

Five-Year Review Report

Third Five-Year Review Report
for
Plymouth Harbor, Cannon's Engineering Corporation, Superfund Site
Town of Plymouth
Plymouth County, Massachusetts

September 2003

Prepared by:

The United States Environmental Protection Agency
Region 1, New England
Boston, Massachusetts



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Approved by:

Date:

Susan Studlien
Susan Studlien, Acting Director
Office of Site Remediation and Restoration
U.S. EPA, New England

September 26, 2003

**TABLE OF CONTENTS
FIVE-YEAR REVIEW
PLYMOUTH HARBOR
CANNONS ENGINEERING CORPORATION SITE
PLYMOUTH, MASSACHUSETTS**

<u>SECTION</u>	<u>PAGE</u>
ES EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION.....	1-1
2.0 SITE CHRONOLOGY	2-1
3.0 BACKGROUND.....	3-1
3.1 Physical Characteristics	3-1
3.2 Land and Resource Use	3-4
3.3 History of Contamination.....	3-5
3.4 Initial Response	3-6
3.5 Basis for Taking Action	3-6
4.0 REMEDIAL ACTION.....	4-1
4.1 Remedy Selection.....	4-1
4.2 Remedy Implementation	4-2
4.2.1 Floodplains Assessment.....	4-2
4.2.2 Tank Dismantling and Disposal	4-2
4.2.3 Supplemental Sampling.....	4-3
4.2.4 Consent Decree.....	4-3
4.2.5 Soil Removal.....	4-4
4.2.6 Endangerment Assessment.....	4-4
4.2.7 Institutional Controls	4-4
4.3 Operations & Maintenance	4-5
5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW	5-1
6.0 FIVE-YEAR REVIEW PROCESS	6-1
6.1 Administrative Components	6-1
6.2 Community Notification and Involvement.....	6-1
6.3 Document Review	6-1
6.4 Data Review.....	6-2
6.4.1 Soil.....	6-2
6.4.2 Groundwater	6-3
6.4.3 Surface Water	6-3
6.4.4 Sediment.....	6-3
6.5 Site Inspection	6-4
6.6 Interviews.....	6-4
7.0 TECHNICAL ASSESSMENT.....	7-1
7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?.....	7-1

TABLE OF CONTENTS (cont.)
FIVE-YEAR REVIEW
PLYMOUTH HARBOR, CANNONS ENGINEERING CORPORATION SITE
PLYMOUTH, MASSACHUSETTS

<u>SECTION</u>	<u>PAGE</u>
7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels and Remedial Action Objectives (RAOs) used at the time of Remedy Selection still valid?	7-2
7.3 Question C: Has Any Other Information Come To Light That Could Call Into Question the Protectiveness of the Remedy?	7-4
7.4 Technical Assessment Summary	7-4
8.0 ISSUES	8-1
9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS	9-1
10.0 PROTECTIVENESS STATEMENTS	10-1
11.0 NEXT REVIEW.....	11-1

TABLE

<u>NUMBER</u>	<u>PAGE</u>
2-1 Chronology of Site Events.....	2-1

FIGURES

<u>NUMBER</u>	<u>PAGE</u>
3-1 Site Locus.....	3-2
3-2 Site Map	3-3

APPENDICES

A	Document Review List/References
B	Site Inspection Report
C	Interview List
D	Risk Assessment Memorandum
E	Declaration of Restrictions

ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
CEC	Cannons Engineering Corporation
COC	Contaminant of Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cPAH	Carcinogenic polynuclear aromatic hydrocarbons
CSF	Cancer Slope Factor
DL	Detection Limit
EA	Endangerment Assessment
FEMA	Federal Emergency Management Agency
FOP	Field Operations Plan
FS	Feasibility Study
MADEP	Massachusetts Department of Environmental Protection
MADEQE	Massachusetts Department of Environmental Quality Engineering
MCL	Maximum Contaminant Level
ND	non detect
NMV	New Millenium Ventures
NPL	National Priorities List
NUS	NUS Corporation
O&M	Operations and Maintenance
PAH	Polynuclear aromatic hydrocarbons
ppb	parts per billion
ppm	parts per million
RAO	Remedial Action Objective
RfDs	USEPA Risk Reference Doses
RI	Remedial Investigation
ROD	Record of Decision
RP	Responsible Parties
Site	Plymouth Harbor, Cannons Engineering Superfund Site
SP	Settling Parties
TBC	To be Considered
TtNUS	Tetra Tech NUS, Inc.
Trust	Salt Water Trust

ACRONYMS (cont.)

µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

This is the third five-year review for the Plymouth Harbor, Cannons Engineering Corporation (CEC) Superfund Site. The triggering action for this policy review was the completion of the Second Five-Year Review on July 29, 1998. The five-year review is required since hazardous contamination remains at the Site above levels that allow for unlimited use and unrestricted exposure.

Three above ground storage tanks were constructed on the property in the 1920s, and until 1974, were used for storage of No. 6 Marine Fuel and Bunker C Oil. Tank Nos. 1 and 2 had a capacity of 250,000 gallons each; Tank No. 3 had a capacity of 300,000 gallons. From 1976 until 1980, CEC used Tank Nos. 1 and 2 for storage of motor oils, solvents, lacquers, organic and inorganic chemicals, cyanide and plating waste, clay and filter media containing chemicals, plating sludge, oil solids, and pesticides. In response to a 1980 Order of Revocation, CEC closed the Plymouth facility. Although CEC ceased operations, approximately 500,000 gallons of liquid hazardous wastes in Tank Nos. 1 and 2 were abandoned at the facility. Tank No. 3 was not used by CEC.

Tank No. 1 was drained in 1983 and its contents disposed of off-site. In January 1984, Tank No. 2 was drained, cleaned, and its contents disposed of off-site. By 1985 the three tanks were empty, the connecting piping was cleaned, and the waste was removed. On September 30, 1985, the United States Environmental Protection Agency (USEPA) issued a Record of Decision (ROD). The goal of the ROD was to obtain a more complete understanding of the risks associated with the Site to assess the need for an amended ROD and a final remedy that would be protective of human health and the environment. The ROD required the completion of the following three tasks before selecting and implementing a final remedy.

1. Dismantle the three tanks and associated piping and dispose of the materials off-site.
2. Perform supplemental sampling of all media to confirm the pattern of contamination identified in the RI and characterize the areas beneath the three tanks.
3. Prepare a site-specific floodplains assessment.

USEPA determined that additional sampling was necessary to address the uncertainty about the extent of contamination both below the tanks and elsewhere on site. USEPA intended to

amend the ROD following an evaluation of the supplemental data and the selection of a final remedial alternative.

The three tanks were inspected, decontaminated, demolished, and disposed of off-site in the fall of 1987. In the fall of 1987, supplemental samples were collected of soils under the dismantled tanks, surface and subsurface soil locations outside the tank berms, five on-site groundwater monitoring wells, and sediments located off-site in the tidal seep. In September 1988, approximately 200 tons of stained soil contaminated with oily and hazardous materials were excavated and disposed of at a Subtitle C hazardous waste facility. An additional 50 tons of contaminated soils excavated from the top 6 to 12 inches inside each of the three bermed areas were disposed of along with the other stained soils.

USEPA completed a supplemental Endangerment Assessment (EA) in April 1989 using Site data collected during the remedial and response actions. Based on the findings of the EA and the characterization of the response action as a removal action, USEPA, in consultation with the MADEP, concluded that no additional remedial action or a ROD amendment were necessary for the Site.

A deed restriction, recorded in 1992, limited future property use to commercial or industrial development and also included a number of restricted uses. The deed restriction specified that a risk assessment must be performed prior to redevelopment of the Site for any of the listed restricted uses. If the risk assessment concluded that redevelopment for a restricted use was within an acceptable risk range, USEPA and MADEP could either concur or could require that an additional response action be performed before agreeing to a change in the deed restriction to allow the restricted use.

Changes in risk assessment guidelines and recommendations made since the EA have resulted in the need to reassess the protectiveness of the remedy for the allowed commercial or industrial property use in accordance with the new risk assessment guidelines and recommendations. Computations using site data collected during post excavation soil sampling to aid in this reassessment are discussed in Section 7.0 and Appendix D. As discussed in Section 7.2, USEPA has expressed concerns with the age, adequacy, and appropriateness of the available data. The updated risk calculations show the combined risk (ingestion and dermal) for an older child/trespasser is within EPA's acceptable range and adult commercial

worker exposure to carcinogenic polynuclear aromatic hydrocarbons (cPAHs) is at the high end of the protective range.

Although there has not been any redevelopment of the Site since the last review, there have been preliminary discussions and plans to potentially redevelop the Site for residential and/or commercial purposes. Consistent with the deed restriction, USEPA has required that additional sampling and a risk assessment be conducted prior to proceeding with any redevelopment, to ensure that the remedy remains protective of human health.

Five-Year Review Protectiveness Statement:

The remedy for the Plymouth Harbor Site currently protects human health and the environment because clean fill covers the remaining subsurface contamination. A deed restriction limiting future development is in place. Risk calculations show the combined risk (ingestion and dermal) for an older child/trespasser is within USEPA's acceptable range and future adult commercial worker exposure to cPAHs is at the high end of the protective range. However, the data on which these calculations are based are of questionable quality. For the remedy to be protective in the long-term, the following actions need to be taken. The northern shoreline perimeter site fence must be reconstructed and maintained to provide complete access controls around the property. Additional soil data must be collected in accordance with a USEPA-approved soil sampling and management program designed for risk assessment purposes. A new risk assessment must be completed using the new data and updated exposure assumptions based on any of the proposed site uses to confirm that the exposures remain within the protective range.

In addition, prior to commencement of any site redevelopment activities, a detailed redevelopment plan must be submitted to USEPA and MADEP. This plan should include a statement of the proposed work and site activities and address monitoring procedures, health and safety measures and soil management activities to ensure worker and public safety during construction.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (<i>from WasteLAN</i>): Plymouth Harbor/Cannon Engineering Corp.		
EPA ID (<i>from WasteLAN</i>): MAD980525232		
Region: 1	State: MA	City/County: Plymouth
SITE STATUS		
NPL status: Deleted		
Remediation status (choose/ all that apply): Complete		
Multiple OUs?* No	Construction completion date: 1987	
Has site been put into reuse? No		
REVIEW STATUS		
Lead agency: USEPA		
Author name: Derrick Golden		
Author title: Remedial Project Manager	Author affiliation: EPA Region I	
Review period: 3/1/03 to 9/30/03		
Date(s) of site inspection: 05/19/03		
Type of review: Pre-SARA Policy Review		
Review number: 3 (third) **		
Triggering action: Second Five-Year Review		
Triggering action date (<i>from WasteLAN</i>): July 29, 1998		
Due date (five years after triggering action date): July 29, 2003		

* "OU" refers to operable unit.

** Five-Year Reviews were completed in 1992 and 1998

Five-Year Review Summary Form, cont'd.

Issues:

- Site redevelopment for a restricted use.
- New calculations show a risk for adult workers in the commercial/industrial allowed use scenario at the high end of the protective range. The soil data used are of questionable quality.
- Available soil data are of questionable quality and were not collected for risk assessment purposes.
- Access controls are inadequate; there is no northern perimeter site fence.

Recommendations and Follow-up Actions:

- Complete a new risk assessment once new soil data are available.
- Complete a new risk assessment with new data to confirm the industrial/commercial use exposures remain within the protective range.
- Perform soil sampling and management following a plan approved by USEPA.
- Replace and maintain the northern perimeter site fence.

Protectiveness Statement(s):

The remedy for the Plymouth Harbor Site currently protects human health and the environment because clean fill covers the remaining subsurface contamination. A deed restriction limiting future development is in place. Risk calculations show the combined risk (ingestion and dermal) for an older child/trespasser is within USEPA's acceptable range and future adult commercial worker exposure to cPAHs is at the high end of the protective range. However, the data on which these calculations are based are of questionable quality. For the remedy to be protective in the long-term, the following actions need to be taken. The northern shoreline perimeter site fence must be reconstructed and maintained to provide complete access controls around the property. Additional soil data must be collected in accordance with a USEPA-approved soil sampling and management program designed for risk assessment purposes. A new risk assessment must be completed using the new data and updated exposure assumptions based on any of the proposed site uses to confirm that the exposures remain within the protective range.

In addition, prior to commencement of any site redevelopment activities, a detailed redevelopment plan must be submitted to USEPA and MADEP. This plan should include a statement of the proposed work and site activities and address monitoring procedures, health and safety measures and soil management activities to ensure worker and public safety during construction.

1.0 INTRODUCTION

The purpose of this five-year review is to determine if the remedy selected for the Plymouth Harbor, Cannons Engineering Corporation Superfund Site (Site) in Plymouth, Massachusetts is protective of human health and the environment. This report summarizes the five-year review process, investigations and remedial actions undertaken at the Site; evaluates the monitoring data collected; reviews, as appropriate, the Applicable or Relevant and Appropriate Requirements (ARARs) specified in the Record of Decision (ROD) for changes; discusses any issues identified during the review; and presents recommendations to address those issues.

The United States Environmental Protection Agency, Region 1 (USEPA) prepared this five-year review pursuant to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) §121 and the National Contingency Plan. CERCLA §121 states:

“If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.”

The USEPA interpreted this requirement further in the National Contingency Plan; 40 CFR §300.430(f)(4)(ii) states:

“If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.”

USEPA conducted this five-year review of the remedial actions implemented at the Plymouth Harbor Site in Plymouth, Massachusetts. Tetra Tech NUS, Inc. (TtNUS) supported USEPA in completion of the review under EPA Contract No. 68-W6-0045, W.A. No. 129-FRFE-0128. Assistance was provided by Massachusetts Department of Environmental Protection (MADEP). Work on this review was undertaken between March and September 2003. The review was completed in accordance with USEPA Guidance OSWER NO. 9355.7-03B-P.

This is the third five-year review for the Site. The two prior five-year reviews were completed in 1992 and 1998. The triggering action for this policy review was the completion of the second five-year review in 1998. The five-year review is required since hazardous contamination remains at the Site above levels that allow for unlimited use and unrestricted exposure.

2.0

SITE CHRONOLOGY

**TABLE 2-1
CHRONOLOGY OF SITE EVENTS
FIVE-YEAR REVIEW
PLYMOUTH HARBOR, CANNON'S ENGINEERING CORPORATION SITE
PLYMOUTH, MASSACHUSETTS**

Event	Date
Storage tanks were constructed for the Plymouth Cordage Company.	1920s
Emhart Company sold the property (purchased in 1956) to the Columbian Rope Company.	1958
Salt Water Trust (Trust) acquired title to the Site from the Columbian Rope Company.	1969
Until this date No. 6 fuel & Bunker C oil were stored in the tanks.	1974
Tanks were leased by Cannons Engineering Company (CEC) for storage of waste oil. (Only two of the three tanks were ever used by CEC.)	1976
CEC obtained a license from the MA Department of Environmental Quality Engineering (MADEQE) to store waste on-site.	1979
CEC reported types & class of waste stored on-site.	6/9/1980
MADEQE issued an Order of Revocation; the license was revoked and CEC ceased operations.	6/12/1980
MADEQE documented potential problems noted during numerous site visits (leaking tanks, odors, pool of waste on ground surface).	1980-1982
Site proposed for inclusion on National Priority List (NPL).	12/30/1982
USEPA & the Trust entered into a Consent Agreement.	9/1983
Final Site listing on the NPL.	9/8/1983
Jetline Services began pumping wastes from Tank No.1 (under contract to the Trust).	9/22/1983
Tank No. 2 drained by EPA contractors.	1/1984
NUS Corporation (NUS) completed a Remedial Investigation (RI) for EPA. Polynuclear aromatic hydrocarbons (PAHs), pesticides & lead were identified as contaminants of concern (COCs).	7/1984-8/1984
Feasibility Study (FS) was issued.	6/1985
NUS conducted a Wetlands Reconnaissance for EPA.	7/1985
NUS completed a Wetland Assessment for EPA.	8/1985
ROD issued (required completion of additional tasks prior to selecting final remedy).	9/1985
Floodplains Assessment was completed (per ROD).	1/1986
Work Plan & Field Operations Plan issued by the Responsible Parties (RPs) for tank demolition and disposal and a Supplemental Sampling Program.	4/1987
Remedial Action (fencing, tank demolition, drum, debris, waste and stained soil removal) completed by the RPs.	6/87 – 11/87

TABLE 2-1 (cont.)
CHRONOLOGY OF SITE EVENTS
FIVE-YEAR REVIEW
PLYMOUTH HARBOR, CANNON'S ENGINEERING CORPORATION SITE
PLYMOUTH, MASSACHUSETTS
PAGE 2 OF 2

Event	Date
Supplemental sampling conducted (per ROD) by the RPs.	Fall/1987
Revised Draft Supplemental Report completed by the RPs.	2/88
Partial Consent Decree was entered into between USEPA & CEC Settling Parties.	9/1988
ATSDR issued a Health Assessment.	10/1988
USEPA completed an Endangerment Assessment.	4/1989
Deed restriction filed at Plymouth County Registry of Deeds.	4/1992
USEPA issued a Site Close Out report.	5/29/1992
First Five-Year Review completed.	12/1992
Site deleted from NPL.	11/19/93
Second Five-Year Review completed.	7/1998
Risk Assessment submitted on behalf of New Millennium Ventures (NMV) to support lifting of deed restriction to allow residential development.	11/2000
USEPA found the Risk Assessment inadequate and requested additional sampling & that a soil management plan be prepared.	2/2001
Additional soil sampling and proposed soil management plan submitted by NMV's consultant.	8/7/2001
USEPA approved the sampling & soil management plans.	9/20/2001
Third Five-Year Review completed.	9/2003
Completion of soil sampling and management plan.	TBD

3.0 BACKGROUND

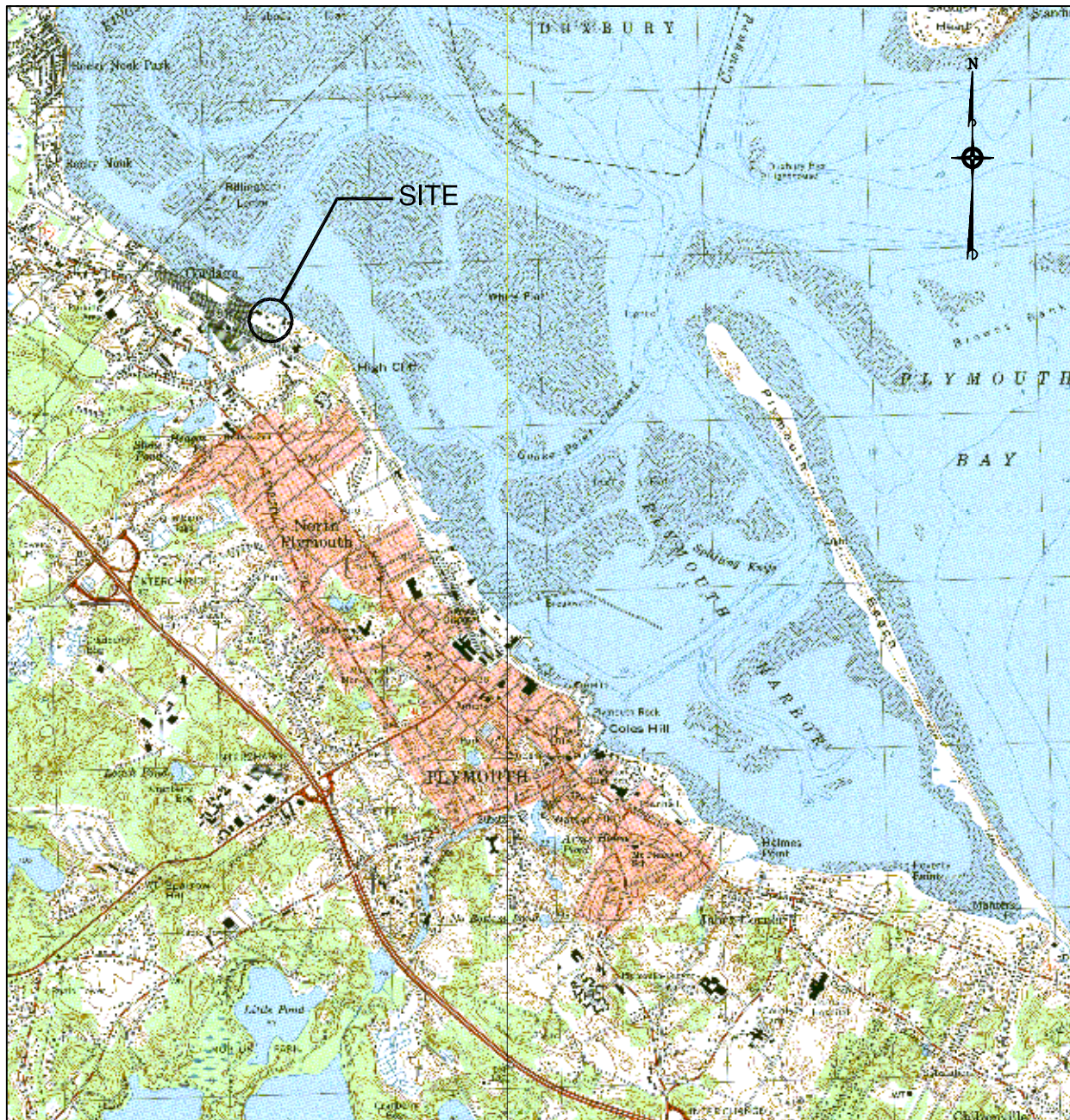
This section contains information pertaining to the Site's physical characteristics, current and prior land use at the property, as well as waste identification and characterization information. This information has been obtained through a review of historical information, previous investigations, zoning and flood maps, and a site visit.

3.1 Physical Characteristics

The Site is located in Cordage Park, a business and industrial park, adjacent to Plymouth Harbor, Plymouth, Massachusetts (Figure 3-1). The Site consists of approximately 2.5 acres and is bordered by a tidal stream to the southeast, a warehouse to the southwest, a former fish processing plant to the northwest, and Plymouth Harbor to the northeast (Figure 3-2).

Three above-ground storage tanks were located in 6 to 8 foot deep earthen berms on the property between the 1920s and 1987. Tank Nos. 1 and 2 each had a storage capacity of 250,000 gallons; Tank No. 3 had a capacity of 500,000 gallons. The tanks were constructed in the 1920s and were used until 1974 for storage of No. 6 marine fuel and Bunker C oil that was off-loaded from ocean barges. In 1976, the Cannon's Engineering Corporation (CEC) began using Tank Nos. 1 and 2 to store motor oils, plating sludge, solvents, oily solids, pesticides and other industrial substances. Tank No. 3 was not used by CEC and remained empty. In response to an order of revocation, CEC ceased operations at the Plymouth facility in 1980. Approximately 500,000 gallons of liquid hazardous substances stored in Tank Nos. 1 and 2 were left on-site. Tank No. 1 was drained by the Site owners in 1983. Tank No. 2 was drained by EPA in 1984. The three tanks and connecting piping were dismantled and removed from the Site in 1985. A perimeter fence was constructed to prevent access to the Site in 1987. Figure 3-2 shows the major features of the Site, including the locations of the three former tanks and the remaining tank berms.

The topography of the property is relatively flat with a slight easterly slope towards Plymouth Harbor. The highest points on the Site were determined to be the three berms surrounding the former tanks, approximately 6 to 8 feet higher than the natural site elevation. The Site is heavily vegetated with grasses, large Cypress trees, and 4- to 5-foot high shrubs. Due to the vegetation, there is limited potential for erosion.



NOTES:

1. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
2. BASE MAPS FROM MASSACHUSETTS GIS.

GRAPHIC SCALE

0' 1000 m.

SITE LOCUS

FIGURE 3-1

PLYMOUTH HARBOR, CANNON'S ENGINEERING CORP. SITE - FIVE YEAR REVIEW

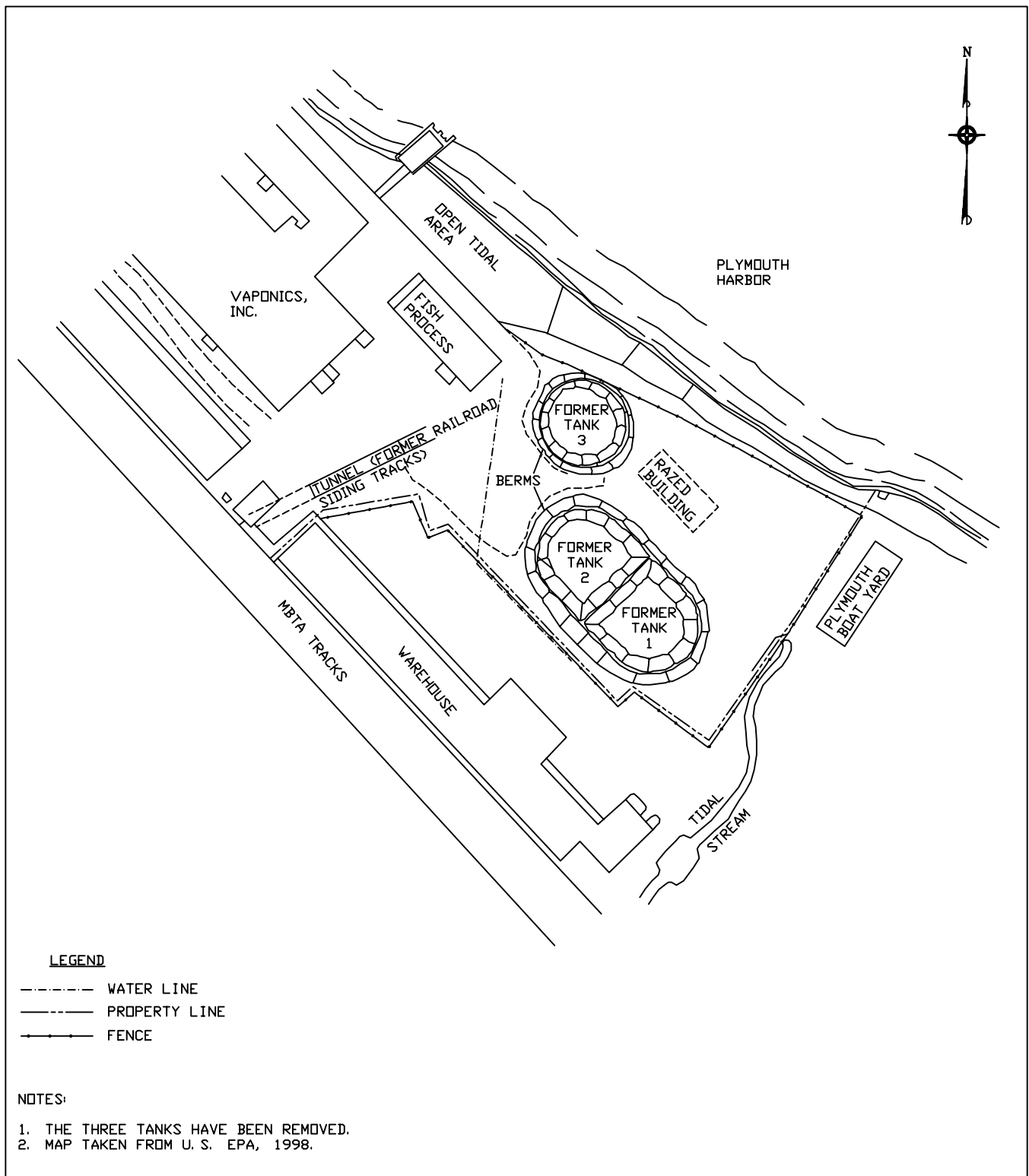
PLYMOUTH, MA

DRAWN BY:	R.G. DEWSNAP	REV.:	0
CHECKED BY:	P. CALL	DATE:	JUNE 23, 2003
SCALE:	AS SHOWN	ACAD NAME:	DWG\5206\0500\FIG_3-1.DWG



TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887
(978)658-7899



SITE MAP

PLYMOUTH HARBOR, CANNON'S ENGINEERING CORP. SITE - FIVE YEAR REVIEW

PLYMOUTH, MASSACHUSETTS

DRAWN BY: D.W. MACDOUGALL

REV.: 0

CHECKED BY: P. CALL

DATE: JUNE 23, 2003

SCALE:

ACAD NAME: DWG\5206\0500\FIG_3-2.DWG

FIGURE 3-2



TETRA TECH NUS, INC.

55 Jonspin Road

Wilmington, MA 01887

(978)658-7899

The Site is comprised primarily of fill material containing silty sands, rock, brick, and/or slag. This fill varies in thickness across the property, from one to nine feet and overlies a peat deposit in the northern and northeastern portions of the property. These materials are underlain primarily by unstratified sand and gravel, approximately twenty-two feet thick. Beneath that layer, fine grained sand overlies a layer of silty clay that has created two surficial aquifers underlying the Site. The generalized surficial geology map for Plymouth County shows surficial glacial outwash or fluvial deposits in the vicinity of the Site. Groundwater flows in an easterly direction towards Plymouth Harbor and the stream along the southeast side of the Site and is tidally influenced.

Based on information from the Federal Emergency Management Agency (FEMA), most of the Site lies within a 100-year coastal floodplain (FEMA, 1992). If the berms around the tank areas were not present the area would possibly become inundated during a major storm event (USEPA, 1985). Although part of the coastal floodplain, the Site is not a protected open space, endangered species habitat, or Area of Critical Environmental Concern. A number of surface water bodies are located within 0.5 miles of the Site including: Hedges Pond to the southwest; Spooner Pond to the west; and unnamed water bodies to the west and southeast.

3.2 Land and Resource Use

A review of the current Town of Plymouth zoning map located in the Plymouth Town Offices indicated that the Site lies within an area zoned LI/WF, (Light Industrial/Waterfront). This land use description allows for “a mix of uses including commercial uses of light intensity, clean operational nature, residential uses and compatible industrial uses” (Plymouth, 2002). In the past, the Site and surrounding areas were used for industrial/commercial purposes; the areas presently remain in industrial/commercial use. Future land uses are expected to remain unchanged unless the deed restriction on the Site is modified.

A multi-story, multi-building retail complex is located near the Site; however light industrial uses predominate near the waterfront and directly adjacent to the Site. The Site is in close proximity to a boat yard/marina located approximately 150 feet to the southeast, a knife processing plant and warehouse approximately 150 feet to the southwest, a former fish processing plant to the northwest, and a water-purification equipment manufacturer approximately 250 feet to the northwest (ATSDR, 1988). A number of beaches and tourist areas are nearby. For example,

Duxbury beach is approximately 4.0 miles northeast of the Site and Plymouth (Long) Beach is approximately 2.0 miles southeast of the Site. In addition, Plymouth Harbor, abutting the Site to the northeast, is used for boating and other recreational activities. The Plymouth Rock historic area is located approximately 1.0 mile southeast of the Site.

The Site is located in a medium-yield non-potential drinking water source area. A high-yield non-potential drinking water source area is located within 0.5 miles of the Site. The Kingston municipal water well supply is located 2.5 miles upgradient and inland from the Site. The aquifer below the Site is not potable due to saline intrusion, therefore it is unlikely that it has been, or will be, utilized as a source of drinking water (USEPA, 1989). There are no known private wells within a 0.5-mile radius. All residents in the area are supplied with public water.

3.3 History of Contamination

In the 1920's, the three tanks were constructed for the Plymouth Cordage Company. Tank Nos. 1 and 2 had capacities of 250,000 gallons each, Tank No. 3 had a capacity of 500,000 gallons. All were surrounded by 6- to 8-foot high berms (see Figure 3-2). The tanks were used for storage of No. 6 fuel oil and Bunker C oil until 1974. CEC leased the tanks in 1976 and used Tank Nos. 1 and 2 for storage of motor oils, solvents, lacquers, organic and inorganic chemicals, cyanide and plating waste, clay and filter media containing chemicals, plating sludge, oil solids, and pesticides. Only two of the three tanks on-site were used by CEC, since facility operations were terminated prior to the third tank becoming operational (USEPA, 1985). The facility was licensed by the Commonwealth of Massachusetts for waste storage in 1979.

The Massachusetts Department of Environmental Quality Engineering (MADEQE) issued an Order of Revocation in 1980, which forced CEC to close the Plymouth facility. When CEC ceased operations, approximately 500,000 gallons of liquid hazardous wastes were left at the facility in Tank Nos. 1 and No. 2. Between 1980 and 1983, MADEQE made numerous site inspections and noticed leaks from seams in Tank Nos. 1 and 2 and a small pool of waste material on the ground surface approximately 20 yards from Plymouth Harbor. Both USEPA and MADEQE were concerned about a possible catastrophic tank failure. The local fire marshall certified that the tanks posed a fire and explosion hazard. Complaints of bad odors from the leaking tanks were also made by adjacent property owners.

3.4 Initial Response

Following the closing of the Plymouth facility and the identification of potential site hazards, the MADEQE contracted with Jetline Services, Inc. (Jetline) to remove hazardous materials and contaminated soils from the Site and drain and clean the tanks. Jetline determined that Tank No. 1 contained approximately 221,000 gallons of product, 73,000 gallons of water, and no sludge or PCBs. Tank No. 2 contained approximately 204,000 gallons of product with an estimated 82 parts per million (ppm) of PCBs, 71,000 gallons of water with 71 ppm PCBs, and 6,000 gallons of sludge with 77 ppm PCBs (ATSDR, 1988). The Site was ranked according to the Hazard Ranking System and proposed for inclusion on the National Priority List (NPL) in December 1982. The Site was officially on the NPL by September 1983.

In 1983, pursuant to a Consent Agreement between the USEPA and the Trust, Jetline was contracted by the Trust to drain Tank No. 1 and dispose of the waste. In January 1984, a USEPA contractor drained and cleaned Tank No. 2. By 1985, the three tanks were empty, the connecting piping was cleaned, and the waste was removed. In total, approximately 425,000 gallons of product, 144,000 gallons of water, and 6,000 gallons of sludge from the two tanks were transported off-site for proper disposal (ATSDR, 1988). USEPA initiated a Remedial Investigation (RI) in early 1984.

3.5 Basis for Taking Action

By 1985, NUS Corporation (NUS) had completed an RI, a Wetlands Reconnaissance, and a Wetlands Assessment on the Site on behalf of USEPA. A qualitative risk assessment was conducted as part of the RI and identified the primary contaminants of concern (COCs) as polynuclear aromatic hydrocarbons (PAH), pesticides, and lead. The risk assessment found the greatest potential risk to be from direct contact or incidental ingestion of contaminated soils and concluded that the shallow soils presented the greatest risk (USEPA, 1992). The highest concentrations of COCs were found within the bermed areas to a depth of 6 feet below ground surface. Pesticides and lead, but no PAHs, were found in subsurface soils. The contaminants were distributed within the on-site soils in a random pattern both laterally and vertically; no areas characteristic of a source area were identified. Off-site sediments from the tidal stream contained a number of pesticides. It was concluded, however, that the pesticides in the sediments were not site related (USEPA, 1992).

The primary COCs identified in the groundwater and surface water included low levels of metals, in particular lead. Air samples showed no contaminants detected above ambient air background concentrations.

4.0 REMEDIAL ACTION

This section describes the remedial actions selected for and implemented at the Site.

4.1 Remedy Selection

Ten remedial alternatives for the contaminated soils were evaluated in the 1985 Feasibility Study (FS). The 10 remedial alternatives, with the exception of the no action alternative, were variations of excavation, capping, off-site land disposal, and off-site incineration. On September 30, 1985, the USEPA issued a ROD based on the conclusions of the RI and FS completed by USEPA/NUS in 1985. The goal of the ROD was to obtain a more complete understanding of the risks associated with the Site to assess the need for an amended ROD with a final remedy that would be protective of human health and the environment. The ROD identified the following remedial action objectives (RAOs) based on the information in the RI:

- “Minimize the potential for direct contact with surface soil; and
- Minimize the potential for off-site migration of hazardous chemicals” (USEPA, 1985).

Capping or excavation with off-site disposal were determined to be most applicable alternatives based on the RAOs listed above. Because the Site is located in a 100-year floodplain, USEPA determined that the capping alternative required further study and that a floodplains assessment should be performed to be consistent with Executive Order 11988 and USEPA's policy concerning floodplains and wetlands. USEPA felt that it would be advantageous to identify possible sources of contamination beneath the tanks (after their removal) and confirm the pattern of contamination identified in the RI prior to selection of the capping alternative. Therefore, prior to any soil excavation and offsite disposal activities, USEPA determined that additional sampling was necessary to address the uncertainty about the extent of contamination both below the tanks and elsewhere on the Site.

Rather than selecting a final remedy, the USEPA required the completion of the following three tasks before selecting and implementing a final remedy.

1. Dismantling and off-site disposal of the three tanks and associated piping.

2. Supplemental sampling of all media to confirm the pattern of contamination identified in the RI and characterize the areas beneath the three tanks.
3. Preparation of a Site-specific floodplains assessment.

USEPA concluded that supplemental sampling and preparation of a floodplain assessment were necessary to verify the RI data and conclusions, and that the selection of the final alternative should be deferred until the supplemental evaluation was completed. USEPA intended to amend the ROD following an evaluation of the supplemental data and the selection of a final remedial alternative.

4.2 Remedy Implementation

This section describes the completion of the tasks required by the ROD, the results of which were intended to support the selection of a final remedy.

4.2.1 Floodplains Assessment

As required under the ROD, a site-specific Floodplains Assessment was completed in January 1986. The report examined the potential for the remedial alternatives identified in the FS to adversely impact the floodplain, since the Site lies within the 100-year floodplain. A number of measures to mitigate potential impacts to the floodplain were identified in the report. The recommendations presented in the report were implemented during the response actions described below (USEPA, 1992).

4.2.2 Tank Dismantling and Disposal

In April 1987, a USEPA contractor completed a Work Plan and Field Operations Plan (FOP) for the tank dismantling and disposal and also the performance of the supplemental sampling program. The Site was fenced in June 1987, prior to dismantling the tanks. The three tanks were inspected, decontaminated, demolished, and disposed of off-site by USEPA contractors in the fall of 1987 in accordance with the FOP.

Non-hazardous wastes, including miscellaneous demolition debris (e.g. concrete shed rubble, overhead piping, and piping support materials) were disposed of at the James G. Grant Co.

facility in Hyde Park, Massachusetts. Manifested hazardous wastes, including drums (steel and plastic, empty and with liquids or solids) were transported for processing at the Clean Harbors facility in Braintree, Massachusetts. Clean Harbors packaged and shipped the liquid and solid wastes to appropriate disposal facilities (USEPA, 1992).

During the dismantling process an area of stained soil was found adjacent to the former location of Tank No. 1. Approximately 3 cubic yards of soil from the area were excavated and drummed. The drummed soil was transferred to Clean Harbors and disposed of off-site along with the other hazardous wastes. However, the USEPA contractor estimated that an additional 180 cubic yards of soil contaminated with hazardous substances and oils remained within the Tank No. 1 bermed area (USEPA, 1992). Ambient air samples collected at the site perimeter after the tanks were dismantled did not indicate any significant contamination.

4.2.3 Supplemental Sampling

The supplemental sampling program specified in the ROD was necessary to confirm the pattern of contamination that was reported in the 1984 RI and to characterize the distribution of contaminants located beneath the storage tanks following their removal. Supplemental samples were collected in the fall of 1987 from soils located under the former tanks, surface and subsurface soil located outside the tank berms, five on-site groundwater monitoring wells and sediments located off-site in the tidal seep (ATSDR, 1988). The results of the sampling events are discussed in Section 6.4.

4.2.4 Consent Decree

In April 1988, the USEPA and the CEC Settling Parties (SPs) entered into a partial Consent Decree, which set forth a response action of soil excavation, confirmatory sampling, and backfilling with clean soil. USEPA and the MADEP concluded that an amended ROD was not necessary. The partial Consent Decree set forth the following remedies:

- Excavate and dispose of soil contaminated with oily materials from inside the Tank No. 1 berm;
- Collect confirmatory soil samples from the excavated area; and
- Backfill the tank bermed areas with clean fill.

4.2.5 Soil Removal

Pursuant to the September 1988 Consent Decree, the SPs conducted a removal of the remaining stained soil found near the former location of Tank No. 1 during the tank dismantling activities. Approximately 200 tons of soil contaminated with oily and hazardous materials were excavated and disposed of at a Subtitle C hazardous waste facility (USEPA, 1992). An additional 50 tons of contaminated soils excavated from the top 6 to 12 inches inside each of the three bermed areas were disposed of along with the other stained soils (USEPA, 1992).

Post-excavation soil grab samples were collected from the base and perimeter of the excavated area, from the interior of the bermed areas, and from outside the bermed areas and composited. The post-excavation sample results are discussed in Section 6.4.1. After the post-excavation sampling, the excavated areas inside the three bermed areas were backfilled with 6 to 12 inches of clean fill and re-graded to the grade of the area prior to the removal action. Perimeter air monitoring for VOCs was conducted during the removal action. No ambient air readings above background concentrations were detected.

4.2.6 Endangerment Assessment

USEPA completed a supplemental Endangerment Assessment (EA) in April 1989 using Site data collected during the remedial and response actions. Local demographics, land use, and zoning were used to develop current and future use exposure scenarios. Data from grab soil samples collected and composited following excavation and removal of the stained soils (Section 4.2.5), were used in the EA risk calculations. USEPA concluded that use of the Site for commercial or industrial purposes (the likely future use) would not present any current or future exposure risk to human health or the environment and recommended the issuance of a deed restriction on the Site. Based on the findings of the EA and the characterization of the response action as a removal action, USEPA, in consultation with the MADEP, concluded that no additional remedial action or a ROD amendment were necessary for the Site.

4.2.7 Institutional Controls

As recommended in the Endangerment Assessment, a deed restriction was the main institutional control required for the Site. A copy of the deed restriction is included in

Appendix E of this report. The deed restriction, recorded in the Plymouth County Registry of Deeds on April 21, 1992, limited future property use to commercial or industrial development and also listed a number of restricted uses. The deed restriction specifies that a risk assessment must be performed prior to redevelopment of the Site for any of the listed restricted uses. USEPA and the MADEP would use the risk assessment results to determine if the proposed restricted use would pose an unacceptable risk of exposure to contaminated site soils. If the risk is acceptable, USEPA, in consultation with MADEP, would certify the change in use and record the certification in the deed. However, if the proposed use poses an unacceptable risk, the change in use would only be allowed by USEPA and MADEP after a response action is performed to reduce the risk to an acceptable level.

The deed restriction also requires the property owner to inspect, maintain and repair the fence around the perimeter of the Site. This requirement will remain in place until USEPA and MADEP certify that it is no longer required.

4.3 Operations & Maintenance

The remedy selected and implemented did not include any operations and maintenance activities. According to the Site Close-Out report, “no groundwater extraction and treatment systems were required and no source control measures, such as capping, were implemented which would necessitate a long term operation and maintenance program” (USEPA, 1992). As mentioned in Section 4.2.7, pursuant to the deed restriction the Site owners are required to inspect, maintain and repair a Site boundary fence until the USEPA, in consultation with the MADEP, determines that such maintenance and repair of the fence is no longer necessary.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

This is the third five-year review for the Site. The Second Five-Year Review (USEPA, 1998) concluded that the remedial action selected for the Site was protective of human health and the environment, provided the property was redeveloped for commercial/industrial uses and the current deed restriction remains in place. The previous review also stated that USEPA and MADEP should review any reports and/or site redevelopment plans to ensure that future use of the Site remains protective of human health and the environment. No further follow-up actions were recommended in the last five-year review report.

Although there has not been any redevelopment of the Site since the last review, there have been preliminary discussions and plans to potentially redevelop the Site for residential and/or commercial purposes. A consultant for a property developer prepared a risk assessment in 2000 to support rescinding the restricted uses listed in the deed restriction to allow redevelopment of the Site for residential and recreational uses (RMI, 2000). In response, USEPA required that additional sampling, and subsequently a new risk assessment, be conducted prior to proceeding with any redevelopment that includes residential areas and other restricted uses, in order to ensure that the remedy remains protective of human health. Changes in dermal risk assessment exposure assumptions made since the last five year review have resulted in the need to reassess the protectiveness of the remedy for trespassers and adult commercial workers in accordance with the updated risk assessment guidelines. Issues associated with the risk assessment and site redevelopment options, as well as the changes in the exposure assumptions, are discussed further in Sections 7 and 8.

6.0 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken by the USEPA to complete the review.

6.1 Administrative Components

USEPA, the lead agency for this five-year review, notified MADEP and the SPs in early 2003 that the five-year review would be completed. USEPA issued a scope of work, WAF No. 129-FRFE-0128, to TtNUS, under USEPA RAC1 Contract No. 68-W6-0045, on February 21, 2003 to assist USEPA in performing the five-year review. The USEPA Work Assignment Manager was Derrick Golden. Evelina Vaughan of the MADEP was part of the review team.

The schedule established by USEPA included completion of the review by September 2003.

6.2 Community Notification and Involvement

A press release was published in the Old Colony Memorial newspaper on April 9, 2003. Public notices were published in the Old Colony Memorial, Patriot Ledger, and The Enterprise newspapers announcing USEPA's five-year review of the status of the Plymouth Harbor Site remedy. The press release and public notices encouraged public participation. To date USEPA has not received any responses from the public.

During a visit to the Plymouth Town Offices on May 19, 2003, representatives from TtNUS briefly described the five-year review process to the town officials and asked for comments regarding the Site and potential redevelopment plans for the property. According to previous investigations and site visits there has been limited public interest in the Site.

6.3 Document Review

This five-year review consisted of a review of relevant documents including decision documents and monitoring reports, as specified in the USEPA SOW for this review (see Appendix A).

6.4 Data Review

A review was completed of various SP-contractor plans and monitoring reports. A summary of relevant data regarding the components of the Site remedy is presented below. The data reviewed were collected from 1987 to 1988, as part of the 1987 supplemental sampling required by the ROD and the 1988 soil excavation response action required by the Consent Decree. The results of these sampling events are summarized below by media.

6.4.1 Soil

Soil samples collected during the 1987 supplemental sampling event were free of VOC contamination, but low levels of pesticides, PAHs, and lead were detected. The distribution of contaminants was random, both vertically and laterally, as was concluded or found in the RI. The highest concentrations were detected in shallow soils (ATSDR, 1988).

Following excavation of contaminated soils during the removal action in 1988, soil samples were collected to characterize the excavated areas and general site soils. Post-excavation soil samples were collected from the base and perimeter walls of the excavated areas, from around the exterior of the three bermed areas, from inside each of the three berms, and from soil excavated from the Tank No. 1 area. Grab samples from each of the four areas were composited to form representative samples, which were analyzed for PAHs, inorganics, and pesticides. The results of these 1988 composite samples are discussed below.

No pesticides were detected in any of the samples; however, PAHs were detected in all of the samples. The average PAH concentration was 111 ppm (total PAH) inside the bermed areas and 6 ppm (total PAH) outside the bermed areas (USEPA, 1992). Inorganic compounds were detected in all samples at concentrations that were generally within the range of naturally occurring inorganic compounds. The average lead concentration was 192 ppm inside the bermed areas and 78 ppm outside the bermed areas (USEPA, 1992). The lowest concentrations of both PAHs and lead were found in the composited samples from outside the berms. The clean soil fill material was also sampled prior to backfilling on site. The fill material contained lead at 2.7 ppm, but no PAHs (USEPA, 1992).

The cPAH data from the 1988 post-excavation composite soil samples were used in the Endangerment Assessment (see Section 4.2.6), as well as in the risk computations included in both the Second Five-Year Review Report (USEPA, 1998) and this third five-year review (see Appendix D).

6.4.2 Groundwater

Groundwater sampling was conducted as part of the 1987 supplemental sampling event at both low and high tide to determine if the distribution of contamination was tidally influenced. In both the RI and the supplemental sampling, groundwater samples were free of organic contamination, but contained low levels of lead (below the federal maximum contaminant level (MCL) of 50 parts per billion (ppb)). The distribution of lead contamination was random and no tidal influence was found (ATSDR, 1988).

6.4.3 Surface Water

Surface water samples were collected from the tidal stream during the 1987 supplemental sampling event. During both the RI and this supplemental investigation, organic compounds were not detected and lead was the only inorganic compound detected. Lead concentrations were significantly higher in the RI samples than they were in the supplemental samples; in fact, only two of the eight samples collected as part of the supplemental investigation contained low-level detectable concentrations. Silver and selenium were detected during the RI investigation, but not during the supplemental sampling round (USEPA, 1989). No COCs associated with surface water were identified.

6.4.4 Sediment

The collection of sediment samples during both the RI and the 1987 supplemental sampling was limited to the tidal stream (see Figure 3-2). Similar contaminants (PAHs and lead) and levels of contamination were detected in both sets of samples. The only difference noted was that pesticides were not detected in the 1987 supplemental samples as they had been in the 1984 RI (ATSDR, 1988). In addition, no COCs associated with sediment were identified.

6.5 Site Inspection

A site inspection conducted by representatives from USEPA, MADEP, Cordage Park Property Management, and USEPA's contractor, was completed on May 19, 2003. The inspection included a site walkover and an inspection of the berms and other topographic features. A site inspection report, including site photographs, is included in Appendix B.

The northwestern and southern sides of the Site were secured by a chain link fence with a padlocked gate. Along the northern and eastern property boundaries remnants of a snow fence were noted, but none of the fencing was still intact. There did not appear to be any signs of vandalism.

Debris including metal scraps, brick, plastic tubing, and broken sea shells were noted strewn throughout the property, in the high vegetation and on top of a razed building foundation. Several areas of "coal ash" type material were observed around the Site outside the berms. Five monitoring wells, used during previous investigations, were noted. Although the wells appeared to be intact, several wells were not locked or secured by other means.

The boat yard, knife warehouse, and a small building located to the south appear to be fully operational, unlike a multi-story brick structure, located north, which appears completely vacant. A multi-level, multi-building retail complex, located just southwest of the Site is also operational.

6.6 Interviews

General discussions and observations were documented during the site inspection on May 19, 2003. Telephone interviews and e-mail correspondence were completed as a follow-up to the site inspection. The list of individuals interviewed regarding this five-year review is shown in Appendix C.

Paul Barcellos, the Cordage Park property manager, mentioned that trespassing is a problem, but there has been no evidence of vandalism. His company manages properties contiguous to the Site and provides security and monitoring for all the properties. He is involved in the redevelopment plans for Cordage Park, including the Site.

No individuals in the Planning and Development Department or the Office of Economic Development at the Plymouth Town Hall were aware of any major flooding events that had inundated the Site. A woman with the Conservation Department formerly worked in one of the Cordage Park buildings (Bldg 36) and commented that in the past it had flooded at the lower level.

Dean Rizzo, the Town of Plymouth Office of Economic Development Preservation and Development Planner, was aware of the development plans for Cordage Park in general, although not specifically with regard to the Site parcel. According to Mr. Rizzo, the redevelopment of the parcel is generally perceived as a good thing for the town, however there are minor concerns for traffic and access (car, rail) in the area.

The reference librarian at the Plymouth Public Library stated that while people were well aware of the location of the government documents, she was not specifically aware of any interest in the Plymouth Harbor documents.

7.0 TECHNICAL ASSESSMENT

This section provides a technical assessment of the remedy implemented at the Site, as outlined in the *Comprehensive Five-Year Review Guidance* (USEPA, 2001b). The remedy has been evaluated based on its function in accordance with decision documents, its adherence to valid risk data and scenarios, as well as any other information that could have affected the remedy's protectiveness. There were no ARARs and/or "to be considered" (TBCs) identified in the 1985 ROD since it was a pre-SARA ROD.

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Remedial action performance and monitoring results. The dismantling and disposal of the three tanks, a floodplains assessment, and the collection of supplemental soil, groundwater, surface water, and sediment samples were required by the 1985 ROD. Soil excavation and off-site disposal, the collection of confirmatory samples, and backfilling with clean fill were additional remedial activities required by the 1988 Consent Decree. All remedial activities were completed by 1988. Since the ROD and subsequent decision documents did not establish any clean-up criteria, there were no specific performance standards that had to be achieved. The Site was deleted from the NPL in 1993.

Operations and Maintenance Costs. There were no O&M activities specified in the ROD, however in the 1988 Consent Decree the SPs agreed to maintain and repair the fence surrounding the Site until USEPA, in consultation with the MADEP, determines that it is no longer necessary.

Indicators of Remedy Problems. Based on the site inspection and a review of site documents, there do not appear to be any indications of problems with the remedy, with the exception of risk assessment factors and access controls, discussed below.

Implementation of Institutional Controls. As required by the EA, a deed restriction on the property was recorded in the Plymouth County Registry of Deeds on April 12, 1992. The deed restriction limited future property use to commercial, industrial and/or other use as permitted under the Town of Plymouth Zoning Bylaws. In addition, the deed restriction included the following restricted uses: single-family or multiple-family residences, school facilities, hotel,

motel, or recreational or community facilities (Declaration of Restrictions, 1992, see Appendix E). Redevelopment for any listed restricted use can only be considered after performance of a risk assessment and the concurrence of USEPA and MADEP. The deed restriction continues to be in effect. The deed restriction also requires access controls; the property owner is required to inspect, maintain and repair the fence around the perimeter of the Site. The snow fence along the northern perimeter of the Site is no longer in place leaving open access to the Site, placing the remedy's protectiveness at risk.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels and Remedial Action Objectives (RAOs) used at the time of Remedy Selection still valid?

Changes in Standards and TBCs. Since the ROD and subsequent decision documents did not specify any ARARs or TBCs there were no standards to review, except for the risk assessment guidance described below. Site soils were identified as the only potential threat, and PAHs and lead as the only COCs, in the Endangerment Assessment. The soil removal action and subsequent the Site delisting were based on risk calculations determined to be within the EPA acceptable range.

Changes in Exposure Pathways and Exposure Assumptions. There have been no changes in land use in the vicinity of the Site since the last five-year review. The 1989 EA identified older child trespassers and adult workers as those most likely to be exposed to soil contamination and dermal contact and incidental ingestion as the only two exposure pathways. These two exposure scenarios remain the most likely current or future exposures. The adult worker exposure scenario assumes full-time workers at the Site after redevelopment for industrial/commercial use. Currently, the Site remains vacant. With proper maintenance of the perimeter fence, all current exposures are eliminated. The older child trespasser and adult worker scenarios identified in the EA reflect potential future scenarios should the Site be redeveloped for industrial/commercial use or the fence be removed, allowing access to trespassers.

Since the development of these scenarios in the EA, USEPA has established recommended default exposure frequency and exposure duration assumptions for industrial/commercial workers. These default assumptions reflect greater exposures than those estimated in the EA. No default assumptions regarding exposure frequency and exposure duration have been established for trespassers. The *Risk Assessment Guidance for Superfund Volume 1: Human*

Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Interim Guidance (1997) was used to establish dermal exposure parameters during the previous five-year review. Soil adherence factors and exposed surface areas were most recently updated in this risk assessment guidance document in September 2001.

Changes in Toxicity and Other Contaminant Characteristics. The contaminants with the greatest cancer risk potential at the Site were carcinogenic PAHs (cPAHs). As noted in the last five-year review, the cancer slope factor (CSF) (formerly called cancer potency factor) for the most toxic PAH, benzo(a)pyrene, decreased from $11.5 \text{ (mg/kg-day)}^{-1}$ to $7.3 \text{ (mg/kg-day)}^{-1}$ and estimated potencies for six cPAHs were established. There have been no changes in CSFs since 1998. A decrease in a CSF indicates that potential risk from exposure to contaminants is lower than previously calculated. However, the historical data does not consistently report specific PAH constituents; subsequent risk assessment calculations have thus assumed that the reported total PAH concentrations represent cPAHs of equivalent potency to benzo(a)pyrene. This approach likely overestimates risk.

Changes in Risk Assessment Methods. The EA identified lead as a COC. As noted in the 1998 five-year review, USEPA now uses several models to predict blood lead levels that would result in exposure to lead-contaminated soil. This change in risk assessment method for evaluation of lead exposures has remained the same since the last five-year review. Since lead concentrations were below the residential screening level currently used, they do not pose a significant public health hazard.

Changes in Risk Assessment Conclusions. As part of this Five-Year Review, cancer risks for older child trespassers and adult commercial workers exposed to cPAHs through soil ingestion and dermal contact were re-calculated, using current risk assessment methods and assumptions. The calculations (see Appendix D) follow the methods used in the EA and the last five-year review. The calculated potential risks are as follows:

Combined risk for older child trespasser exposure to cPAHs = 5.8×10^{-5}
Combined risk for adult commercial worker exposure to cPAHs = 1.7×10^{-4}

Appendix D of this report presents the assumptions and calculations used to make these determinations. USEPA considers the combined cancer risk estimate for adult commercial

workers to be at the high end of the acceptable range. The risk calculations included in the last five-year review, as well as this five-year review (see Appendix D), use the highest composite cPAH data from the 1988 post-excavation composite samples, but not the site-wide average, also used in the EA. The use of the highest composite cPAH data, which are over 15 years old, likely have little bearing on the actual risk to either an older child/trespasser or future adult workers who may come in contact with the site soils. In addition, the use of total cPAH data in the EA, the second five-year review, and this review, rather than individual cPAH data, likely overstates the estimated risk attributed to PAHs. Because estimated adult commercial worker risks are at the high end of the protectiveness range, it is particularly important to collect new data and reevaluate risks to confirm protectiveness prior to any redevelopment.

Expected Progress Towards Meeting RAOs. While the remedy has been completed and the Site deleted from the NPL, additional soil sampling and a new risk assessment will be required before site redevelopment plans are approved by USEPA and the MADEP. Contaminant concentrations used in the above computation and in the evaluation of lead are over 15 years old and may not reflect current Site concentrations.

7.3 Question C: Has Any Other Information Come To Light That Could Call Into Question the Protectiveness of the Remedy?

Aside from the human health risk assessment factors described above, there is no additional information that may call into question the protectiveness of the remedy. The Site is within a 100-year floodplain, as previously mentioned, but there have been no substantial changes to the Site with regard to flooding, construction, grading, etc. In addition, there are no species whose habitat is likely to be at risk. Data collected in 2000 and used in a new risk assessment to support rescinding the restricted uses listed in the deed restriction were considered inadequate by USEPA and additional data collection has been required by USEPA.

7.4 Technical Assessment Summary

The discussions related to Questions A, B, and C above indicate that in general the remedy for the Site is protective. However, improvements to access controls, and collection of new soil data to support and confirm that the exposures are within the protective range are required to ensure the protectiveness of the remedy. The basis for this conclusion is summarized below.

Question A: The deed restriction is functioning as intended with the exception of the portion dealing with access controls. The perimeter fence has not been maintained to restrict access to trespassers along the shoreline side of the Site.

Question B: Exposure assumptions, toxicity data, and risk assessment methods have changed since the 1998 five-year review, resulting in a conclusion that while conditions at the Site appear protective of human health based on an industrial/commercial use scenario, new data are required to further support and confirm this conclusion.

Question C: No changes have occurred at the Site and it remains vacant and undeveloped. While new data were collected in 2000, the quality and usability of the data are questionable. Therefore no acceptable data are available at this time to further support the determination of the protectiveness of the remedy. Additional sampling, designed for use in a risk assessment, is needed for that purpose.

8.0 ISSUES

This section provides a summary of the issues identified during this five-year review. Recommendations and follow-up actions are presented in Section 9.0.

The first issue deals with the proposed redevelopment of the Site for a restricted use. The deed restriction on the Site requires the completion of a new risk assessment before redevelopment for any restricted use listed in the deed restriction. A combined MCP/CERCLA risk assessment report, entitled *Method 3 Risk Characterization/CERCLA*, was prepared by Risk Management Inc. (RMI), a consultant for the site developer, in November 2000 to support rescinding the restricted uses listed in the deed restriction. According to the procedures outlined in the deed restriction, if the risk assessment concluded that redevelopment for a restricted use was within an acceptable risk range, USEPA and MADEP could either concur or could require that an additional response action be performed before agreeing to a change in the deed restriction to allow the restricted use. USEPA determined that the data used in the RMI risk assessment were inadequate; and therefore USEPA required that additional data be collected (see third issue).

A second issue arises from the calculations in this report (see Appendix D) showing that the cancer risk for adult workers in a commercial/industrial future use scenario is at the high end of USEPA's acceptable range. The risk calculations were made using data from 1988 that were not collected for risk assessment purposes. Using available data of questionable quality (now over 15 years old) in conjunction with updated default exposure frequencies and durations and updated dermal exposure parameters has resulted in risk estimates at the high end of the acceptable range that need to be confirmed with better quality data. This issue is discussed in greater detail in a memorandum included in Appendix D. A new risk assessment, using new data, should be performed to support and confirm the cancer risk estimates prior to any site development, including redevelopment for the allowed industrial/commercial use. New data from the soil sampling plan approved by USEPA in 2001 would aid in the preparation, and accuracy, of a new risk assessment for industrial/commercial use (see third issue).

The third issue deals with the need for adequate and appropriate data for completion of a risk assessment to support any redevelopment of the Site. USEPA's review of the RMI document raised concerns about the adequacy and appropriateness of the data used in the risk

assessment due to the age of the data used their risk calculations. In addition, a concern was raised regarding the depth and type of soil samples collected for use in the risk assessment (USEPA, 2001a). The grab and composited sample data used in the RMI risk assessment and the risk calculations in this five-year review were collected during the 1988 soil removal activities. Those samples were collected to confirm the extent of excavation of contaminated soil, and were not intended to be used in a risk assessment. The USEPA concluded that there was “insufficient data to properly evaluate the risks to a residential receptor” (USEPA, 2001a) and required the submission of an updated sampling plan so that new data could be combined with the older data for a more accurate risk determination. Discussions between USEPA and RMI, a consultant for the site developer, continued during 2001 (RMI, 2001a, 2001b) and led to the August 2001 submittal of a memorandum providing details for additional soil sampling and a proposed Soil Management Plan (RMI, 2001c). The additional sampling plan was approved by USEPA in 2001 (USEPA, 2001c). To date the sampling has not been performed. An evaluation of the protectiveness related to future site redevelopment for a restricted use cannot be made without additional data collected according to a plan approved by USEPA and MADEP.

A fourth issue, identified during the site inspection, is the inadequacy of the perimeter fence. According to the 1988 Consent Decree the Settling Parties agreed to maintain and repair the fence surrounding the Site until USEPA, in consultation with the MADEP, determines that it is no longer necessary. Although the chain link fence at the entranceway was secured with a padlock, the snow fence along the northern property border had fallen and has not been replaced. This issue affects both current and future protectiveness.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The following is a summary of recommendations and follow-up actions that are proposed for the Site.

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Redevelop the Site for a restricted use.	Perform a new risk assessment with new data.	SPs	USEPA/ MADEP	Based on site redevelopment plans.	N	Y
Confirm risk estimates for future commercial/ industrial site development	Perform a new risk assessment with new data.	SPs	USEPA	Prior to redevelopment for industrial/ commercial use.	N	Y
Inadequate data to determine risk	Perform soil sampling and management plan approved by USEPA.	SPs	USEPA	Prior to completion of new risk assessment.	N	Y
Inadequate access controls	Replace/maintain northern shoreline perimeter fence.	SPs	USEPA	12/2003	Y	Y

10.0 PROTECTIVENESS STATEMENTS

The remedy for the Plymouth Harbor Site currently protects human health and the environment because clean fill covers the remaining subsurface contamination. A deed restriction limiting future development is in place. Risk calculations show the combined risk (ingestion and dermal) for an older child/trespasser is within USEPA's acceptable range and future adult commercial worker exposure to cPAHs is at the high end of the protective range. However, the data on which these calculations are based are of questionable quality. For the remedy to be protective in the long-term, the following actions need to be taken. The northern shoreline perimeter site fence must be reconstructed and maintained to provide complete access controls around the property. Additional soil data must be collected in accordance with a USEPA-approved soil sampling and management program designed for risk assessment purposes. A new risk assessment must be completed using the new data and updated exposure assumptions based on any of the proposed site uses to confirm that the exposures remain within the protective range.

In addition, prior to commencement of any site redevelopment activities, a detailed redevelopment plan must be submitted to USEPA and MADEP. This plan should include a statement of the proposed work and site activities and address monitoring procedures, health and safety measures and soil management activities to ensure worker and public safety during construction.

11.0 NEXT REVIEW

A fourth five-year review for the Plymouth Harbor Site will be conducted in 2008.

APPENDIX A

DOCUMENT REVIEW LIST/REFERENCES

DOCUMENTS REVIEWED/REFERENCES CITED

Agency for Toxic Substances and Disease Registry (ATSDR), 1988. *Health Assessment*, October 26, 1988.

Declaration of Restrictions, 1992. Recorded at the Plymouth County Registry of Deeds on April 21, 1992.

Executive Order 11988, Floodplains Management.

Executive Order 11990, Protection of Wetlands.

Executive Order 12148, Federal Emergency Management.

Fasanella & Wood, LLP, 2001. *Letter from Attorney Fasanella to USEPA and MADEP regarding sampling plan and soil management plan approval*, September 27, 2001.

FEMA, 1992. *Flood Insurance Rate Map, Town of Plymouth, Massachusetts*. Community Panel Number 250278 0006 D. Revised July 2, 1992.

MADEP, 2001a. *Fax from Harish Panchel, MADEP, to Derrick Golden, USEPA, regarding draft letter to RMI*, January 30, 2001.

MADEP, 2001b. *Internal Memorandum regarding review of MCP Method 3 Risk Characterization/CERCLA Risk Assessment dated November 22, 2000*, April 27, 2001.

MADEP, 2002. *Letter from Harish Panchal, MADEP, to Derrick Golden, USEPA, regarding change in lead of Project Management of the site*, March 8, 2002.

Plymouth Registry of Deeds, 1992. *Deed Restriction*, April 21, 1992.

Plymouth, 2002. *Town of Plymouth Zoning Bylaw*, revised December 23, 2002.

RMI, 2000. *MCP Method 3 Risk Characterization/CERCLA Risk Assessment*, November 22, 2000.

RMI, 2001a. *Letter from Peter Woodman, RMI, to Derrick Golden, USEPA, regarding response to USEPA Risk Assessment comments*, April 12, 2001.

RMI, 2001b. *Internal Memorandum regarding USEPA additional sampling request*, July 11, 2001.

RMI, 2001c. *Internal Memorandum regarding details for USEPA additional soil sampling and management plan request*, August 7, 2001.

US District Court, 1988. *Partial Consent Decree (C.A. No.'s. 88-1786-WF, 88-1797-WF, 88-1788-WF)*, April 9, 1988.

USEPA, 1985. *EPA Superfund Record of Decision*. U.S. Environmental Protection Agency, Region I. September 30, 1985.

USEPA, 1989. *Endangerment Assessment Public Health Post-Remedial/Removal Action*. U.S. Environmental Protection Agency, Region I. April 6, 1989.

USEPA, 1992. *Superfund Site Close Out Report*. U.S. Environmental Protection Agency, Region I. May 29, 1992.

USEPA, 1992a. *Five-year Review*. U.S. Environmental Protection Agency, Region I. December 4, 1992.

USEPA, 1998. *Second Five-year Review*. U.S. Environmental Protection Agency, Region I. July 29, 1998.

USEPA, 2000. *Internal Memorandum regarding review of MCP Method 3 Risk Characterization/CERCLA Risk Assessment dated November 22, 2000*, December 20, 2000.

USEPA, 2001a. *Letter from Derrick Golden, USEPA, to Peter Woodman, RMI, regarding MCP Method 3 Risk Characterization/CERCLA Risk Assessment report dated November 22, 2000*, February 12, 2001.

USEPA, 2001b. *Comprehensive Five-year Review Guidance, OSWER Directive 9355.7-03B-P*, June 2001.

USEPA, 2001c. *Letter from Derrick Golden, USEPA, to Peter Woodman, RMI, regarding additional sampling plan*, September 20, 2001.

USEPA, 2001d. *Letter from Derrick Golden, USEPA, to Attorney Fasanella regarding letters dated September 27, 2000 & October 17, 2001 as well as conference call on September 17, 2001*, October 26, 2001.

40 C.F.R. 264.228, RCRA Closure Regulations

42 U.S.C. 9621 (CERCLA)

APPENDIX B

SITE INSPECTION REPORT

**Plymouth Harbor, Cannons Engineering Cordage Park Site
Field Site Inspection – May 19, 2003
Five Year Review, WA # 129-FRFE-0128**

Attendees:

Derrick Golden – USEPA RPM
Evelina Vaughan – MADEP
Paul Barcellos – Cordage Park Property Manager
Phoebe Call – TtNUS, USEPA contractor, Project Manager
Mary Spofford – TtNUS, USEPA contractor, Project Scientist

The Site inspection was conducted during the morning of Monday, May 19, 2003. All attendees met at the adjacent property and traveled to the Site together. Site access is controlled by a chain-link fence on three sides of the property, with a padlocked gate. Along the shoreline, from approximately the eastern end of tank berm 3 to the eastern property border, remnants of a snow fence were noted but none of the fence was still standing.

A boat yard/marina is located across the tidal stream on the southeast side of the Site. The L. Knife (Sheehan Environmental Trust) warehouse lies south of the Site between the Site and the railroad tracks. A vacant, multistory building lies northwest of the Site (labeled Vaponics, Inc. on NUS RI Figure). According to Paul Barcellos, the property manager, there was a fire at this building in 1899 and it was subsequently rebuilt. Although only speculation, he said that the coal ash reported by RMI could have been part of the rubble and debris strewn on the Site subsequent to the fire. In addition, a one-story building lies just beyond the western property border. A small gas tank is located at the northeastern corner of this building.

Paul Barcellos also mentioned that trespassing is a problem although there was no evidence of vandalism. He continued by saying that his company manages properties contiguous to the Site and provide security and monitoring on the properties.

Five monitoring wells from previous investigations were observed. Although all of the wells appeared intact, two of the wells were not locked. It is unclear whether the three other wells were secured since it was difficult to reach their location, however they also appeared intact.

As mentioned in notes from RMI's October 14, 2000 site visit (RMI, 2000), the test pits from which Key Environmental collected soil samples in 2000 were still open and visually evident along the walls of the three bermed excavated areas.

The majority of the Site, including the berms, was well vegetated with grasses, large Cypress trees and other 4-5 ft high shrubs. Debris including metal scraps, brick, plastic tubing, and broken shells were strewn across the Site. Rubble was observed inside the former Tank 3 berm. The area inside the former Tank 2 berm was well vegetated. Many of the shrubs still had portions of the root ball fabric around their trunks. The berm dividing the Tank 1 and Tank 2 areas was breeched on the south end. At the breach in the berm the eastern side was significantly higher (approximately 6-8 feet in height) than the western side (approximately 3-4 feet in height). The area inside the former Tank 1 berm was quite open with little vegetation. The surface soils (post-excavation clean fill) were predominantly sands, with little organic matter visible.

Just east of the Tank 3 berm the foundation of a razed building was observed. (This building is shown on site drawings). There was significant vegetation on the concrete foundation. To the southeast of this building was a pile of "coal tar ash". Similar piles were noted across the property, however not in the tank berms. A concrete pad was observed, flush to the ground (approx. 10' x 30') and located just west of the Tank 2 berm.

Following the Site visit, Mr. Barcellos took the group onto the surrounding parcels where a multi-building retail complex is located. He described future plans for the property and the work that had previously been completed. Most of the area has been renovated and contains a mixed use of retail, office and industrial activities. The area was busy with employees and customers. However, the Site is located some distance from the main activities.

Town Hall Visits

Following the site visit, TtNUS personnel traveled to the Town of Plymouth Planning and Development Department and reviewed zoning maps and determined that the Cordage Park area is zoned LI/WF (light zoning/waterfront). A copy of the Plymouth Zoning Ordinance had already been obtained from the town website. After speaking with individuals in the Planning and Development Department as well as the Office of Economic Development, we obtained a copy of FEMA map of the area around the Site. No one was aware of major flooding events that had inundated the Site. A woman with the Conservation Department formerly worked in one of the Cordage Park buildings (Bldg 36) and commented that in the past it had flooded at the lower level.

While in the Office of Economic Development we spoke with Dean Rizzo, the Preservation and Development Planner. He was aware of the plans for Cordage Park in general, not specifically with regard to the Cannons parcel. However he stated that Mr. Barcellos had frequented the town offices and made his plans and intentions for that parcel well known. According to Mr. Rizzo the redevelopment of the parcel is generally perceived as a good thing for the town, however there are minor concerns for traffic and access (car, rail) in the area.

Plymouth Public Library

The entire Delisting Docket, five volumes, was readily available in the "government documents" section of the reference department. These documents were reviewed to ensure completion and accuracy of our investigation. Although the reference librarian stated that many people were well aware of the location of the government documents, she was not specifically aware of any interest in the Plymouth Harbor documents. There was no strong evidence from either the documents in the delisting docket or from discussions with EPA, Paul Barcellos, of a source of the coal tar, ash, etc. mentioned in RMI's report.

Plymouth County Registry of Deeds

A visit to the Registry of Deeds verified the recording of the deed restriction imposed on the parcel. Although there was conflicting information in previous reports, the deed restriction was found at Book 10915 and Page 249 on the main floor of the Registry of Deeds.

**Plymouth Site Inspection
Photographic Record**



Photo No: 1

Date: May 19, 2003

Comments: Facing northwest toward the perimeter fence and entrance gate. Note piles of rubble.



Photo No: 2

Date: May 19, 2003

Comments: On Tank 3 berm facing north. Note rubble piles and edge of berm in the top center portion of the photo.

**Plymouth Site Inspection
Photographic Record**



Photo No: 3

Date: May 19, 2003

Comments: Bottom of former Tank 2 facing north. Note sandy cover soil, planted vegetation and berm in background.



Photo No: 4

Date: May 19, 2003

Comments: Rubble pile in center and test pit in the side of Tank 1 berm. Facing south.

**Plymouth Site Inspection
Photographic Record**



Photo No: 5

Date: May 19, 2003

Comments: Concrete pad at northwest side of the Tank 2 berm, looking toward Plymouth Harbor.



Photo No: 6

Date: May 19, 2003

Comments: Base of former Tank 1 taken from the berm facing southwest. Note sandy soil and lack of vegetation.

**Plymouth Site Inspection
Photographic Record**



Photo No: 7

Date: May 19, 2003

Comments: Razed building foundation visible in left center of photo. Facing east toward Plymouth Harbor.



Photo No: 8

Date: May 19, 2003

Comments: Note dark "coal ash" on ground. (File folder placed for size comparison.)

**Plymouth Site Inspection
Photographic Record**



Photo No: 9

Date: May 19, 2003

Comments: Shoreline at right. Facing north-west. Remnants of snow fence visible; no chainlink perimeter fence along shoreline.



Photo No: 10

Date: May 19, 2003

Comments: On Tank 2 berm. Tank 3 berm to left. Plymouth Harbor in center of photo.

**Plymouth Site Inspection
Photographic Record**



Photo No: 11

Date: May 19, 2003

**Comments: MW-5.
Perimeter fence line
on south side of Site,
facing south.**

APPENDIX C
INTERVIEW LIST

**INDIVIDUALS INTERVIEWED FOR THE PLYMOUTH HARBOR
FIVE-YEAR REVIEW**

Name/Position	Organization/Location	Date
Paul Barcellos/ Property Manager	Cordage Park/Plymouth, MA	05/19/03
Derrick Golden/ USEPA RPM	USEPA/Boston, MA	05/19/03
Sarah Levinson/ USEPA Risk Assessor	USEPA/Boston, MA	05/22/03
Cindy Woods/ TtNUS Risk Assessor	Tetra Tech NUS/Wilmington, MA	05/23/03
Dean Rizzo/ Preservation and Development Planner	Office of Economic Development/ Plymouth, MA	05/19/03
Department Staff	Planning Department/Plymouth, MA	05/19/03
Reference Librarian	Plymouth Public Library	05/19/03

APPENDIX D

RISK ASSESSMENT MEMORANDUM

To: Phoebe Call
From: Cindy Woods
Date: September 4, 2003
Subject: Addendum to Cannons-Plymouth Harbor Five-Year Review

I have reviewed the 1998 "Second Five-year Review" for Cannons Engineering Corporation, Plymouth Harbor Superfund Site, Plymouth, Massachusetts and the addendum provided by Sarah Levinson of EPA Region 1, as Attachment 4 to that review.

As Sarah points out the original data collected at Cannons Engineering from the mid-1980's reflecting post-removal composite soil sampling, which has since been covered by "clean fill", is likely to have little bearing on current risk to a trespasser or occupational worker in contact with surface soil at the site. With that caveat in mind, calculations from that data are likely to overestimate exposures to workers or trespassers who do not disturb the soil. As part of the 1998 Second Five-year Review, Sarah performed risk computations using the highest composite concentrations from the mid-1980's sampling and scenarios as defined in the 1989 Endangerment Assessment.

The primary contaminants of concern at this site have been carcinogenic polyaromatic hydrocarbons (cPAHs) and lead.

EPA guidance relative to lead remains unchanged since the last five-year review. At this site lead concentrations are below the residential screening level and therefore do not pose a significant public health hazard.

Toxicity information and chemical-specific absorption values for PAHs remain similarly unchanged since the last five-year review. As Sarah noted there are now relative potency factors available for several cPAHs; however, in the absence of individual PAH concentration data, cPAH risks at this site were evaluated assuming the total PAH concentration reflects the most toxic PAH (benzo(a)pyrene).

The new dermal risk assessment guidance ("Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment, Interim") to which Sarah referred was most recently updated in September 2001. The chemical-specific absorption values for cPAHs remain unchanged since the last five-year review. The default dermal absorption factor for benzo(a)pyrene and other cPAHs remains at 13%. Recommended soil adherence factors and exposed surface areas have undergone some revisions.

Since the original 1989 Endangerment Assessment for this site, EPA has provided recommended default exposure frequencies and exposure durations for evaluations of exposures to industrial/commercial workers. These default exposure assumptions are greater than those used in the 1989 Endangerment Assessment. The Endangerment Assessment presented calculations for a future commercial/industrial development scenario based on a site wide average cPAH concentration of 9 mg/kg and a high composite cPAH concentration of 49 mg/kg. The post-excavation composited soil samples results used in the Endangerment Assessment are summarized in Table 1, attached to this memorandum.

In light of the revisions and recommendations, and to address the stated scenarios, risk computations are provided below for dermal contact and ingestion pathways. The presumed

scenarios for this site are an adult commercial worker and an older child trespasser. These risk computations use the highest composite concentrations from the mid-1980's sampling. Note that while Sarah used 53 mg/kg as the highest composite, based on averages of the duplicate samples shown in Table 1, 49 mg/kg is the highest composite, and was used in the Endangerment Assessment calculations. This minor difference has little impact on the calculations presented below.

Further sampling has been performed at the site in 1989 and more recently in 2000; however, those results have not been included in these computations.

Table 2, attached to this memorandum, shows a summary of the exposure assumptions and rates presented below, referenced for the source of the exposure rates, and provides an explanation for any changes in the assumptions since the second five-year review.

Incidental Soil Ingestion Exposure Assumptions:

Older child and adult soil ingestion rate: 100 mg/event
Older child exposure frequency: 50 days/year
Adult exposure frequency: 175 days/year
Older child exposure duration: 10 years
Adult exposure duration: 25 years
Older child body weight: 45 kg
Adult body weight: 70 kg
Exposed carcinogenic PAH concentration: 53 mg/kg (highest composite)

Older Child Trespasser Soil Ingestion Cancer Risk for cPAHs =

$$\frac{7.3 \text{ (mg/kg-day)}^{-1} \times 53 \text{ mg cPAHs/kg soil} \times 100 \text{ mg/kg} \times 10^{-6} \text{ kg soil/mg soil} \times 50 \text{ events/yr} \times 10 \text{ yr}}{45 \text{ kg} \times 365 \text{ days/yr} \times 70 \text{ yr}}$$

Older Child Trespasser Soil Ingestion Cancer Risk for cPAHs = 1.7×10^{-5}

Adult Worker Soil Ingestion Cancer Risk for cPAHs =

$$\frac{7.3 \text{ (mg/kg-day)}^{-1} \times 53 \text{ mg cPAHs/kg soil} \times 100 \text{ mg/kg} \times 10^{-6} \text{ kg soil/mg soil} \times 175 \text{ events/yr} \times 25 \text{ yr}}{70 \text{ kg} \times 365 \text{ days/yr} \times 70 \text{ yr}}$$

Adult Worker Soil Ingestion Cancer Risk for cPAHs = 9.4×10^{-5}

Dermal Contact Exposure Assumptions:

Dermal absorption cPAHs: 0.13
Older child exposed surface area: 4,650 cm²/day
Adult exposed surface area: 3,300 cm²/day
Older child soil adherence factor: 0.4 mg/cm²
Adult soil adherence factor: 0.2 mg/cm²
Older child exposure frequency: 50 days/year
Adult exposure frequency: 175 days/year
Older child exposure duration: 10 years

Adult exposure duration: 25 years
Older child body weight: 45 kg
Adult body weight: 70 kg
Exposed carcinogenic PAH concentration: 53 mg/kg (highest composite)

Older Child Trespasser Soil Dermal Contact Cancer Risk for cPAHs =

$$\frac{7.3 \text{ (mg/kg-day)}^{-1} \times 53 \text{ mg cPAHs/kg soil} \times 0.13 \times 4650 \text{ cm}^2/\text{day} \times 0.4 \text{ mg soil/cm}^2 \times 10^{-6} \text{ kg soil/mg soil} \times 50 \text{ events/yrs} \times 10 \text{ yr}}{45 \text{ kg} \times 365 \text{ days/yr} \times 70 \text{ yr}}$$

Older Child Trespasser Soil Dermal Contact Cancer Risk for cPAHs = 4.1×10^{-5}

Adult Worker Soil Dermal Contact Cancer Risk for cPAHs =

$$\frac{7.3 \text{ (mg/kg-day)}^{-1} \times 53 \text{ mg cPAHs/kg soil} \times 0.13 \times 3300 \text{ cm}^2/\text{day} \times 0.2 \text{ mg soil/cm}^2 \times 10^{-6} \text{ kg soil/mg soil} \times 175 \text{ events/yrs} \times 25 \text{ yr}}{70 \text{ kg} \times 365 \text{ days/yr} \times 70 \text{ yr}}$$

Adult Worker Soil Dermal Contact Cancer Risk for cPAHs = 8.1×10^{-5}

Combined risk for Older Child exposure to cPAHs (ingestion + dermal) = 5.8×10^{-5}

Combined risk for Adult Worker exposure to cPAHs (ingestion + dermal) = 1.7×10^{-4}

The combined cancer risk estimate for an older child trespasser is within EPA's target cancer risk range of 1×10^{-4} to 10^{-6} . The combined cancer risk estimate for adult commercial workers is at the high end of the acceptable range, slightly above EPA's target cancer risk levels. EPA considers the adult commercial worker exposure as within the protective range, based on current exposure assumptions and the use of data over 15 years old whose validity for risk assessment purposes is questionable. The calculations use the highest soil composite data, rather than the site wide data, as also presented in the Endangerment Assessment, which likely overestimates the exposure risk. New soil data must be collected to further support and confirm the protectiveness of the remedy.

TABLE 1
POST-EXCAVATION COMPOSITED SOIL SAMPLE RESULTS
USED IN RISK CALCULATIONS

Sample Location	# Samples Collected	Total cPAHs (mg/kg)
Excavation Base 1	4	15.8
Excavation Base 1 (dup.)	4	23.5
Excavation Base 2	4	9.1
Excavation Perimeter 1	4	74.3
Excavation Perimeter 1 (dup.)	4	23.8
Excavation Perimeter 2	4	32.1
Interior Berms	12	28.3
Interior Berms (dup.)	12	52.8
Exterior Berms	12	2.4
Excavated Soil Pile	4	27.0

Source: USEPA, 1989

Note: These cPAH data were used in the Endangerment Assessment, USEPA, 1989. The post excavation samples were collected as grab samples from the locations noted above and then composited. Sample depths and details of the analytical results were not available.

TABLE 2
SUMMARY OF EXPOSURE ASSUMPTIONS, RATES, AND CHANGES SINCE THE LAST FIVE-YEAR REVIEW

Exposure Assumptions for Soil Ingestion and Dermal Contact	3 rd Five-Year Review		Explanation for Changes in Assumptions
	Value	Reference*	
Older child/trespasser soil ingestion rate	100 mg/event	3	Same value used in the 2 nd five-year review.
Adult soil ingestion rate	100 mg/event	3, 4	Updated since the 2 nd five-year review.
Dermal absorption cPAHs	0.13	1	Same factor used in the 2 nd five-year review.
Older child exposed surface area	4,650 cm ² /day	4	Corrected for an older child.
Adult exposed surface area	3,300 cm ² /day	1	Updated to reflect outdoor worker exposure.
Older child soil adherence factor	0.4 mg/cm ²	1	Updated guidance since the 2 nd five-year review.
Adult soil adherence factor	0.2 mg/cm ²	1	Updated guidance since the 2 nd five-year review.
Older child exposure frequency	50 days/year	6	Same value used in the 2 nd five-year review.
Adult exposure frequency	175 days/year	2	Updated since the 2 nd five-year review.
Older child exposure duration	10 years	6	Same value used in the 2 nd five-year review.
Adult exposure duration	25 years	5	Updated since the 2 nd five-year review.
Body weight – older child	45 kg	4	Corrected for an older child.
Body weight – adult	70 kg	4	Same weight used in the 2 nd five-year review.
Exposed cPAH concentration	53 mg/kg	7	Same concentration used in the 2 nd five-year review.

* References:

1. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Interim Guidance (September 2001).
2. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, USEPA, OSWER 9355.4-24 (March 2001); workdays reduced by 50 days to 175 days/year to account for winter conditions.
3. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, USEPA, OSWER 9355.4-24 (March 2001) and estimates of RME exposure.
4. Exposure Factors Handbook Volume I, USEPA, EPA/600/P-95/002Fa (August 1997).
5. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluations Manual (Part A), December 1989.
6. Professional judgment.
7. USEPA, 1998, Attachment 4.

APPENDIX E
DECLARATION OF RESTRICTIONS

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DECLARATION OF RESTRICTIONS

Reference is made to the following facts:

A. Arthur B. Blackett, Konrad Gesner, and Francis C. Rogerson, Jr., not individually but as trustees of the Salt Water Trust ("SWT") under declaration of trust dated June 2, 1966, recorded with the Plymouth County Registry of Deeds ("Deeds") at Book 3568, Page 228, as amended, own certain land situated in the Town of Plymouth, Massachusetts, as more particularly shown as "Restricted Area" on a plan entitled "Plan of Restricted Area in Plymouth, Massachusetts" prepared for Arthur B. Blackett, Konrad Gesner and Francis C. Rogerson, Jr., Trustees of Salt Water Trust by Hayward-Boynton and Williams, Inc., dated October 1, 1991, to be recorded herewith (the "Plan"), containing approximately 2.73 acres (the "Premises").

B. The Premises constitutes the Cannons Engineering Corporation - Plymouth Harbor Superfund Site which is listed on the National Priorities List of hazardous substances sites pursuant to Section 105 of Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9605, on September 8, 1983.

C. The Premises is the subject of a partial consent decree entered by the United States District Court for the District of Massachusetts in the case of United States v. Cannons Engineering Corporation, et. al., 720 F. Supp. 1027 (D. Mass. 1989), aff'd,

899 F.2d 79 (1st Cir. 1990).

D. The United States Environmental Protection Agency ("USEPA"), in consultation with the Massachusetts Department of Environmental Protection ("MADEP"), has selected and overseen the implementation of response actions for the Site Pursuant to CERCLA.

E. The response actions consisted in part of the removal of three storage tanks for the Premises and the sampling of soils from under those tanks, and the sampling of soils and groundwater on the Premises and of surface water and sediments off-Premises. Thereafter, the USEPA, in consultation with the MADEP, determined that removal and disposal of contaminated soil contaminated with oily materials and CERCLA hazardous substances was necessary. The contaminated soil was located inside the berm where storage tank #1 previously was situated and consisted of shallow soils, contaminated with oily materials and CERCLA hazardous substances to a depth of three to five feet.

NOW, THEREFORE, in order to protect the health, safety and welfare of the inhabitants on the Town of Plymouth, SWT hereby grants the following restrictions to the Town of Plymouth, its successors and assigns, and to the MADEP, its successors and assigns, which inure to their benefit;

(1) The Premises shall not be used for any single-family or multiple-family residences, school facilities, hotel, motel, or recreational or community facilities (collectively, the "Restricted Uses") unless the terms of this paragraph (1) (a)

through (1) (d) have been complied with.

(a) prior to using all or any portion of the Premises for any Restricted Uses, an evaluation (hereafter, "risk assessment") of the potential health risks of exposure to contaminated Premises soils due to the proposed Restricted Use shall be conducted by SWT or its successors or assigns, at the expense of SWT or its successors or assigns. The risk assessment shall be performed by persons (s) experienced in the performance of risk assessment and, unless otherwise directed by USEPA in consultation with MADEP, shall be conducted in accordance with CERCLA, the National Contingency Plan ("NCP"), 40 C.F.R. Part 300, and USEPA and Massachusetts guidance in effect at the time the risk assessment is performed. A full description of the proposed Restricted Use, including all proposed development plans, must be submitted to USEPA and MADEP along with the risk assessment.

(b) Within 120 days of receipt by USEPA and MADEP of the risk assessment and the description of the proposed Restricted Use, USEPA, in consultation with MADEP, shall determine in writing if the proposed Restricted Use would pose an unacceptable risk of exposure to contaminated Premises soils, or shall inform SWT or its successors or assigns of a reasonable period of time which USEPA and MADEP

require to review the risk assessment and description of the proposed Restricted Use. Failure by USEPA to respond within 120 days shall not constitute a determination authorizing SWT, or its successors or assigns, to proceed with its plans to use the Premises for such proposed Restricted Use.

(c) If USEPA, in consultation with MADEP, determine that SWT, or its successors or assigns, may proceed with its plans to use the Premises for a proposed Restricted Use, it shall so certify, in a form recordable by SWT or its successors or assigns, and such portion of the Premises proposed to be used for a Restricted Use may be used for such purpose without limitation or restriction, effective upon the recording of such certification in Deeds.

(d) After reviewing the risk assessment and the description of the proposed Restricted Use, If USEPA, in consultation with MADEP, determines that the proposed Restricted Use would pose an unacceptable risk of exposure to contaminated Premises soils, such portion of the Premises proposed to be used for a Restricted Use thereafter may be used for such purpose only after a response action to reduce such potential unacceptable health risk has been authorized by USEPA, in consultation with MADEP, and performed and completed by SWT or its successors or assigns, at the expense of

Premises for any commercial, industrial, or other use now or hereafter permitted under Section 410.16 (Light Industrial/Waterfront) or other applicable sections of the Town of Plymouth, Massachusetts Zoning Bylaw, as amended, except for the Restricted Uses as provided above and as provided in paragraph (3) below.

(3) SWT or its successors or assigns shall inspect, maintain, and repair the fence constructed on the Premises as part of the response actions, which is shown on the Plan, until USEPA, in consultation with MADEP, certifies that no further inspection, maintenance, or repair of all or a portion of the fence is required; provided, however, that USEPA, in consultation with MADEP, shall agree to so certify upon request in connection with any use of the Premises for any purpose allowed hereunder other than Restricted Uses wherever such use, in the opinion of USEPA in consultation with MADEP, would not significantly increase the potential health risks of exposure to contaminated Premises soils due to the proposed use. Within 30 days after receipt of a request for such certification, USEPA, in consultation with MADEP, shall grant or deny the requested certification or shall inform SWT or its successors or assigns of a reasonable additional period of time which USEPA and MADEP require to review the request for such certification. Failure by USEPA to respond to such request within 30 days shall not constitute a certification that no further inspection, maintenance, or repair of the fence is required.

(4) These restrictions shall run with the land.

(5) These restrictions hereby imposed are in gross and are not for the benefit of or appurtenant to any particular land but are for the benefit of and enforceable by the USEPA, its successors and assigns, and MADEP, its successors and assigns.

(6) These restrictions shall be enforceable by the United States and the Commonwealth of Massachusetts, pursuant to the provisions of G.L. c. 184, § 26 et. seq., or otherwise, or by either one acting singly. A notice of restrictions, in compliance with law, shall be recorded before the expiration of thirty (30) years from the date of this Declaration of Restrictions and shall name the person or persons appearing of record who own the Premises at the time of recording; and in the case of any such recording, a subsequent notice of restriction shall be recorded within twenty (20) years after the recording of any prior notice of restriction until the period of these restrictions has elapsed. Any grantee hereby covenants for itself, its successors and assigns, to timely execute, and record such documents and take such action, including the surrender of certificate of title, if any, for notation thereon, as shall be necessary to cause such notice of restriction to be effective and enforceable under the then applicable G. L. c. 184, § 26, et. seq. The grantor further covenants for itself, its successors and assigns, to include the restrictions and protective covenants herein set out, in each lease and sublease of the Premises or any portion thereof.

No documentary stamps are affixed hereto as none are required by law as this conveyance is made without monetary consideration.

