investigation was performed in 1987. Based on the results of the assessment and investigation, the U.S. EPA determined that the site should be included on the National Priorities List (NPL). The site was placed on the NPL on February 16, 1990.

A Master Environmental Plan was developed by OHM, Inc. in 1992 and was supplemented by Ecology and Environment, Inc. in 1993. This plan was developed in accordance with the objectives of the IRP. The Master Environmental Plan identified 68 study areas at the site. Three of these areas, SAs P16, P23, and P41 are the focus of this memorandum.

Section 2

SECTION 2 STUDY AREA P16

2.1 Site Description

2.1.1 Physical Location and Description

SA P16 is located in the north central part of the Sudbury Annex on slightly higher ground between a wetland on the west and Puffer Pond to the east. SA P16 consists of three bunkers (302, 306, and 309) that are located 800 feet west of Puffer Pond along a dirt road which, in this area, runs parallel to Puffer Pond Road (see Figure 2-1). The three bunkers are surrounded by forest and their entrances face the dirt road. Surface elevations range from approximately 195 feet above mean sea level (amsl) at Bunker 309 to over 200 feet amsl at Bunker 302. Depth to groundwater is estimated to be less than 16 feet below ground surface (bgs). Surface water flows from the site to the northwest to the wetland and east toward Puffer Pond.

2.1.2 Study Area Background

Bunkers 302, 306, and 309 were constructed during the early 1940s as part of the ammunition storage activities of the Maynard Ordnance Depot. The bunkers have been used by Natick Labs as storage and may have been used to store waste chemicals collected at Natick Labs prior to dumping on site. An inspection of the bunkers in 1990, showed that Bunker 302 contained stacks of empty wooden pallets Bunker 306 contained sheet metal duct work and heat exchangers, and Bunker 309 contained surplus packaged foods and food preparation equipment.

2.1.3 Removal Site Evaluation

A Phase I investigation of SA P16 was conducted by OHM in 1994. Soil samples were collected near the three bunker locations and analyzed. Concentrations of pesticides and polycyclic aromatic hydrocarbons (PAHs) were detected at levels exceeding risk-based levels in soils at Bunkers 306 and 309. Semivolatile organic compounds (SVOCs) were detected in a soil sample collected at a former drum location between Bunkers 306 and 309. The Phase I investigation also included removal of the empty drum located between Bunkers 306 and 309.

Ecology & Environment (E&E) conducted a Phase II investigation in 1994 by sampling soils along the drainage pathways from the bunkers. Arsenic and SVOCs were detected above screening levels in the soil samples.

In 1995, ABB conducted a Supplemental Site Investigation (SSI) consisting of additional sampling to characterize the lateral distribution of analytes in the surface soil; to determine whether subsurface soil had been affected; to determine the source of the analytes; and to evaluate the groundwater

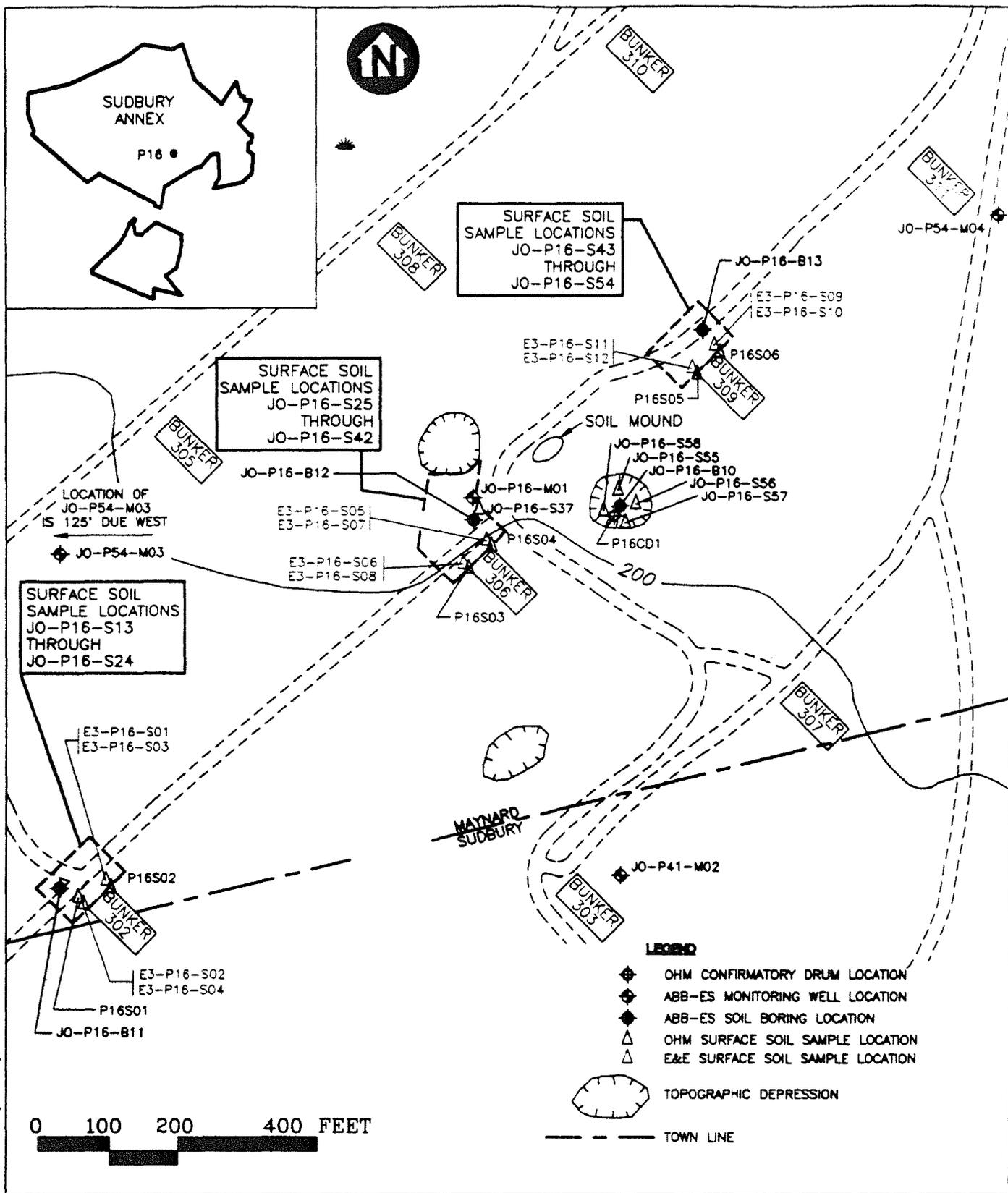


FIGURE 2-1
 EXPLORATION LOCATIONS, STUDY AREA P16
 SUPPLEMENTAL SITE INVESTIGATION
 FORT DEVENS SUDBURY TRAINING ANNEX
 MIDDLESEX COUNTY, MASSACHUSETTS

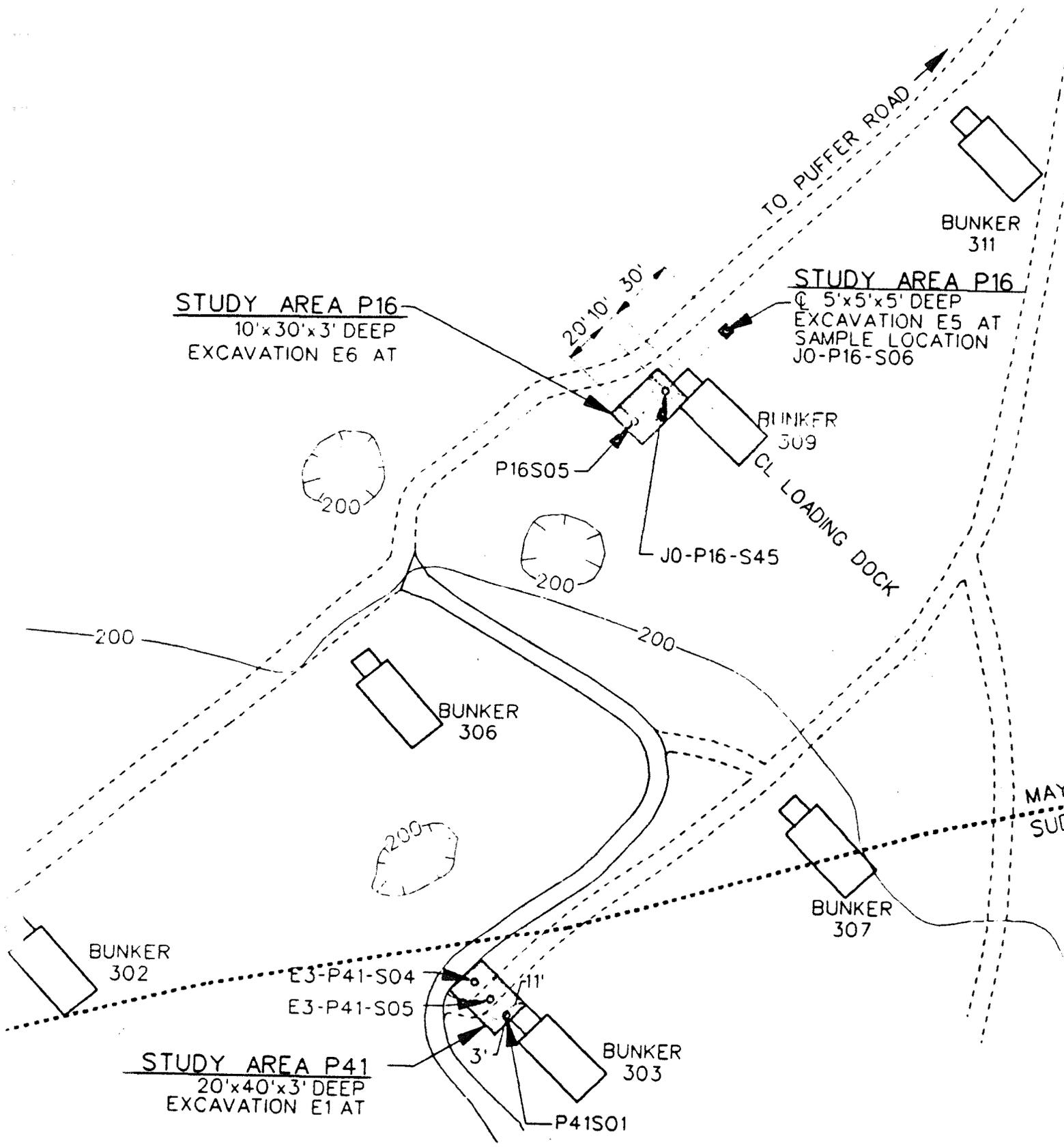


FIGURE 2-2
 EXCAVATION LOCATIONS, STUDY AREA P16
 FORT DEVENS SUDBURY TRAINING ANNEX
 MIDDLESEX COUNTY, MASSACHUSETTS

quality and aquifer conditions. Surface soil samples analyzed detected DDT, DDD, and DDE at concentrations above background levels in soils located near Bunkers 302, 306, and 309. The SSI included human health and ecological Preliminary Risk Evaluations (PRE). The PREs concluded that human receptors potentially exposed to isolated areas of PAH and pesticide surface soil contamination in the vicinity of the bunkers may be at risk, but exposure to average study area PAH and pesticide soil concentrations does not pose a substantial risk. Exposure to average concentrations of soil pesticides contamination to terrestrial vertebrate receptors does not pose a substantial risk and populations of these receptors are likely to be unaffected. The PRE concluded that it is unlikely that these analytes pose a substantial risk to plant on invertebrate receptors. The SSI recommended that a removal action of the pesticide contaminated soil be implemented.

2.2 Other Actions to Date

No other action was conducted between the time of the investigations and the remedial actions.

2.3 State and Local Authorities Role

The MADEP, in cooperation with CENED and the EPA, provided regulatory guidance for the project. Also, the local fire-fighting departments provided assistance in the development of emergency response procedures

2.4 Threats to Human Health or Public Welfare

2.4.1 Actual or Potential Exposure to Hazardous Substances or Pollutants or Contaminants By Nearby Populations or the Food Chain

The SSI conducted by ABB in 1995 included human health and ecological PRE. The PREs concluded that human receptors potentially exposed to isolated areas of PAH and pesticide surface soil contamination in the vicinity of the bunkers may be at risk, but exposure to average study area PAH and pesticide soil concentrations does not pose a substantial risk.

2.4.2 Actual or Potential Contamination of Drinking Water Supplies

ABB installed groundwater monitoring wells JO-P16-M01, JO-P41-M02, JO-P54-M03, and JO-P54-M04. Samples collected from these wells were analyzed for pesticides and PAL metals. No analytes were detected in the groundwater at concentrations above primary Maximum Contaminant Levels (MCLs).

2.4.3 Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release

At the time of site investigations, performed by OHM in 1994, an empty 55-gallon drum located between Bunkers 306 and 309 was removed and a confirmatory soil sample collected at the former drum location. SVOCs were detected in the confirmatory soil sample.

During excavation of soil from the area in August 1996, no additional drums were found.

2.4.4 High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate

The analytical results from the various investigation suggest that, although arsenic compounds, organic pesticides and materials containing SVOCs may have been stored in the bunkers, traces of these analytes in soil near the bunkers may be unrelated to the bunkers. A separate facility-wide survey performed in conjunction with the SSI indicated that a persistent pattern of elevated arsenic along transportation corridors. Although no specific documentation has been obtained of past herbicide usage at Sudbury Annex, the observed patterns are consistent with the application of arsenic-based herbicides.

Arsenic and pesticides were not detected in the groundwater at SA P16 indicating that surface conditions did not affect groundwater quality.

2.4.5 Weather Conditions That May Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released

The only weather conditions that may have had the potential to cause the contaminants in the soil to migrate would have been wind and precipitation. Considering that the area was sparsely vegetated, wind may have caused contaminants to become air borne through dust. Rain may have caused lateral and vertical migration. However, contaminants were not detected in the groundwater at SA P16 indicating that surface conditions did not affect groundwater quality.

2.4.6 Threat of Fire or Explosion

No threat of fire or explosion associated with SA P16 has been identified.

2.5 Threats to the Environment

2.5.1 Actual or Potential Exposure to Hazardous Substances or Pollutants or Contaminants by Nearby Populations or the Food Chain

The SSI conducted by ABB in 1995 included human health and ecological PRE. Exposure of average concentrations of soil pesticides contamination to terrestrial vertebrate receptors does not pose a substantial risk and populations of these receptors are likely to be unaffected. Some of the PAH, DDT and inorganic analytes contamination exceeded plant and invertebrate benchmark values. However, the PRE concluded that it is unlikely that these analytes pose a substantial risk to plant or invertebrate receptors.

2.5.2 Actual or Potential Contamination of Sensitive Ecosystems

Sensitive ecosystems were not identified in the vicinity of SA P16.

2.5.3 Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers That May Pose a Threat of Release

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The only weather conditions that may have had the potential to cause the contaminants in the soil to migrate would have been wind and precipitation. Considering the area was sparsely vegetated, wind may have caused contaminants to become air borne through dust. Rain may have caused lateral and vertical migration. However, contaminants were not detected in the groundwater at SA P16 indicating that surface conditions did not affect groundwater quality.

2.5.6 Threat of Fire or Explosion

No threat of fire or explosion associated with SA P16 has been identified.

2.6 Endangerment Determination

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected, could have presented an imminent and substantial endangerment to public health or welfare, or to the environment.

2.7 Proposed Action

2.7.1 Proposed Action Description

The proposed action for the areas E5 and E6 of SA P16 was to excavate and remove the soil containing DDD, DDE and DDT concentrations greater than the site specific clean-up levels of 2 ppm. The dimensions of the two excavation areas, E5 and E6, are 5'x5'x5' and 30'x10'x3', respectively. The volume of contaminated soil that was to be excavated was 4.6 cubic yards from E5 and 33.3 cubic yards from E6.

2.7.1.1 Mobilization/Site Preparation

Prior to mobilization to the site, certain steps were taken to ensure worker health and safety and to ensure efficient removal procedures. These steps included the development of a site safety and health plan (SSHP) and a site sampling and analysis plan (SAP).

The SSHP was developed in accordance with 29 CFR 1910.120(b)(4) and previous SSHPs prepared for work at Fort Devens. The SSHP established safety guidelines for the work operations, and included key personnel, medical surveillance, training, site control, hazardous waste operations, equipment operations, personal protection, construction safety, and an Emergency Response Plan.

The SAP detailed field sampling protocols and laboratory procedures for the confirmation sampling. The intent of the SAP was to ensure the removal of soil containing DDD, DDE, and DDT concentrations above the clean up goal of 2 ppm.

Health and safety equipment such as fire extinguishers, first aid kits, eye wash station, and mobile communications were available on-site during removal activities.

2.7.1.2 Soil Excavation and Disposal

The soils located in the E5 and E6 areas were excavated with a rubber tired excavator. Soils were loaded directly into dump trucks for transportation to the landfill located at SA A7. Soils from the two excavation areas were used as fill for the subgrade preparation of the landfill cap. The excavations took place within the established work area.

2.7.1.3 Confirmation Soil Sampling

Soil samples were collected at every 25 feet along the sidewalls. Side wall samples consisted of the composite of two grab samples from depths of approximately 2 and 4 feet. Floor samples consisted of a composite of samples collected from each of the four corner and the center of each floor. A total of 4 sidewall and 1 floor samples were collected from each excavation. See the attachments for a description of the sampling locations.

Soil samples were submitted to a CENED validated off-site laboratory for analysis of DDD, DDE, and DDT. Levels of three pesticides in all samples were below the site specific clean-up level of 2 ppm.

2.7.1.4 Demobilization

Upon completion of the excavation, the excavated area was backfilled to original grade with materials obtained from the on-site borrow source located at P22. All equipment was then removed from the P16 site.

2.7.1.5 Project Schedule

The removal action SA P16 took place on August 1, 1996. Site backfilling was completed on August 27, 1996.

2.7.2 Contribution to Remedial Performance

The removal of the contaminated soils from SA P16 significantly reduces or eliminates potential of future risks to human health. The removal action contributes to the reduction of overall site risks. Soil removed from the area was designated as material posing health risks.

2.7.3 Description of Alternative Technologies

Because of the health risks associated with the contaminated soil at the site, it was determined to remove the soil from the location.

At the time of the proposed removal action, additional work was being performed at the Sudbury Training Annex. This work included the construction of a RCRA-Subtitle C landfill cap at the A7 Landfill. The construction of the cap required placement of fill in order to achieve the design elevations and grades for the subgrade. As a sandy-gravelly material, the contaminated soil from SA P16 met the requirements for subgrade fill material. Since it was possible to fill the needs of the landfill cap construction and complete the removal of contaminated soil from SA P16, a determination was made to remove the soil from P16 and place it in the landfill.

Other remedial alternatives considered were off-site disposal and on-site treatment. However, because costs for both of these options were not economical, further evaluation for off-site disposal or on-site treatment were not considered for this removal action.

2.7.4 Engineering Evaluation/Cost Analysis

Because the removal or treatment of contaminated soil was necessary at the P16 site, a cost would be incurred. The options include removal of the soil or treatment at the site. The cost for on-site treatment would include mobilization of equipment and treatment materials and the cost of treatment performance. The costs for disposal would include the transportation of materials to a regulated landfill or treatment facility as well as a facility handling/disposal fee.

The chosen option was to remove the soil and place it at the site landfill at Study Area A7. This option eliminated the need for off-site transportation and disposal fees associated with landfills and treatment facilities. Therefore, the removal of the soil from P16, and the placing of it at the A7 landfill, was a cost effective approach for the removal action.

2.7.5 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARS) are federal and state public health and environmental requirements used to evaluate the appropriate extent of site cleanup, plan removal action alternatives, and govern the implementation of a selected removal action.

The scope of the removal action is unrelated to groundwater or surface water and therefore there were no ARARs developed for these media.

2.7.6 Estimated Project Cost

The removal action at SA P16 was estimated and performed for approximately \$ 17,600.

2.8 Expected Change in the Situation Should Action be Delayed or Not Taken

If the removal action had been delayed or not performed, the human health risk associated with the area would not have been reduced or eliminated. Based upon expected site usage, the risk to human health would have remained continuous until the time of the contaminated soil removal.

2.9 Outstanding Policy Issues

No outstanding policy issues relative to this Action Memorandum were identified.

2.10 Enforcement

The lead agency for the removal action was the Army Corps of Engineers - New England Division (CENED). All oversight was performed by CENED, in coordination with the EPA and MADEP. However, specific enforcement measures were not applicable to this site.

2.11 Recommendation

This document is a written account of the removal action conducted at SA P16 and a summary of selected site investigations. Based upon the Preliminary Risk Evaluation, it was recommended to remove the soil identified as posing a risk to human health and ecology.

Confirmation sample results identified no area within the removal action location as containing DDD, DDT or DDE above the clean up goal. Therefore, no further action is recommended for this area.

Section 3

SECTION 3 STUDY AREA P23

3.1 Site Description

3.1.1 Physical Location and Description

SA P23 is located on the south side of Puffer Road in the central portion of the Annex, and includes Building T465 and a concrete pad near the building (see Figure 3-1). SA P23 is on the broad crest of a ridge that slopes southeastward toward the northeasternmost bunkers and slopes northwestward across Puffer Road toward Honey Brook (a tributary of Taylor Brook).

3.1.2 Study Area Background

SA P23 was used by the Air Drop Engineering Division of Natick Labs for aerial delivery testing on the concrete pad and for testing aircraft rollers. P23 was also used by GCA Corporation of Bedford, Massachusetts for optical electronic instrument evaluation in measuring smoke obscuration. Building T465 was constructed in 1960. The building was used by Dames & Moore to store drilling supplies during a 1984 investigation.

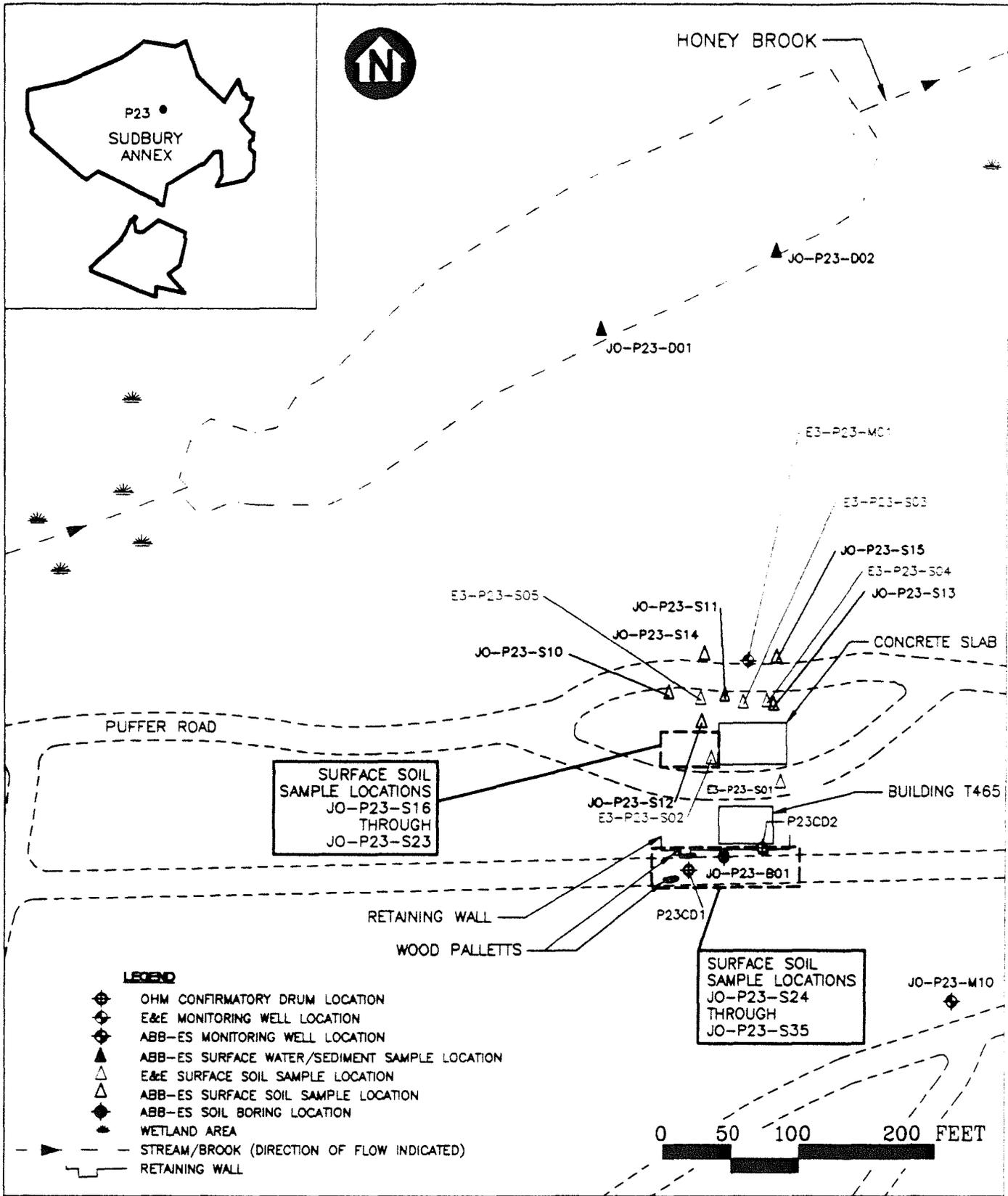
3.1.3 Removal Site Evaluation

A Phase I investigation was conducted by OHM in 1994. The investigation consisted of removal of two empty 55-gallon drums and confirmatory sampling at each drum location. Pesticides, PAHs and metals were detected at these locations. Lead was detected at a concentration of 16,000 ppm at one of the locations.

A Phase II investigation was conducted by Ecology & Environment and consisted of surface soil sampling around the concrete pad. Total petroleum hydrocarbons (TPH) were detected at concentrations of 2,300 ppm and 15,000 ppm in samples near Puffer Road. Lead was detected in one sample at 320 ppm.

A SSI was conducted by ABB in 1995 and consisted of soil sampling for TPH near the concrete pad; sampling for lead in the area of the previously detected lead near the concrete pad; and sampling for lead and arsenic at the former railroad bed. In addition, one eight foot boring was drilled at the railroad bed and sampled for lead and arsenic.

TPH was detected at 847 ppm in one out of six samples collected near the concrete pad. Lead was not detected in the eight samples collected near the concrete pad. Lead was detected below Annex background levels in six of the twelve samples collected at the former railroad bed. Arsenic was detected above Annex background levels in ten of the twelve samples collected at the former railroad bed. Arsenic and lead were not detected in the subsurface soils in the boring drilled in the former railroad bed.



G:\7148-01\FIG\7148F408.DWG (1=100)

Note:

- Locations based on survey conducted by Martinge Engineering Assoc., July 1995, field measurements and a review of historical site maps.

FIGURE 3-1
EXPLORATION LOCATIONS, STUDY AREA P23
SUPPLEMENTAL SITE INVESTIGATION
FORT DEVENS SUDBURY TRAINING ANNEX
MIDDLESEX COUNTY, MASSACHUSETTS



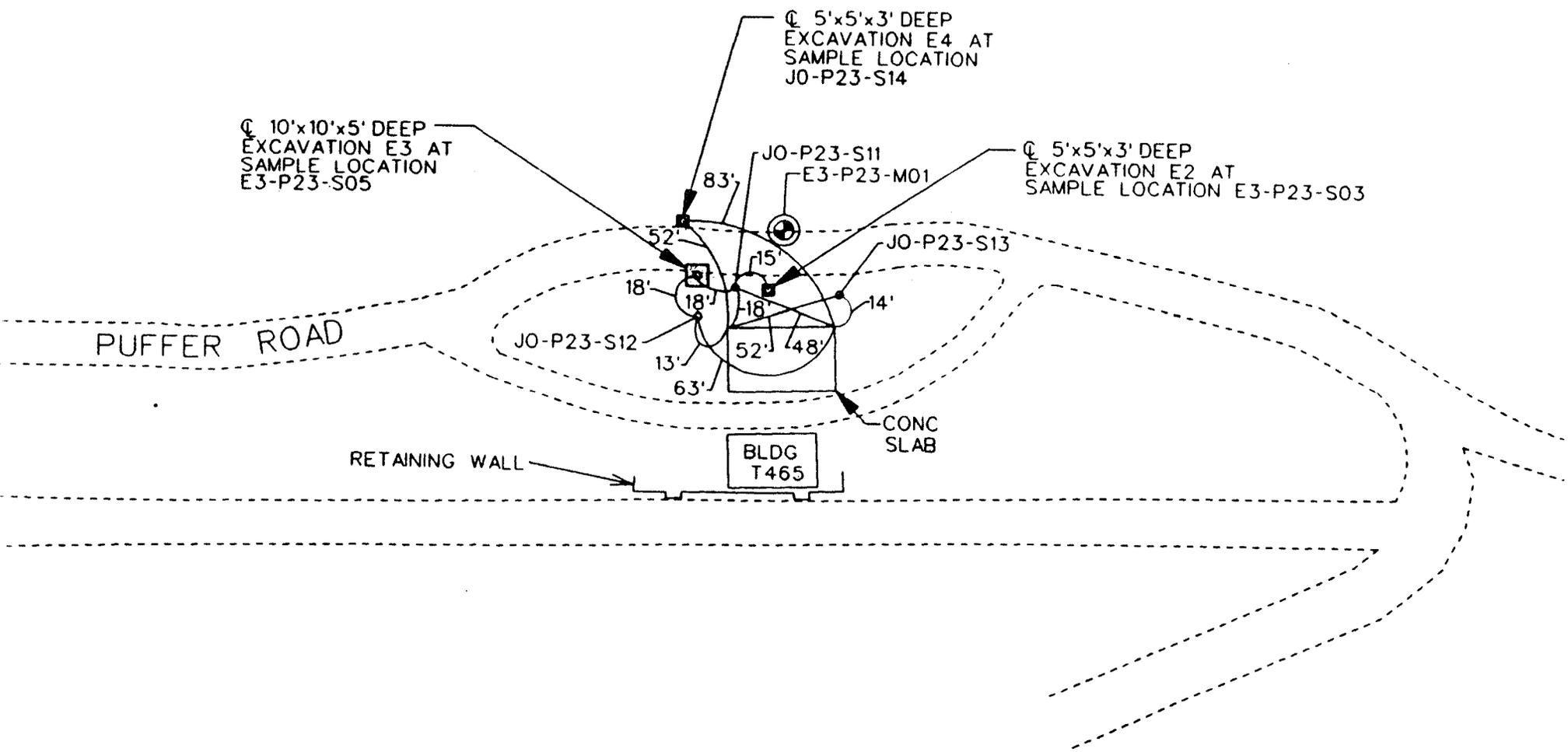


FIGURE 3-2
 EXCAVATION LOCATIONS, STUDY AREA P23
 FORT DEVENS SUBBURY TRAINING ANNEX
 MIDDLESEX COUNTY, MASSACHUSETTS

ABB's SSI included human health and ecological PREs of SA P23. The PREs concluded that potential exposures to arsenic and TPH in surface soils may pose a risk to human receptors. Both analytes were detected at concentrations above screening values in several locations across SA P23, although exposures to surface soil at this SA would not occur at the magnitude assumed in the risk screening analyses. In addition, a potential may exist for inhalation exposures to dusts generated from the sandy soils at this SA. Potential exposures to lead on a single surface soil sample (P23CD2) may pose a risk to human and ecological receptors; lead and PAH concentrations throughout the remainder of the SA do not pose a substantial risk. The SSI recommended that a removal action of TPH contaminated soil for the south side of Puffer Road be implemented.

3.2 Other Actions to Date

No other action was conducted between the time of the investigations and the remedial actions.

3.3 State and Local Authorities Role

The MADEP, in cooperation with CENED and the EPA, provided regulatory guidance for the project. Also, the local fire-fighting departments provided assistance in the development of emergency response procedures.

3.4 Threats to Human Health or Public Welfare

3.4.1 Actual or Potential Exposure to Hazardous Substances or Pollutants or Contaminants By Nearby Populations or the Food Chain

The SSI conducted by ABB in 1995 included human health and ecological PRE. The PREs concluded that human receptors potentially exposed to isolated areas of PAH and pesticide surface soil contamination in the vicinity of the bunkers may be at risk, but exposure to average SA PAH and pesticide soil concentrations does not pose a substantial risk.

3.4.2 Actual or Potential Contamination of Drinking Water Supplies

ABB installed one monitoring well (JO-P23-M10) to evaluate groundwater quality downgradient from the former drum locations. Samples were collected from JO-P23-M10 and E3-P23-M01 and analyzed for metals and TPH. Antimony, beryllium, and manganese were detected in filtered groundwater at concentrations above risk screening values. In September 1995, groundwater samples collected and analyzed indicated that concentrations of arsenic and lead have decrease below levels of concern. Only antimony was detected at a concentration slightly above the primary MCL. Since filtered groundwater data are more representative of the analyte concentrations to which humans using the groundwater as drinking water would potentially be exposed to, it is unlikely that potential exposures to SA P23 groundwater used as drinking water would pose a substantial risk.

3.4.3 Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release

Two empty 55-gallon drums were identified during OHM's Phase I investigation. Soil samples were collected at each of the drum locations. Pesticides, PAH and metals were detected at these locations.

3.4.4 High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate

The absence of any chemicals of concern in the groundwater at and downgradient from SA P23 indicated that surface soil conditions did not affect groundwater quality. Surface water and sediment samples were collected from pond located north of Puffer Road. Analytical results indicated the presence of arsenic in the surface water and TPH in the sediment. The arsenic detected in the surface water from the pond likely originated in upstream areas along Honey Brook. The low concentrations of TPH in the pond sediment may be associated with decaying vegetative matter. Migration of arsenic and petroleum compounds in surface runoff from P23 is unlikely because of the absence of drainage channels.

3.4.5 Weather Conditions That May Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released

The only weather conditions that may have had the potential to cause the contaminants in the soil to migrate would have been wind and precipitation. Considering the area was sparsely vegetated, wind may have caused contaminants to become air borne through dust. Rain may have caused lateral and vertical migration. However, antimony was the only contaminant detected in the groundwater at SA P23 slightly above the primary MCL indicating that surface conditions did not affect groundwater quality.

3.4.6 Threat of Fire or Explosion

No threat of fire or explosion associated with SA P23 has been identified.

3.5 Threats to the Environment

3.5.1 Actual or Potential Exposure to Hazardous Substances or Pollutants or Contaminants by Nearby Populations or the Food Chain

The SSI conducted by ABB in 1995 included human health and ecological PREs. The PREs concluded that potential exposures to lead on a single surface soil sample may pose a risk to ecological receptors. Lead and PAH concentrations throughout the remainder of P23 do not pose a substantial risk. No substantial risks were identified for potential ecological receptor exposures to surface water or sediment. It is unlikely that the analytes detected in the pond samples are related to SA P23.

3.5.2 Actual or Potential Contamination of Sensitive Ecosystems

Sensitive ecosystems were not identified in the vicinity of SA P23.

3.5.3 Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers That May Pose a Threat of Release

Two empty 55-gallon drums were identified during OHM's Phase I investigation. Soil samples were collected at each of the drum locations. Pesticides, PAH and metals were detected at these locations.

3.5.4 High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface That May Migrate

The absence of any chemical concern in the groundwater at and downgradient from SA 23 indicates that surface soil conditions did not affect groundwater quality. Surface water and sediment samples were collected from pond located north of Puffer Road. Analytical results indicated the presence of arsenic in the surface water and TPH in the sediment. The arsenic detected in the surface water from the pond likely originated in upstream areas along Honey Brook. The low concentrations of TPH in the pond sediment may be associated with decaying vegetative matter. Migration of arsenic and petroleum compounds in surface runoff from P23 is unlikely because of the absence of drainage channels.

3.5.5 Weather Conditions That May Cause Hazardous Substances, Pollutants or Contaminants to Migrate or be Released

The only weather conditions that may have had the potential to cause the contaminants in the soil to migrate would have been wind and precipitation. Considering the area was sparsely vegetated, wind may have caused contaminants to become air borne through dust. Rain may have caused lateral and vertical migration. However, antimony was the only contaminant detected in the groundwater at SA P23 slightly above the primary MCL indicating that surface conditions did not affect groundwater quality.

3.5.6 Threat of Fire or Explosion

No threat of fire or explosion associated with SA P23 has been identified.

3.6 Endangerment Determination

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected, could have presented an imminent and substantial endangerment to public health or welfare, or to the environment.

3.7 Proposed Action

3.7.1 Proposed Action Description

The proposed action for the areas E2, E3, and E4 of SA P23 was to excavate and remove the soil containing THP concentrations greater than the site specific clean-up levels of 500 ppm. The dimensions of the three excavation areas, E2, E3, and E4 are 5'x5'x3', 10'x10'x5', and 5'x5'x3', respectively. The volume of contaminated soil that was to be excavated from E2, E4, and E5 was 2.8 yd³, 18.5 yd³, and 2.8 yd³, respectively.

3.7.1.1 Mobilization/Site Preparation

Prior to mobilization to the site, certain steps were taken to ensure worker health and safety and to ensure efficient removal procedures. These steps included the development of a site safety and health plan (SSHP) and a site sampling and analysis plan (SAP).

The SSHP was developed in accordance with 29 CFR 1910.120(b)(4) and previous SSHPs prepared for work at Fort Devens. The SSHP established safety guidelines for the work operations, and included key personnel, medical surveillance, training, site control, hazardous waste operations, equipment operations, personal protection, construction safety, and an Emergency Response Plan.

The SAP detailed field sampling protocols and laboratory procedures for the confirmation sampling. The intent of the SAP was to ensure the removal of soil containing TPH concentrations above the clean up goal of 500 ppm.

Health and safety equipment such as fire extinguishers, first aid kits, eye wash station, and mobile communications were available on-site during removal activities.

3.7.1.2 Soil Excavation and Disposal

The soils located in the E2, E3, and E4 areas were excavated with a rubber tired excavator. Soils were loaded directly into dump trucks for transportation to the landfill located at SA A7. Soils from the two excavation areas were used as fill for the subgrade preparation of the landfill cap. The excavations took place within the established work area.

3.7.1.3 Confirmation Soil Sampling

Soil samples were collected at every 25 feet along the sidewalls. Side wall samples consisted of the composite of two grab samples from depths of approximately 2 and 4 feet. Floor samples consisted of a composite of samples collected from each of the four corner and the center of each floor. A total of 4 sidewall and 1 floor samples were collected from each excavation. See the attachments for a description of the sampling locations.

Soil samples were submitted to a CENED validated off-site laboratory for analysis of TPH. Levels of TPH in all samples were below the site specific clean-up level of 500 ppm.

3.7.1.4 Demobilization

Upon completion of the excavations, the excavated areas were backfilled to original grade with materials obtained from the on-site borrow source located at P22. All equipment was then removed from the P23 site.

3.7.1.5 Project Schedule

The removal action SA P23 took place on August 2, 1996. Site backfilling was completed on August 28, 1996.

3.7.2 Contribution to Remedial Performance

The removal of the contaminated soils from SA P23 significantly reduces or eliminates potential of future risks to human health. The removal action contributes to the reduction of overall site risks. Soil removed from the area was designated as material posing health risks.

3.7.3 Description of Alternative Technologies

Because of the health risks associated with the contaminated soil at the site, it was determined to remove the soil from the location.

At the time of the proposed removal action, additional work was being performed at the Sudbury Training Annex. This work included the construction of a RCRA-Subtitle C landfill cap at the A7 Landfill. The construction of the cap required placement of fill in order to achieve the design elevations and grades for the subgrade. As a sandy-gravelly material, the contaminated soil from SA P23 met the requirements for subgrade fill material. Since it was possible to fill the needs of the landfill cap construction and complete the removal of contaminated soil from SA P23, a determination was made to remove the soil from P23 and place it in the landfill.

Other remedial alternatives considered were off-site disposal and on-site treatment. However, because costs for both of these options were not economical, further evaluation for off-site disposal or on-site treatment were not considered for this removal action.

3.7.4 Engineering Evaluation/Cost Analysis

Because the removal or treatment of contaminated soil was necessary at the P23 site, a cost would be incurred. The options include removal of the soil or treatment at the site. The cost for on-site treatment would include mobilization of equipment and treatment materials and the cost of treatment performance. The costs for disposal would include the transportation of materials to a regulated landfill or treatment facility as well as a facility handling/disposal fee.

The chosen option was to remove the soil and place it at the site landfill at Study Area A7. This option eliminated the need for off-site transportation and disposal fees associated with landfills and

treatment facilities. Therefore, the removal of the soil from P23, and the placing of it at the site landfill, was a cost effective approach for the removal action.

3.7.5 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) are federal and state public health and environmental requirements used to evaluate the appropriate extent of site cleanup, plan removal action alternatives, and govern the implementation of a selected removal action.

The scope of the removal action is unrelated to groundwater or surface water and therefore there were no ARARs developed for these media.

3.7.6 Estimated Project Cost

The removal action at SA P23 was estimated and performed for approximately \$ 12,200.

3.8 Expected Change in the Situation Should Action be Delayed or Not Taken

If the removal action had been delayed or not performed, the human health risk associated with the area would not have been reduced or eliminated. Based upon expected site usage, the risk to human health would have remained continuous until the time of the contaminated soil removal.

3.9 Outstanding Policy Issues

No outstanding policy issues relative to this Action Memorandum were identified.

3.10 Enforcement

The lead agency for the removal action was the Army Corps of Engineers - New England Division (CENED). All oversight was performed by CENED, in coordination with the EPA and MADEP. However, specific enforcement measures were not applicable to this site.

3.11 Recommendation

This document is a written account of the removal action conducted at SA P23 and a summary of selected site investigations. Based upon the Preliminary Risk Evaluation, it was recommended to remove the soil identified as posing a risk to human health and ecology.

Confirmation sample results identified no area within the removal action location as containing TPH above the clean up goal. Therefore, no further action is recommended for this area.

Section 4

SECTION 4 STUDY AREA P41

4.1 Site Description

4.1.1 Physical Location and Description

SA P41 is located in the north central part of the Sudbury Annex, north of Buildings T206 and T267 and 900 feet due west of Puffer Pond (see Figure 4-1).

4.1.2 Study Area Background

Bunker 303 was constructed prior to 1973 and has been used for pesticide and herbicide storage. During a 1977 inspection of Bunker 303, approximately three-hundred 50-pound bags of the herbicide Ureabor were observed, some of which had spilled on the bunker floor. During a 1979 inspection, eight 55-gallon drums of 20% DDT/oil solution and approximately seventy 50-pound bags of Ureabor were stored in Bunker 303.

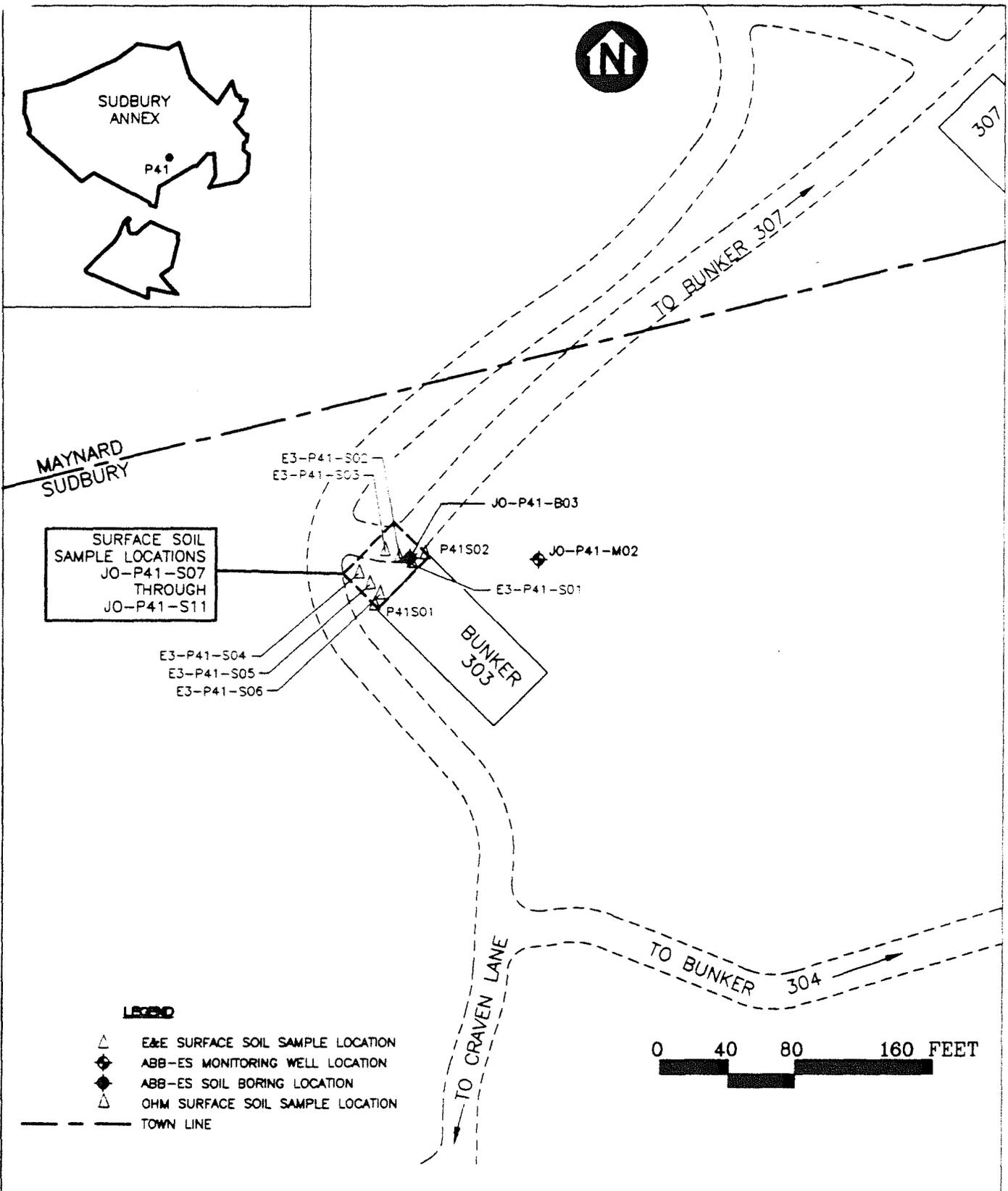
4.1.3 Removal Site Evaluation

A Phase I investigation was performed by OHM in 1994 and consisted of collection of two surface soil from SA P41. The two soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, explosives, and chlorinated herbicides. DDT and cadmium were detected at concentrations of 30 ppm and 55 ppm, respectively, which were above risk-based levels. Several other metals were detected above background concentrations.

A Phase II investigation conducted by Ecology & Environment in 1994, identified DDT (59 ppm), DDD (30 ppm) and DDE (3.4) above risk-based screening levels in six surface soil samples. Herbicides and metals detected in the surface soil samples were below screening levels.

An SSI conducted by ABB in 1995 consisted of soil sampling in front of the drains and the loading dock of Bunker 303 and soil boring at the base of the slope below the northeast drain of Bunker 303. The samples were analyzed for PAL metals and PAL pesticides. DDT, DDD, and DDE were detected at a maximum concentration of 1.7 ppm, 0.64 ppm, and 0.139 ppm, respectively, in some of the surface samples and in the subsurface samples. These concentrations were above background levels but below risk-based screening levels.

The SSI included human health and ecological PREs of SA P41. The PREs concluded that human receptors potentially exposed to average concentrations of DDD and DDT contamination in surface soils may be at risk.



G:\7148-01\FIG\7148F306.DWG (1=80)

Note:
 1. Locations based on survey conducted by Martinage Engineering Assoc., July 1995, field measurements and a review of historical site maps.

FIGURE 4-1
 EXPLORATION LOCATIONS, STUDY AREA P41
 SUPPLEMENTAL SITE INVESTIGATION
 FORT DEVENS SUBBURY TRAINING ANNEX
 MIDDLESEX COUNTY, MASSACHUSETTS



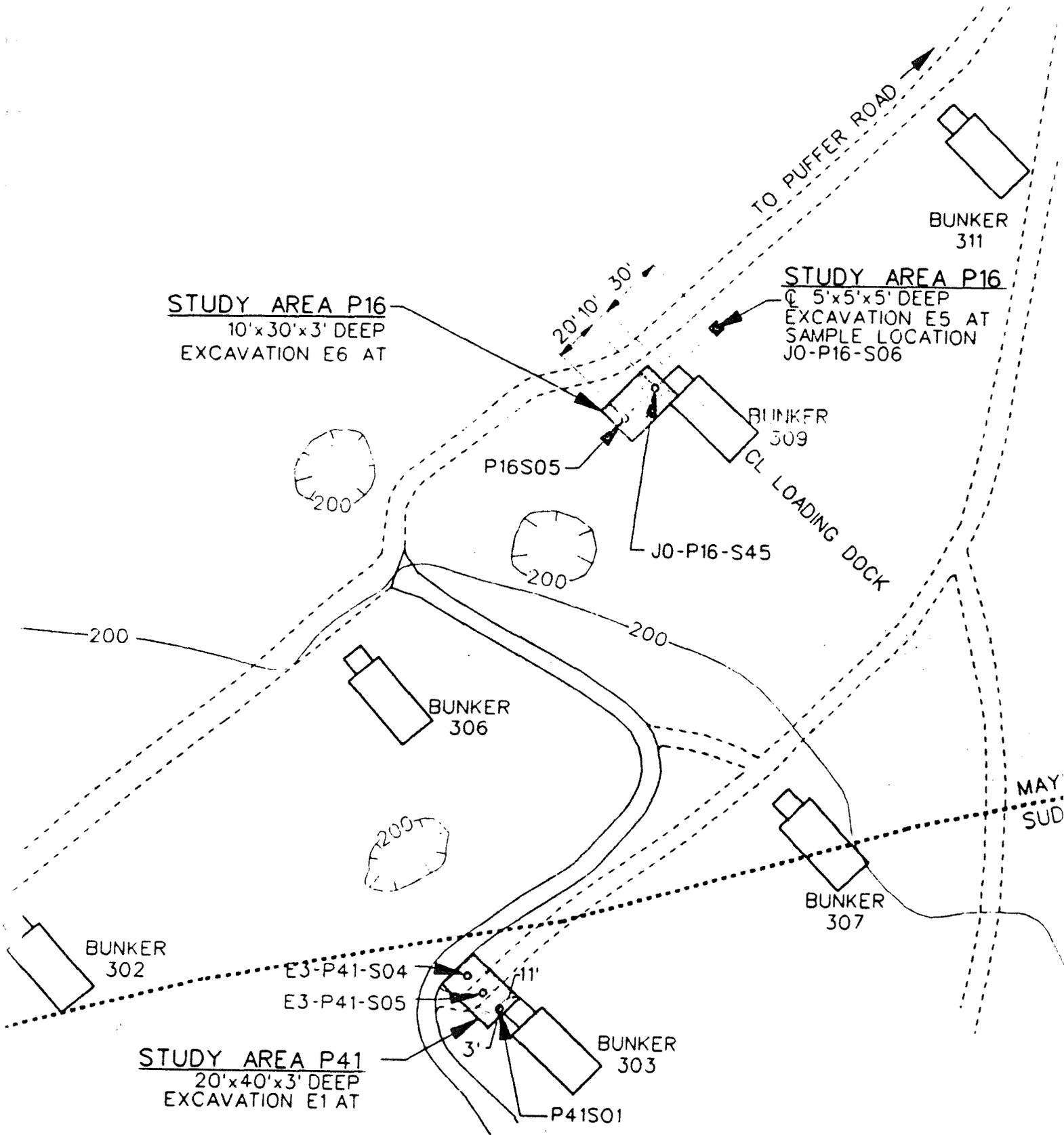


FIGURE 4-2
EXCAVATION LOCATIONS STUDY AREA P41
FORT DEVENS SUDBURY TRAINING ANNEX
MIDDLESEX COUNTY, MASSACHUSETTS

Isolated areas of pesticide surface soil contamination in the vicinity of the bunkers may be at risk, but exposure to average SA pesticide soil concentrations does not pose a substantial risk. Exposure of average concentrations of soil pesticides contamination to terrestrial vertebrate receptors does not pose a substantial risk and populations of these receptors are likely to be unaffected. Some of the DDT and inorganic analytes contamination exceeded plant and invertebrate benchmark values. However, the PRE concluded that it is unlikely that these analytes pose a substantial risk to plant or invertebrate receptors. The SSI recommended that a removal action of the pesticide contaminated soil be implemented.

4.2 Other Actions to Date

No other action was conducted between the time of the investigations and the remedial actions.

4.3 State and Local Authorities Role

The MADEP, in cooperation with CENED and the EPA, provided regulatory guidance for the project. Also, the local fire-fighting departments provided assistance in the development of emergency response procedures.

4.4 Threats to Human Health or Public Welfare

4.4.1 Actual or Potential Exposure to Hazardous Substances or Pollutants or Contaminants By Nearby Populations or the Food Chain

The SSI included human health and ecological PREs of SA P41. The PREs concluded that human receptors potentially exposed to average concentrations of DDD and DDT contamination in surface soils may be at risk. Isolated areas of pesticide surface soils contamination in the vicinity of the bunkers may be at risk, but exposure to average SA pesticide soil concentrations does not pose a substantial risk.

4.4.2 Actual or Potential Contamination of Drinking Water Supplies

Groundwater samples collected from four monitoring wells in the areas of the bunkers were analyzed for pesticides and metals. No analytes were detected in the groundwater samples at concentrations above primary MCLs.

4.4.3 Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers that may Pose a Threat of Release

The observed pesticide contamination in the surface soils was associated with the past storage and handling of DDT at Bunker 303.

4.4.4 High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface that may Migrate

The patterns of surface soil contamination indicate that Bunker 303 was the source of elevated pesticide levels in soil from SA P41. The presence of DDT, DDT, and DDE in the subsurface soil sample indicated that there was downward migration of these contaminants. Pesticides were not detected in groundwater from any of the four monitoring wells in the bunker area indicating that groundwater quality was not affected by the conditions at Bunker 303.

4.4.5 Weather Conditions That May Cause Hazardous Substances, Pollutants or Contaminants to Migrate or to be Released

The only weather conditions that may have had the potential to cause the contaminants in the soil to migrate would have been wind and precipitation. Considering the area was sparsely vegetated, wind may have caused contaminants to become air borne through dust. Rain may have caused lateral and vertical migration. However, no contaminants were detected in the groundwater at SA P41 at concentrations above the primary MCL indicating that surface conditions did not affect groundwater quality.

4.4.6 Threat of Fire or Explosion

No threat of fire or explosion associated with SA P41 has been identified.

4.5 Threats to the Environment

4.5.1 Actual or Potential Exposure to Hazardous Substances or Pollutants or Contaminants by Nearby Populations or the Food Chain

An ecological PRE was performed for the surface soil associated with SA P41. Groundwater data and subsurface data were not evaluated, and no surface water or sediment samples were collected. Although forested areas occur in the general vicinity of SA P41, minimal ecological habitat occurs at the site. All surface soil samples were collected immediately to the northwest of Bunker 303, in a small grassy area with patches of sand and gravel. This area may provide extremely limited habitat for ground-foraging avian receptors. It is unlikely that the sand and gravel substrate in this region provides a suitable growth medium for invertebrate and plant receptors.

4.5.2 Actual or Potential Contamination of Sensitive Ecosystems

Sensitive ecosystems were not identified in the vicinity of SA P41.

4.5.3 Hazardous Substances, Pollutants, or Contaminants in Drums, Barrels, Tanks, or Other Bulk Storage Containers That May Pose a Threat of Release

The observed pesticide contamination in the surface soils was associated with the past storage and handling of DDT at Bunker 303.

4.5.4 High Levels of Hazardous Substances or Pollutants or Contaminants in Soils Largely at or Near the Surface That May Migrate

The observed pesticide contamination in the surface soils was associated with the past storage and handling of DDT at Bunker 303. The presence of DDT, DDT, and DDE in the subsurface soil sample indicated that there was downward migration of these contaminants. Pesticides were not detected in groundwater from any of the four monitoring wells in the bunker area indicating that groundwater quality was not affected by the conditions at Bunker 303.

4.5.5 Weather Conditions That May Cause Hazardous Substances, Pollutants or Contaminants to Migrate or be Released

The only weather conditions that may have had the potential to cause the contaminants in the soil to migrate would have been wind and precipitation. Considering the area was sparsely vegetated, wind may have caused contaminants to become air borne through dust. Rain may have caused lateral and vertical migration. However, no contaminants were detected in the groundwater at SA P41 at concentrations above the primary MCL, indicating that surface conditions did not affect groundwater quality.

4.5.6 Threat of Fire or Explosion

No threat of fire or explosion associated with SA P41 has been identified.

4.6 Endangerment Determination

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected, could have presented an imminent and substantial endangerment to public health or welfare, or to the environment.

4.7 Proposed Action

4.7.1 Proposed Action Description

The proposed action for the area E1 SA P41 was to excavate and remove the soil containing DDD, DDE, DDT concentrations greater than the site specific clean-up levels of 2 ppm. The dimensions of the excavation area E1 is 40'x20'x3'. The volume of contaminated soil that was to be excavated from E1 was 89 yd³.

4.7.1.1 Mobilization/Site Preparation

Prior to mobilization to the site, certain steps were taken to ensure worker health and safety and to ensure efficient removal procedures. These steps included the development of a site safety and health plan (SSHP) and a site sampling and analysis plan (SAP).

The SSHP was developed in accordance with 29 CFR 1910.120(b)(4) and previous SSHPs prepared for work at Fort Devens. The SSHP established safety guidelines for the work operations, and included key personnel, medical surveillance, training, site control, hazardous waste operations, equipment operations, personal protection, construction safety, and an Emergency Response Plan.

The SAP detailed field sampling protocols and laboratory procedures for the confirmation sampling. The intent of the SAP was to ensure the removal of soil containing DDD, DDE, and DDT concentrations above the clean up goal of 2 ppm.

Health and safety equipment such as fire extinguishers, first aid kits, eye wash station, and mobile communications were available on-site during removal activities.

4.7.1.2 Soil Excavation and Disposal

The soils located in the E1 area were excavated with a rubber tired excavator. Soils were loaded directly into dump trucks for transportation to the landfill located at SA A7. Soils from the excavation area were used as fill for the subgrade preparation of the landfill cap. The excavation took place within the established work area.

4.7.1.3 Confirmation Soil Sampling

Soil samples were collected at every 25 feet along the sidewalls. Floor samples consisted of a composite of samples collected from each of the four corner and the center of each floor. A total of 4 sidewall and 1 floor samples were collected from the excavation. See the attachments for a description of the sampling locations.

Soil samples were submitted to a CENED validated off-site laboratory for analysis of pesticides. Levels of DDD, DDE, and DDT in all samples were below the site specific clean-up level of 2 ppm.

4.7.1.4 Demobilization

Upon completion of the excavations, the excavated areas were backfilled to original grade with materials obtained from the on-site borrow source located at P22. All equipment was then removed from the P41 site.

4.7.1.5 Project Schedule

The removal action SA P41 took place on August 1, 1996. Site backfilling was completed on August 28, 1996.

4.7.2 Contribution to Remedial Performance

The removal of the contaminated soils from SA P41 significantly reduces or eliminates potential of future risks to human health. The removal action contributes to the reduction of overall site risks. Soil removed from the area was designated as material posing health risks.

4.7.3 Description of Alternative Technologies

Because of the health risks associated with the contaminated soil at the site, it was determined to remove the soil from the location.

At the time of the proposed removal action, additional work was being performed at the Sudbury Training Annex. This work included the construction of a RCRA-Subtitle C landfill cap at the A7 Landfill. The construction of the cap required placement of fill in order to achieve the design elevations and grades for the subgrade. As a sandy-gravelly material, the contaminated soil from SA P41 met the requirements for subgrade fill material. Since it was possible to fill the needs of the landfill cap construction and complete the removal of contaminated soil from SA P41, a determination was made to remove the soil from P41 and place it in the landfill.

Other remedial alternatives considered were off-site disposal and on-site treatment. However, because costs for both of these options were not economical, further evaluation for off-site disposal or on-site treatment were not considered for this removal action.

4.7.4 Engineering Evaluation/Cost Analysis

Because the removal or treatment of contaminated soil was necessary at the P41 site, a cost would be incurred. The options include removal of the soil or treatment at the site. The cost for on-site treatment would include mobilization of equipment and treatment materials and the cost of treatment performance. The costs for disposal would include the transportation of materials to a regulated landfill or treatment facility as well as a facility handling/disposal fee.

The chosen option was to remove the soil and the place it at the site landfill at Study Area A7. This option eliminated the need for off-site transportation and disposal fees associated with landfills and treatment facilities. Therefore, the removal of the soil from P41, and the placing of it at the site landfill, was a cost effective approach for the removal action.

4.7.5 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) are federal and state public health and environmental requirements used to evaluate the appropriate extent of site cleanup, plan removal action alternatives, and govern the implementation of a selected removal action.

The scope of the removal action is unrelated to groundwater or surface water and therefore there were no ARARs developed for these media.

4.7.6 Estimated Project Cost

The removal action at SA P41 was estimated and performed for approximately \$ 16,300.

4.8 Expected Change in the Situation Should Action be Delayed or Not Taken

If the removal action had been delayed or not performed, the human health risk associated with the area would not have been reduced or eliminated. Based upon expected site usage, the risk to human health would have remained continuous until the time of the contaminated soil removal.

4.9 Outstanding Policy Issues

No outstanding policy issues relative to this Action Memorandum were identified.

4.10 Enforcement

The lead agency for the removal action was the Army Corps of Engineers - New England Division (CENED). All oversight was performed by CENED, in coordination with the EPA and MADEP. However, specific enforcement measures were not applicable to this site.

4.11 Recommendation

This document is a written account of the removal action conducted at SA P41 and a summary of selected site investigations. Based upon the Preliminary Risk Evaluation, it was recommended to remove the soil identified as posing a risk to human health and ecology.

Confirmation sample results identified no area within the removal action location as containing DDD, DDE, or DDT above the clean up goal. Therefore, no further action is recommended for this area.

Section 5

SECTION 5 REFERENCES

ABB Environmental Services, Inc., Final Supplemental Site Investigation Report, Data Sudbury Training Annex Study Areas A3, A5, A10, A11, P5, P6, P9, P16, P23, P27, P38, P41, P45, and P54., October 1996.

Stone & Webster Environmental Technology & Services, Final Contract Specifications and Design Drawings, Source Control Remedial Design - Study Areas A7 and A9 with Removal Actions at Study Areas A1, A2, P2, P16, P23, P39, and P41. Contract No. DACW33-94-D-0007, Delivery Order 08, July 1996.

Stone & Webster Environmental Technology & Services, Technical Memorandum for Consolidation of Soil From Study Areas P16, P23, and P41 for Use as Subgrade Under Landfill Cap at AOC A7, Fort Devens Sudbury Training Annex, Draft - March 1996.