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EPA Region 1 RAC 2 Contract No. EP-S1-06-03

September 30, 2008
Nobis Project No. 80034
NH-1647-2008-F

Via Electronic Submittal

U.S. Environmental Protection Agency, Region 1
Attention: Mr. Derrick Golden, Task Order Project Officer
1 Congress Street, Suite 1100
Boston, Massachusetts 02114-2023

Subject: Transmittal of Fourth Five-Year Review
Plymouth Harbor/Cannon Engineering Corporation Superfund Site
Plymouth, Massachusetts
Five-Year Review
Task Order No. 0034-FR-FE-0128

Dear Mr. Golden:

Enclosed for EPA's use is the fourth Five-Year Review for the Plymouth Harbor/Cannon Engineering Corporation Superfund Site located in Plymouth, Massachusetts.

Should you have any questions or comments, please contact me at (603) 724-6235, or sharding@nobisengineering.com.

Sincerely,

NOBIS ENGINEERING, INC.

A handwritten signature in blue ink that reads "Scott Harding".

Scott W. Harding, P. E.
Project Manager

Attachments

c: File 80034/NH (w/enc.)

Five-Year Review Report

Fourth Five-Year Review
for
Plymouth Harbor – Cannon Engineering
Corporation Superfund Site
Plymouth, Massachusetts

September 2008

Prepared by:

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



Superfund Records Center

SITE: CANNON'S PLYMOUTH

BREAK: 8.3

OTHER: _____

Five-Year Review Report



Fourth Five-Year Review
for

SDMS DocID 295059

Plymouth Harbor – Cannon Engineering
Corporation Superfund Site
Plymouth, Massachusetts

September 2008

Prepared by:

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




James T. Owens, III Director
Office of Site Remediation and Restoration
U.S. EPA, New England

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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
CEC	Cannon 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
MassDEP	Massachusetts Department of Environmental Protection
MADEQE	Massachusetts Department of Environmental Quality Engineering
MCL	Maximum Contaminant Level
ND	non detect
NMV	New Millenium Ventures
Nobis	Nobis Engineering, Inc.
NPL	National Priorities List
NUS	NUS Corporation
O&M	Operations and Maintenance
PAH	Polynuclear aromatic hydrocarbons
ppb	parts per billion

ACRONYMS (cont.)

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, Cannon Engineering Superfund Site
TBC	To be considered
TtNUS	Tetra Tech NUS, Inc.
Trust	Salt Water Trust
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

EXECUTIVE SUMMARY

This is the fourth five-year review for the Plymouth Harbor, Cannon Engineering Corporation (CEC) Superfund Site (Site). The triggering action for this policy review was the completion of the third Five-year review dated September 2003. 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. Until 1974, the tanks 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 Site. 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 offsite. In January 1984, Tank No. 2 was drained, cleaned, and its contents disposed of offsite. 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 (EPA) 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 and 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. 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 Remedial Investigation (RI) and characterization of the areas beneath the three tanks.
3. Preparation of a site-specific floodplains assessment.

The three tanks were inspected, decontaminated, demolished, and disposed of offsite in the fall of 1987. Also in the fall of 1987, supplemental samples were collected from the soils under the dismantled tanks and surface and subsurface soil locations outside the tank berms; five on-site

groundwater monitoring wells were installed; and sediments located offsite in the tidal seep were sampled. 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.

EPA 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 coupled with the characterization of the response action as a removal action, EPA, in consultation with the Massachusetts Department of Environmental Protection (MassDEP), concluded that no additional remedial action or a ROD amendment were necessary for the Site.

In 1992, a deed restriction was recorded to restrict the use of the property and limit future property use to commercial or industrial development. The deed restriction also specified that a risk assessment must be performed prior to redevelopment of the Site for any of the listed restricted uses. Based on the results of the risk assessment, EPA and MassDEP could either concur on the proposed use or could require that an additional response action be performed before allowing the proposed use.

Subsequent to the 1989 EA, changes in risk assessment guidelines and recommendations resulted in the need to reassess the protectiveness of the remedy for the allowed commercial or industrial property use and for older child/trespassers in accordance with the new risk assessment guidelines and recommendations. Computations of updated risks to commercial or industrial workers and to older child/trespassers using Site data collected during post excavation soil sampling were provided in the 2003 five-year review and Section 7.2 of this fourth five-year review, respectively. As discussed in Section 7.2, EPA has expressed concerns with the age, adequacy, and appropriateness of the available data for the purposes of performing an updated risk assessment. Although the updated risk calculations show the combined risks (ingestion and dermal) for older child/trespasser (Appendix D) and adult commercial worker (from the 2003 five-year review) exposures to carcinogenic polynuclear aromatic hydrocarbons (cPAHs) are both slightly above 1×10^{-4} , it is likely that the risks are 1×10^{-4} or less (at the high end of the protective range) as further explained in Section 7.2. Because these risks are at the high end of the protective range and the data on which they are based are questionable, further sampling and re-evaluation of risks must be performed if the Site is to be developed.

Although there has not been any redevelopment of the Site since the last five-year review, the Site owner indicated that he has considered Site redevelopment for use as a boat storage facility. As provided in the 2003 five-year review, and in this fourth five-year review, prior to commencement of any Site development activities, a detailed redevelopment plan must be submitted to and approved by both EPA and MassDEP. Additional soil sampling and completion of an updated risk assessment is required prior to any redevelopment of the Site.

Five-Year Review Protectiveness Statement:

The remedy is protective in the short-term because clean fill covers the remaining subsurface contamination; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken:

- The northern and northeastern shoreline perimeter Site fence must be reconstructed and maintained to provide complete access controls around the property.
- If the Site is to be developed, additional soil data must be collected in accordance with an EPA-approved soil sampling and management program designed for risk assessment purposes. A new risk assessment must be completed using the new data, updated methods, and updated exposure assumptions based on any of the proposed Site uses to confirm that the exposures remain within the protective range.
- Prior to commencement of any Site redevelopment activities, a detailed redevelopment plan must be submitted to EPA and MassDEP. This plan should include a statement of the proposed work, Site activities, and information pertaining to environmental 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 (from WasteLAN): Plymouth Harbor/Cannon Engineering Corp.		
EPA ID (from WasteLAN): MAD980525232		
Region: 1	State: MA	City/County: Plymouth/Plymouth
SITE STATUS		
NPL status: <input type="checkbox"/> Final <input checked="" type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Multiple OUs?* <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Construction completion date: 1987	
Has site been put into reuse? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
REVIEW STATUS		
Lead agency: <input checked="" type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency _____		
Author name: Derrick Golden		
Author title: Task Order Project Officer	Author affiliation: U.S. EPA Region I	
Review period:** 7/24/08 to 9/30/08		
Date(s) of site inspection: 7/24/08		
Type of review: <input type="checkbox"/> Post-SARA <input checked="" type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion		
Review number: <input type="checkbox"/> 1 (first) <input type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input checked="" type="checkbox"/> Other (specify) Fourth _____		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction at OU # _____ <input type="checkbox"/> Actual RA Start at OU# _____ <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify)		
Triggering action date (from WasteLAN): September 2003		
Due date (five years after triggering action date): September 2008		

* "OU" refers to operable unit.

** Five-Year Reviews were completed in 1992, 1998, and 2003

Issues:

- Site redevelopment.
- New calculations show a risk for adult workers in the commercial/industrial allowed use as well as the older child/trespasser scenario are at the high end of the protective range. The soil data used are of questionable quality.
- Access controls are inadequate; the northern perimeter Site fence is in disrepair.

Recommendations and Follow-up Actions:

If Site redevelopment is anticipated:

- 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 EPA.

Regardless of redevelopment status:

- Replace and maintain the northern perimeter site fence.

Protectiveness Statement(s):

The remedy is protective in the short-term because clean fill covers the remaining subsurface contamination; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken:

- The northern and northeastern shoreline perimeter Site fence must be reconstructed and maintained to provide complete access controls around the property.
- If the Site is to be developed for any use (including industrial/commercial use), additional soil data must be collected in accordance with an EPA-approved soil sampling and management program designed for risk assessment purposes. A new risk assessment must be completed using the new data, updated methods, and updated exposure assumptions based on any of the proposed Site uses to confirm that the exposures remain within the protective range.
- Prior to commencement of any Site redevelopment activities, regardless of the type of reuse, a detailed redevelopment plan must be submitted to EPA and MassDEP. This plan should include a statement of the proposed work, Site activities, and information pertaining to environmental 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 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 processes, investigations, and remedial actions undertaken at the Site; evaluates the monitoring data collected; reviews, as appropriate, the Applicable or Relevant and Appropriate Requirement (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 (EPA) prepared this five-year review pursuant to Agency policy and consistent with 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 EPA interpreted this requirement further in the National Contingency Plan; 40 Code of Federal Regulations (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. Nobis Engineering, Inc. (Nobis) supported USEPA in completion of the review under EPA Contract No. EP-S1-06-03. Work on this review was undertaken between July and September 2008. The review was completed in accordance with USEPA Guidance OSWER No. 9355.7-03B-P.

This is the fourth five-year review for the Site. The three prior five-year reviews were completed in 1992, 1998, and 2003. The triggering action for this policy review was the completion of the third five-year review in 2003. 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
Plymouth Harbor, Cannon 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 1974 No. 6 fuel & Bunker C oil were stored in the tanks.	1974
Tanks were leased by Cannon 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). Site hazards assessed.	1980-1982
Site proposed for inclusion on National Priority List (NPL).	12/30/1982
EPA & the Trust entered into a Consent Agreement.	9/1/1983
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.	1/1/1984
Completed a Remedial Investigation (RI). Polynuclear aromatic hydrocarbons (PAHs), pesticides & lead were identified as contaminants of concern (COCs).	7/1984-8/1984
Feasibility Study (FS) was issued.	6/1/1985
Wetlands Reconnaissance conducted.	7/1/1985
Wetland Assessment conducted.	8/1/1985
ROD issued (required completion of additional tasks prior to selecting final remedy).	9/1/1985
Floodplains Assessment was completed (per ROD).	1/1/1986

Event	Date
Work Plan & Field Operations Plan issued by the Responsible Parties (RPs) for tank demolition and disposal and a Supplemental Sampling Program.	4/1/1987
Remedial Action (fencing, tank demolition, drum, debris, waste and stained soil removal) completed by the RPs.	6/87 – 11/87
Supplemental sampling conducted (per ROD) by the RPs.	Fall/1987
Revised Draft Supplemental Report completed by the RPs.	2/1/1988
Partial Consent Decree was entered into between EPA & CEC Settling Parties.	9/1/1988
ATSDR issued a Health Assessment.	10/1/1988
EPA completed an Endangerment Assessment.	4/1/1989
Deed restriction filed at Plymouth County Registry of Deeds.	4/1/1992
EPA issued a Site Close Out report.	5/29/1992
First Five-Year Review completed.	12/1/1992
Site deleted from NPL.	11/19/1993
Second Five-Year Review completed.	7/1/1998
Human health risk assessment submitted by Risk Management, Inc. (RMI) on behalf of New Millennium Ventures (NMV) to support lifting of deed restriction to allow residential development.	11/1/2000
EPA found the RMI risk assessment to be inadequate and requested additional sampling & that a soil management plan be prepared.	2/1/2001
Additional soil sampling and proposed soil management plan submitted by NMV's consultant.	8/7/2001
EPA approved NMV's sampling & soil management plans, but NMV never performed further sampling.	9/20/2001
Third Five-Year Review completed.	9/1/2003
Fourth Five-Year Review completed.	9/30/08

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 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 2).



Quadrangle Location

USGS TOPOGRAPHIC MAP

PLYMOUTH, MASSACHUSETTS
1968; (Photo-revised 1984)

APPROXIMATE SCALE
1" = 2,000 FEET

FIGURE
1

**PLYMOUTH HARBOR, CANNONS
ENGINEERING CORPORATION
SUPERFUND SITE
PLYMOUTH, MASSACHUSETTS**

SITE LOCUS PLAN



Nobis Engineering, Inc.
439 South Union Street
Building 2, Suite 207
Lawrence, MA 01843
(978) 683-0891
www.nobisengineering.com

DATE: 07/15/08 REV. 00
PROJECT NO. 80034
FILE NAME: Locus Plan.MXD
PREPARED BY: D. McGRATH
CHECKED BY: S. HARDING



Graphic Obtained From MASSGIS



FIGURE 2	PLYMOUTH HARBOR, CANNONS ENGINEERING CORPORATION SUPERFUND SITE PLYMOUTH, MASSACHUSETTS SITE LAYOUT PLAN	 Nobis Engineering, Inc. 439 South Union Street Building 2, Suite 207 Lawrence, MA 01843 (978) 683-0091 www.nobisengineering.com	DATE: 08/20/08 REV 01 PROJECT NO.: 80034 FILE NAME: Layout_Plan.MXD PREPARED BY: D. McGRATH CHECKED BY: S. HARDING	LEGEND + Overburden + Monitoring Well — Intact Fence — Snow Fence — Tank Berms — Property Boundary — Tidal Stream
			Feet 0 50 100	<small>Graphic Obtained From MASSGIS</small>

Three aboveground 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 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 Site in 1980. Approximately 500,000 gallons of liquid hazardous substances stored in Tank Nos. 1 and 2 were left on the 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 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 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 trees (up to eight-inch-diameter), and 4- to 5-foot high shrubs. Due to the vegetation, there is limited potential for erosion.

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 is tidally influenced and flows in an easterly direction towards Plymouth Harbor and the tidal stream along the southeast side of the Site.

Based on information from the Federal Emergency Management Agency (FEMA), most of the Site lies within a 100-year coastal floodplain (FEMA, 2006). 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; unnamed water bodies to the west and southeast; and Plymouth Harbor to the north.

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, 2008). In the past, the Site and surrounding areas were used for industrial/commercial purposes; the areas near the Site presently remain in industrial/commercial use.

A multi-story, multi-building commercial 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 glass bottle crusher and warehouse located approximately 150 feet to the southwest; a former fish processing plant and a large vacant brick structure formerly occupied by the Plymouth Cordage Co. is located to the northwest. 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. These landmarks are not identified on Figure 1.

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 located 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 approximately 250,000 gallons each; Tank No. 3 had a capacity of approximately 500,000 gallons. All were surrounded by 6- to 8-foot high berms (see Figure 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 Site. When CEC ceased operations, approximately 500,000 gallons of liquid hazardous wastes were left at the Site in Tank Nos. 1 and No. 2. Between 1980 and 1983, MADEQE performed 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 EPA and MADEQE were concerned about a possible catastrophic tank failure. The local fire marshal 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 Site in 1980 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. 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 listed on the NPL in September 1983.

In 1983, pursuant to a Consent Agreement between EPA and the site owner, Jetline was contracted by the site owner to drain Tank No. 1 and dispose of the waste. In January 1984, an EPA 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 an RI in early 1984.

3.5 Basis for Taking Action

By 1985, EPA had completed an RI, a Wetlands Reconnaissance, and a Wetlands Assessment on the Site. A qualitative human health risk assessment was conducted as part of the RI that identified the primary contaminants of concern (COCs) as polynuclear aromatic hydrocarbons (PAHs), 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, 1992a). 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, 1992a).

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 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, EPA issued a ROD based on the conclusions of the RI and FS. 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, EPA

determined that the capping alternative required further study and that a floodplains assessment should be performed to be consistent with Executive Order 11988 and EPA's policy concerning floodplains and wetlands. EPA 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, EPA determined that additional sampling was necessary to address the uncertainty about the extent of on-site 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.

- Dismantling and off-site disposal of the three tanks and associated piping.
- Supplemental sampling of all media to confirm the pattern of contamination identified in the RI and characterize the areas beneath the three tanks.
- Preparing a site-specific floodplains assessment.

EPA 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 sampling and evaluation was completed. EPA intended to amend the ROD following an evaluation of the supplemental data and the selection of a final remedial alternative. However, it was determined that the ROD did not require an amendment based upon the supplemental sampling and floodplains assessment.

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, 1992a).

4.2.2 Tank Dismantling and Disposal

In April 1987, EPA developed 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 offsite 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, 1992a).

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, an estimated additional 180 cubic yards of soil contaminated with hazardous substances and oils remained within the Tank No. 1 bermed area (USEPA, 1992a) (this soil was removed in 1988). 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 the contaminated soils located under the former tanks, and surface and subsurface soil locations outside the tank berms; five on-site groundwater monitoring wells were installed; and sediments located offsite in the tidal seep were sampled (ATSDR, 1988). The results of the sampling events are discussed in Section 6.4.

4.2.4 Consent Decree

In September 1988, the EPA and a group of potentially responsible parties (“PRPs”), including the owner of the Site, entered into a Consent Decree, which set forth a response action of soil excavation, confirmatory sampling, and backfilling with clean soil. EPA and the MassDEP concluded that an amended ROD was not necessary. The Consent Decree set forth the following activities:

- 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 PRPs 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, 1992c). 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, 1992a).

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 soil 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

EPA completed an 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. EPA 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; provided a deed restriction was issued for the Site. EPA, in consultation with the MassDEP concluded that no additional remedial action or a ROD amendment were necessary for the Site. This determination was based on the findings of the EA, and the characterization of the response action as a removal action.

4.2.7 Institutional Controls

As recommended in the EA, 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 human-health risk assessment must be performed prior to redevelopment of the Site for any of the listed restricted uses. EPA and the MassDEP 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, EPA, in consultation with MassDEP, 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 EPA and MassDEP after a response action was 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 EPA and MassDEP certify that it is no longer required.

4.3 Operations and 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, 1992a). 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 EPA, in consultation with the MassDEP, determines that such maintenance and repair of the fence is no longer necessary.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

This is the fourth five-year review for the Site. The third five-year review (USEPA, 2003) concluded that the remedial action selected for the Site was protective of human health and the environment in the short term because the remaining subsurface contamination was covered with clean fill. However, the third five-year review required that several actions be taken to ensure that the remedy remains protective in the long-term. The summary below outlines the recommendations included in the third five year review and the outcome/resolution of recommendations.

- Replace and maintain the northern perimeter site fence
 - The northern shoreline perimeter wooden-slat-type snow fence was repaired in response to the recommendation provided in the third five-Year Review. However, during the site inspection for the fourth five-year review, the fence was again found to be in disrepair with several gaps noted. It is recommended that this recurring problem be rectified with a more-permanent solution such as a chain-linked fence or equivalent, or a more-rigorous maintenance schedule.

- Perform soil sampling and management following a plan approved by USEPA
 - Since 2003, no additional soil sampling has been performed as there has been no development proposed for the parcel.

- Complete a new risk assessment with new data to confirm the industrial/commercial use exposures remain within the protective range
 - New data has not been collected; therefore a new risk assessment has not been performed.

- Complete a new risk assessment once new soil data are available
 - New data has not been collected. Therefore, a new risk assessment has not been performed.

A review conducted at the Plymouth County Registry of Deeds established that the current deed restriction remains in place.

Although the owner of the Site is contemplating using the Site as a boat storage facility, they have no immediate plans to move forward with any redevelopment at this time.

6.0 FIVE-YEAR REVIEW PROCESS

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

6.1 Administrative Components

EPA, the lead agency for this five-year review, notified MassDEP and the property owner in the summer of 2008 that the five-year review would be completed. The MassDEP Site representative is Jay Naparstek. A draft copy of this review has been provided to MassDEP for their review and comment.

6.2 Community Notification and Involvement

A press release was published in the Old Colony Memorial newspaper on July 2, 2008. The press release summarized the Site activities, and stated that the results of this Five-Year Review would be available. A copy of the press release is included in Appendix F.

According to previous investigations 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 (see Appendix A).

6.4 Data Review

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. (A Massachusetts Contingency Plan based human health risk assessment was completed by Risk Management, Inc. (RMI) on behalf of the property owner in 2000. However, EPA did not consider the assessment to be adequate as it did not meet the requirements set forth under CERCLA, and therefore it is not presented here.)

6.4.1 Soil

PCBs were not detected above reporting limits in any soil sample collected during the RI, and therefore, follow-up sample collection completed at the Site did not include PCBs as an analyte.

Soil samples collected during the 1987 supplemental sampling event were free of VOC contamination, but low levels of PAHs, pesticides, 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 these 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, 1992a). Inorganic compounds were detected in 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, 1992a). 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 the 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 EA, as well as, in the risk computations included in both the Second Five-Year Review Report (USEPA, 1998), the Third Five-Year Review (USEPA, 2003), and this fourth Five-Year Review (see Appendix D).

The current use scenario in the 1989 EA assumed unlimited access to the entire site and not just the areas inside the former berms. Therefore the EA assumes that the likelihood of contact with

any portion of the site (inside or outside of the bermed area) is equal. A site wide average concentration was used to calculate exposure doses. The site wide average is an area weighted value calculated assuming the bermed areas comprise approximately 1/3 of the total site area. The contaminant concentrations for the areas inside the berms and outside the berms were obtained from analysis of the fill material covering the berms and the composite samples of the area outside the berms. The area concentrations were weighted to obtain the area weighted site average.

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 the supplemental sampling 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 (Figure 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

On July 24, 2008, EPA's contractor conducted a Site inspection, accompanied by representatives from Cordage Commerce Center property management. 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, southern, southeastern, and eastern sides of the Site were secured by a chain link fence with a padlocked gate. Along the northern and northeastern property boundary, the wooden-slat snow-fence was observed, but several breaches in the fence were also noted, therefore the Site was not fully secured. However, there did not appear to be any evidence of trespassing or vandalism at the Site.

Debris including metal scraps, brick, plastic tubing, and broken sea shells were noted 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. Four of the five monitoring wells, used during previous investigations, were observed. Although the wells appeared to be intact, their metal casings may have rusted-shut.

The boat yard located east of the Site and glass bottle crushing facility located southwest of the property appear to be fully operational, unlike the former fish processing facility and a multi-story brick structure, located northwest, both of which appear to be completely vacant.

6.6 Interviews

General discussions and observations were documented during the Site inspection on July 24, 2008. Telephone interviews and e-mail correspondence were completed as a follow-up to the Site inspection. The list of individuals interviewed regarding this fourth five-year review is shown in Appendix C.

Joseph Jannetty of Janco Development stated that the Master Plan for the properties adjacent to the Site is to raze the existing vacant structures and construct condominiums complete with a multi-slip marina. Though not specifically part of the Master Plan, Mr. Jannetty indicated interest in grading the Site for use as a storage area for boats. Mr. Jannetty stated that he was aware of EPA and MassDEP requests to review any Site redevelopment plans. Redevelopment of the Site is not imminent.

William Rudolph, the Cordage Commerce Center property manager, stated that trespassing was not a problem on the Site itself but was a problem in adjacent vacant structures. His company manages properties contiguous to the Site and provides security and monitoring for all the properties. Mr. Rudolph was not aware of any fires or floods occurring at the Site.

During the course of the project, Mr. Derrick Golden of EPA provided Site-related information regarding the Site history, setting, and project stakeholders. A formal interview of Mr. Golden was not conducted as the interview-information had been obtained previously.

Mr. Jay Naparstek of MassDEP stated that there has not been any public interest in the Site, that he is aware of, during the previous five years. Mr. Naparstek stated that MassDEP is sufficiently informed about the status of the Site. As there has been little activity on the Site since the 1990s, there has not been opportunity to discuss the Site. However, MassDEP is certain that they would be informed of any future redevelopment of the Site.

Interviews conducted with Town of Plymouth Officials from the Economic Development/Planning Department, Building Department, and Zoning Board of Appeals stated that there are no current plans on-file at the town regarding development of the Site.

The Site repository remained located in the Government References section of the Town of Plymouth Public Library.

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?

Yes, the remedy is functioning as intended. Clean fill covers the remaining subsurface contamination. However, in the long-term, before any reuse of the property, new sampling is needed and a current risk assessment should be performed. Requirements are in-place which would require such action on the part of the property owner if the Site is to be redeveloped for any of the restricted uses; however these requirements do not extend to all uses of the site property. In addition, the fence along Plymouth Harbor is in disrepair and requires replacement or a more-rigorous maintenance routine. It should be noted however, that no evidence of trespassing or disturbance of the soil cover was noted during the July 24, 2008 site inspection.

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 response activities required by the 1988 Consent Decree. All response 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 recorded deed restrictions, the property owner agreed to maintain and repair the fence surrounding the Site until EPA, in consultation with the MassDEP, 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 as 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 human health risk assessment and the concurrence of EPA and MassDEP. The deed restriction continues to be in effect. The deed restriction also requires access controls; and the property owner is required to inspect, maintain and repair the fence around the perimeter of the Site. The wooden slat snow-fence along the northern and northeastern perimeter of the Site is in poor condition with several breaches noted, leaving open access to the Site and potentially placing the remedy's protectiveness at risk in the long term. In addition, the deed restriction does not include the more comprehensive redevelopment requirements that were recommended at the time of the third five-year review (e.g., performance of sampling and a risk assessment prior to any reuse of the property, including industrial/commercial uses).

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of the Remedy Selection Still Valid?

No, the exposure assumptions and toxicity data used at the time of the remedy selection are no longer valid. However, recalculations of risk to trespassers and industrial/commercial workers based on composite soil data collected more than 20 years ago indicate that the remedy is still protective of human health for current use and potential future redevelopment of the Site for industrial or commercial use. Because estimated adult commercial worker and adolescent trespasser risks are at the high end of the protectiveness range, and because the soil data is of questionable value for current risk assessment purposes, it is important to collect new data and reevaluate risks to confirm protectiveness prior to any redevelopment. The ROD and subsequent decision documents did not establish any performance standards. The RAOs used at the time of the remedy selection are still valid.

Changes in Land Use of the Site and Physical Site Conditions

No changes in land use or the physical conditions of the property have occurred since the third five-year review. The Site remains vacant; however, the snow-fence located along the northeastern property boundary was noted to be down in several areas. Refer to Photographs 9, 10, and 11 in Appendix B.

New Contaminants and/or Contaminant Sources

No new contaminants or contaminant sources have been identified since the remedy.

Changes in Standards or TBCs

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

Changes in Exposure Pathways and Exposure Assumptions

There have been no changes in land use in the vicinity of the Site since the third 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, EPA 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* (USEPA, 2004) was used to establish dermal exposure parameters during the previous five-year review. This document was updated in 2004, but none of the exposure assumptions utilized in the Third Five-Year Review have changed.

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 third 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 previous five-year reviews, EPA now uses several models to predict blood lead levels that would result due to exposure to lead-contaminated soil. This change in the risk assessment method for evaluation of lead exposures has remained the same since the third Five-Year Review. Since lead concentrations were below the residential screening level currently used, they do not pose a significant public health hazard.

In March 2005, EPA published an updated version of the *Guidelines for Carcinogen Risk Assessment* and a new supplement, *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens*. These documents provide a revised method of evaluating risk to children and adolescents from carcinogens with a mutagenic mode of action, including PAHs. This guidance impacts the risk calculations for the trespasser scenario. They do not impact the calculations for the industrial/commercial worker. For children ages 2 through 16, cancer slope factors for carcinogens with a mutagenic mode of action should be adjusted by a factor of 3. Risks to trespassers from PAHs (the only contaminants evaluated in the previous five-year reviews at this Site) increase 3-fold. Appendix D presents revised cancer risks based on consideration of the mutagenic mode of action for cPAHs for older child trespassers of 1.6×10^{-4} (similar to the cancer risk estimates for industrial workers of 1.7×10^{-4} calculated during the third five-year review). Although the quantitative risk estimates of 1.6×10^{-4} and 1.7×10^{-4} round to 2×10^{-4} , it is likely that the risks are 1×10^{-4} or less (at the high end of the acceptable range) because the calculations used the maximum concentration of total PAH, and assumed that all the PAHs were carcinogenic and as carcinogenic as the most carcinogenic PAH (benzo(a)pyrene). These assumptions are conservative because some of the PAHs are non-carcinogenic or carcinogenic but less toxic than benzo(a)pyrene, and a realistic exposure scenario would be to a lower concentration than the maximum.

Changes in Risk Assessment Conclusions

As part of this five-year review, cancer risks for older child trespassers 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 *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens*. The calculated potential risks are:

$$\text{Combined risk for older child trespasser exposure to cPAHs} = \underline{1.6 \times 10^{-4}}$$

Appendix D presents revised cancer risks based on consideration of the mutagenic mode of action for cPAHs for older child trespassers of 1.6×10^{-4} , which is at the high end of acceptable (similar to the cancer risk estimates for industrial workers calculated during the third five-year review). Appendix D presents revised cancer risks based on consideration of the mutagenic mode of action for cPAHs for older child trespassers of 1.6×10^{-4} , (similar to the cancer risk estimates for industrial workers of 1.7×10^{-4} , calculated during the third five-year review). Although the quantitative risk estimates of 1.6×10^{-4} , and 1.7×10^{-4} , round to 2×10^{-4} , it is likely that the risks are 1×10^{-4} , or less (at the high end of the acceptable range) because the calculations used the maximum concentration of total PAH, and assumed that all the PAHs were carcinogenic and as carcinogenic as the most carcinogenic PAH (benzo(a)pyrene). These assumptions are conservative because some of the PAHs are non-carcinogenic or carcinogenic but less toxic than benzo(a)pyrene, and a realistic exposure scenario would be to a lower concentration than the maximum. Because estimated adult commercial worker (calculated in the third five-year review) and adolescent trespasser (calculated in this five-year review) risks are likely to be at the high end of the protectiveness range, and are based on data collected years ago not using current data collection methods for purposes of risk assessment evaluation, it is particularly important to collect new data and reevaluate risks to confirm protectiveness prior to any redevelopment.

Soil Outside the Bermed Areas

As part of this five-year review, potential risks associated with soil outside the bermed area were recalculated using current risk assessment methods and assumptions. A site wide average of 2 mg/kg carcinogenic PAHs was used for the current use scenario and results in total trespasser cancer risk of 2.3×10^{-6} which is within EPA's acceptable risk range. See section 6.4.1 for further discussion of how the site wide average of 2 mg/kg PAHs was determined and see Appendix G for the risk calculations.

Expected Progress Towards Meeting RAOs

The following is a summary of the RAOs for the remedy that were established in the 1985 ROD with a brief assessment of the progress that has been made towards meeting these objectives.

The ROD identified the following 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.

Minimize the potential for direct contact with surface soil: The tank removal and disposal, excavation and removal of contaminated soils, and backfilling of tank bermed areas with clean fill have reduced potential for direct contact with contaminated surface soil.

Minimize the potential for off-site migration of hazardous chemicals: The tank removal and disposal, excavation and removal of contaminated soils, and backfilling of tank bermed areas with clean fill have reduced off-site migration of hazardous chemicals.

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

No, aside from the human health risk assessment factors described above and the reinstallation of the perimeter fence on the northern and northwestern boundaries, 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.

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, proper maintenance of 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 pertaining to access controls. The perimeter fence has not been maintained to restrict access to

trespassers along the shoreline side of the Site. In addition, the deed restrictions do not require the performance of a risk assessment prior to any site redevelopment (under the deed restriction, this requirement only applies to redevelopment for restricted uses).

Question B: Exposure assumptions, toxicity data, and risk assessment methods have changed since the time of the remedy selection. Recalculations of risk to trespassers and industrial/commercial workers based on composite soil data collected more than 20 years ago results in risks slightly exceeding 1×10^{-4} . It is likely that the risks are 1×10^{-4} or less (at the high end of acceptable) because the calculations used the maximum concentration of total PAH, and assumed that all the PAHs were carcinogenic and as carcinogenic as the most carcinogenic PAH (benzo(a)pyrene). While the conditions at the Site appear to be protective of current and future human health based on an older child/trespasser and an industrial/commercial use scenario, the likely risks for these scenarios are at the high end of the protectiveness range, and the data upon which the estimates are based is of questionable quality. New data is required to further support and confirm this conclusion, prior to site redevelopment.

Question C: No changes have occurred at the Site and it remains vacant and undeveloped.

8.0 ISSUES

This section provides a summary of the issues identified during this fourth five-year review. Recommendations and follow-up actions are presented in Section 9.0. A tabular summary of the issues identified is included at the conclusion of Section 8.0.

- Inadequate Access Controls

As provided in the deed restriction, the site owner is required to maintain and repair the fence surrounding the Site until EPA, in consultation with the MassDEP, determines that the fence is no longer necessary. Although the chain link fence surrounding much of the Site is in good condition and the entranceway was secured with a padlock, the wooden-slat snow-fence along the northern and northeastern property border had fallen in several places and has not been replaced. Refer to photographs 9, 10, and 11 in Appendix B.

- Site Redevelopment for a Restricted Use and/or for Commercial/Industrial Uses

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.

Calculations performed as part of the third five-year review and this report (see Appendix D) indicated that the cancer risks for adult workers in a commercial/industrial future use scenario and for older child/trespassers are likely to be at the high end of EPA'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 20 years old), in conjunction with updated default exposure frequencies and durations, updated dermal exposure parameters, and updated risk guidance, has resulted in risk estimates likely to be at the high end of the acceptable range that need to be confirmed with better quality data (Appendix D).

Based on the current available information and risk estimates provided in the 2003 five-year review and this five-year review, a new risk assessment, using new data and updated methods, should be performed to support and confirm the cancer risk estimates prior to any Site redevelopment (including industrial/commercial redevelopment).

The current deed restriction requires that prior to commencement of Site redevelopment activities for any of the restricted uses, a detailed redevelopment plan must be submitted to EPA and MassDEP. Based on the current available data and risk assessments performed in the 2003 five-year review and this five-year review, a detailed redevelopment plan prior to commencement of any Site redevelopment activities (including industrial/commercial activities), must be submitted to EPA and MassDEP for review and approval.

Table 8-1
Issues
Plymouth Harbor, Cannon Engineering Corporation Site
Plymouth, Massachusetts

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Inadequate Access Controls – Northern/Northeastern perimeter fence in disrepair	N	Y
Site Redevelopment for a Restricted Use & Adequate Risk Assessment	N	Y
Site Redevelopment for a Commercial/Industrial Use & Adequate Risk Assessment	N	Y

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

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

**Table 9-1
Recommendations and Follow-Up Actions
Plymouth Harbor, Cannon Engineering Corporation Site
Plymouth, Massachusetts**

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
Inadequate Access Controls	Replace/maintain northern shoreline perimeter fence	property owner	EPA	12/2008
Site Redevelopment for a Restricted Use (*)	Submit Reuse Plan to EPA/MassDEP and perform a new risk assessment with new data.	property owner	EPA/ MassDEP	Prior to redevelopment of the Site.
Site Redevelopment for an Unrestricted Use(*)	Submit a Reuse Plan to EPA/MassDEP; which will determine if additional sampling and additional risk assessment are required.	property owner	EPA/ MassDEP	Prior to redevelopment of the Site.

(*) – Refer to the deed restriction included in Appendix E

10.0 PROTECTIVENESS STATEMENTS

The remedy is protective in the short-term; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken:

- The northern and northeastern shoreline perimeter Site fence must be reconstructed and maintained to provide complete access controls around the property.
- If the Site is to be developed for a restricted use as stated in the deed restriction, additional soil data must be collected in accordance with an EPA-approved soil sampling and management program designed for risk assessment purposes. A new risk assessment must be completed using the new data, updated methods, and updated exposure assumptions based on any of the proposed Site uses to confirm that the exposures remain within the protective range.

- Prior to commencement of any Site redevelopment activities, a detailed redevelopment plan must be submitted to EPA and MassDEP. This plan should include a statement of the proposed work, Site activities, and information pertaining to environmental monitoring procedures, health and safety measures, and soil management activities to ensure worker and public safety during construction.
- Since exposure scenarios and toxicity values have been modified since the original samples were collected; soil sample collection and an updated risk assessment must be completed prior to any redevelopment of the Site (including commercial/industrial development). All additional soil data must be collected in accordance with an EPA-approved soil sampling and management program designed for risk assessment purposes and procedures in place at that time. To ensure that these requirements are met, EPA will initiate further discussions with the Site owner.

If the site remains undeveloped, no sampling or risk assessment is required.

11.0 NEXT REVIEW

A fifth five-year review for the Plymouth Harbor Site will be conducted in 2013.

APPENDIX A
DOCUMENT REVIEW LIST/REFERENCES

DOCUMENTS REVIEWED/REFERENCES CITED

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

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

Carter, J. 1977. *Executive Order 11988, Floodplains Management 42 F.R. 26951*. May 24.

Carter, J. 1977. *Executive Order 11990, Protection of Wetlands 42 F.R. 26961*. May 24.

Carter, J. 1979. *Executive Order 12148, Federal Emergency Management 44 FR 42957*. July 20.

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

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

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

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

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

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

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

Plymouth, 2008. *Town of Plymouth Tax Assessors Map No. 1*, January 1.

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

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

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

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

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

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

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

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

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

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

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

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.

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

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

USEPA, 2001d. *Letter from Derrick Golden, USEPA, to Attorney Fasanella regarding letters dated September 27, 200 & October 17, 2001 as well as conference call on September 17, 2001*, October 26.

USEPA, 2003. *Third Five-Year Review*. U.S. Environmental Protection Agency, Region I. September.

USEPA, 2004. *Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Interim Guidance*, July.

40 Code of Federal Regulations Part 264 Section 228, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; Subpart K – Surface Impoundments, Closure and Post-Closure Care

Title 42 U.S. Code, Chapter 103; Comprehensive Environmental Response, Compensation, and Liability.

APPENDIX B
SITE INSPECTION REPORT

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	O&M Documents	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> O&M manual	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> As-built drawings	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Maintenance logs	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks _____			

2.	Site-Specific Health and Safety Plan	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Contingency plan/emergency response plan	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks _____			

3.	O&M and OSHA Training Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks _____			

4.	Permits and Service Agreements	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Air discharge permit	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Effluent discharge	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Waste disposal, POTW	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Other permits _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks _____			

5.	Gas Generation Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	Remarks _____			

6.	Settlement Monument Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	Remarks _____			

7.	Groundwater Monitoring Records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks _____			

8.	Leachate Extraction Records	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	Remarks _____			

9.	Discharge Compliance Records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Water (effluent)	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks _____			

10.	Daily Access/Security Logs	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	Remarks _____			

IV. O&M COSTS

1. O&M Organization

- | | |
|--|--|
| <input type="checkbox"/> State in-house | <input type="checkbox"/> Contractor for State |
| <input type="checkbox"/> PRP in-house | <input checked="" type="checkbox"/> Contractor for PRP |
| <input type="checkbox"/> Federal Facility in-house | <input type="checkbox"/> Contractor for Federal Facility |
| <input type="checkbox"/> Other _____ | |

2. O&M Cost Records

- Readily available Up to date
 Funding mechanism/agreement in place
Original O&M cost estimate _____ Breakdown attached

Total annual cost by year for review period if available

From _____ To _____	_____	<input type="checkbox"/> Breakdown attached
Date Date	Total cost	
From _____ To _____	_____	<input type="checkbox"/> Breakdown attached
Date Date	Total cost	
From _____ To _____	_____	<input type="checkbox"/> Breakdown attached
Date Date	Total cost	
From _____ To _____	_____	<input type="checkbox"/> Breakdown attached
Date Date	Total cost	

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS Applicable N/A

A. Fencing

1. **Fencing damaged** Location shown on Site map Gates secured N/A
Remarks: Snow fencing damaged along northeastern property boundary

B. Other Access Restrictions

1. **Signs and other security measures** Location shown on site map N/A
Remarks: _____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented Yes No N/A
Site conditions imply ICs not being fully enforced Yes No N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____

Name	Title	Date	Phone no.
------	-------	------	-----------

Reporting is up-to-date Yes No N/A
Reports are verified by the lead agency Yes No N/A

Specific requirements in deed or decision documents have been met Yes No N/A
Violations have been reported Yes No N/A
Other problems or suggestions: Report attached
Damage to fencing may impact protectiveness of this remedy, repair to the fencing is advised

2. **Adequacy** ICs are adequate ICs are inadequate N/A
Remarks _____

D. General

1. **Vandalism/trespassing** Location shown on site map No vandalism evident
Remarks _____

2. **Land use changes on site** N/A
Remarks _____

3. **Land use changes off site** N/A
Remarks _____

VI. GENERAL SITE CONDITIONS

A. Roads Applicable N/A

1. **Roads damaged** Location shown on site map Roads adequate N/A
Remarks _____

B. Other Site Conditions		
Remarks _____ _____ _____ _____ _____		
VII. LANDFILL COVERS <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
A. Landfill Surface		
1.	Settlement (Low spots) Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Settlement not evident <input type="checkbox"/> Depth _____
2.	Cracks Lengths _____ Widths _____ Depths _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Cracking not evident
3.	Erosion Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Erosion not evident
4.	Holes Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Holes not evident
5.	Vegetative Cover <input type="checkbox"/> Grass <input type="checkbox"/> Cover properly established <input type="checkbox"/> No signs of stress <input type="checkbox"/> Trees/Shrubs (indicate size and locations on a diagram) Remarks _____ _____	
6.	Alternative Cover (armored rock, concrete, etc.) <input checked="" type="checkbox"/> N/A Remarks _____ _____	
7.	Bulges Areal extent _____ Height _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map <input type="checkbox"/> Bulges not evident

8.	Wet Areas/Water Damage <input type="checkbox"/> Wet areas <input type="checkbox"/> Ponding <input type="checkbox"/> Seeps <input type="checkbox"/> Soft subgrade Remarks _____ _____	<input type="checkbox"/> Wet areas/water damage not evident <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Location shown on site map	Areal extent _____ Areal extent _____ Areal extent _____ Areal extent _____
9.	Slope Instability <input type="checkbox"/> Slides <input type="checkbox"/> Location shown on site map <input type="checkbox"/> No evidence of slope instability Areal extent _____ Remarks _____ _____		
B. Benches <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)			
1.	Flows Bypass Bench Remarks _____ _____	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay
2.	Bench Breached Remarks _____ _____	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay
3.	Bench Overtopped Remarks _____ _____	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> N/A or okay
C. Letdown Channels <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1.	Settlement Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of settlement
2.	Material Degradation Material type _____ Areal extent _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of degradation
3.	Erosion Areal extent _____ Depth _____ Remarks _____ _____	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of erosion

4.	Undercutting	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> No evidence of undercutting
	Areal extent _____	Depth _____	
	Remarks _____		
<hr/>			
5.	Obstructions	Type _____	
	<input type="checkbox"/> No obstructions		
	<input type="checkbox"/> Location shown on site map	Areal extent _____	
	Size _____		
	Remarks _____		
<hr/>			
6.	Excessive Vegetative Growth	Type _____	
	<input type="checkbox"/> No evidence of excessive growth		
	<input type="checkbox"/> Vegetation in channels does not obstruct flow		
	<input type="checkbox"/> Location shown on site map	Areal extent _____	
	Remarks _____		
<hr/>			
D. Cover Penetrations <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A			
1.	Gas Vents	<input type="checkbox"/> Active <input type="checkbox"/> Passive	
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance
	<input checked="" type="checkbox"/> N/A		
	Remarks _____		
<hr/>			
2.	Gas Monitoring Probes		
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance <input checked="" type="checkbox"/> N/A
	Remarks _____		
<hr/>			
3.	Monitoring Wells (within surface area of landfill)		
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance <input checked="" type="checkbox"/> N/A
	Remarks _____		
<hr/>			
4.	Leachate Extraction Wells		
	<input type="checkbox"/> Properly secured/locked	<input type="checkbox"/> Functioning	<input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition
	<input type="checkbox"/> Evidence of leakage at penetration		<input type="checkbox"/> Needs Maintenance <input checked="" type="checkbox"/> N/A
	Remarks _____		
<hr/>			
5.	Settlement Monuments	<input type="checkbox"/> Located	<input type="checkbox"/> Routinely surveyed <input checked="" type="checkbox"/> N/A
	Remarks _____		
<hr/>			

E. Gas Collection and Treatment			<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Gas Treatment Facilities	<input type="checkbox"/> Flaring	<input type="checkbox"/> Thermal destruction	<input type="checkbox"/> Collection for reuse
		<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
	Remarks _____			
2.	Gas Collection Wells, Manifolds and Piping	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	
	Remarks _____			
3.	Gas Monitoring Facilities (<i>e.g.</i> , gas monitoring of adjacent homes or buildings)	<input type="checkbox"/> Good condition	<input type="checkbox"/> Needs Maintenance	<input checked="" type="checkbox"/> N/A
	Remarks _____			
F. Cover Drainage Layer			<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Outlet Pipes Inspected	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
	Remarks _____			
2.	Outlet Rock Inspected	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
	Remarks _____			
G. Detention/Sedimentation Ponds			<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Siltation	Areal extent _____	Depth _____	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Siltation not evident			
	Remarks _____			
2.	Erosion	Areal extent _____	Depth _____	
	<input type="checkbox"/> Erosion not evident			
	Remarks _____			
3.	Outlet Works	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
	Remarks _____			
4.	Dam	<input type="checkbox"/> Functioning	<input checked="" type="checkbox"/> N/A	
	Remarks _____			

H. Retaining Walls <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
1.	Deformations <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Deformation not evident Horizontal displacement _____ Vertical displacement _____ Rotational displacement _____ Remarks _____ _____	
2.	Degradation <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Degradation not evident Remarks _____ _____	
I. Perimeter Ditches/Off-Site Discharge <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
1.	Siltation <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Siltation not evident Areal extent _____ Depth _____ Remarks _____ _____	
2.	Vegetative Growth <input type="checkbox"/> Location shown on site map <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Vegetation does not impede flow Areal extent _____ Type _____ Remarks _____ _____	
3.	Erosion <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Erosion not evident Areal extent _____ Depth _____ Remarks _____ _____	
4.	Discharge Structure <input type="checkbox"/> Functioning <input checked="" type="checkbox"/> N/A Remarks _____ _____	
VIII. VERTICAL BARRIER WALLS <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A		
1.	Settlement <input type="checkbox"/> Location shown on site map <input type="checkbox"/> Settlement not evident Areal extent _____ Depth _____ Remarks _____ _____	
2.	Performance Monitoring Type of monitoring _____ <input type="checkbox"/> Performance not monitored Frequency _____ <input type="checkbox"/> Evidence of breaching Head differential _____ Remarks _____ _____	

C. Treatment System		<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> N/A
1.	Treatment Train (Check components that apply) <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation <input type="checkbox"/> Air stripping <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Filters _____ <input type="checkbox"/> Additive (e.g., chelation agent, flocculent) _____ <input type="checkbox"/> Others _____ <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> Sampling ports properly marked and functional <input type="checkbox"/> Sampling/maintenance log displayed and up to date <input type="checkbox"/> Equipment properly identified <input type="checkbox"/> Quantity of groundwater treated annually _____ <input type="checkbox"/> Quantity of surface water treated annually _____ Remarks _____ _____		
2.	Electrical Enclosures and Panels (properly rated and functional) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____		
3.	Tanks, Vaults, Storage Vessels <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input checked="" type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs Maintenance Remarks _____ _____		
4.	Discharge Structure and Appurtenances <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs Maintenance Remarks _____ _____		
5.	Treatment Building(s) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored Remarks _____ _____		
6.	Monitoring Wells (pump and treatment remedy) <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs Maintenance <input type="checkbox"/> N/A Remarks _____ _____		
D. Monitoring Data			
1.	Monitoring Data <input type="checkbox"/> Is routinely submitted on time <input type="checkbox"/> Is of acceptable quality		
2.	Monitoring data suggests: <input type="checkbox"/> Groundwater plume is effectively contained <input type="checkbox"/> Contaminant concentrations are declining		

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

Photo Number: 1 – Facing WNW of main site entrance and glass crushing facility

Date: July 24, 2008



Photo Number: 2 – SE corner of property, showing locked gate.

Date: July 24, 2008



Photo Number: 3 – Facing WNW along southern fence line of typical site overgrowth. Date: July 24, 2008



Photo Number: 4 – Facing NE of concrete area and berm for Tank 2.

Date: July 24, 2008



Photo Number: 5 – Facing S within Tank 1/2 berm, standing in Tank 2 excavation

Date: July 24, 2008



Photo Number: 6 – Facing SE of excavation in berm edge near Tank 1 area.

Date: July 24, 2008



Photo Number: 7 – Area of sulficial coal slag.

Date: July 24, 2008



Photo Number: 8 – Facing N of foundation of razed structure.

Date: July 24, 2008



Photo Number: 9 – Facing N from Tank 3 over downed fence.

Date: July 24, 2008



Photo Number: 10 – Facing south; snow fence down in areas.

Date: July 24, 2008



Photo Number: 11 – Facing SW showing downed fence, ruins, and MW-2.

Date: July 24, 2008



Photo Number: 12 – Facing NNW of vegetation within Tank 3 excavation.

Date: July 24, 2008



Photo Number: 13 – Facing W of existing abutting structures.

Date: July 24, 2008



APPENDIX C
INTERVIEW LIST

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Joseph Jannetty	Principal/Property Owner	JANCO Development, LLC	7/24/2008
Name	Title/Position	Organization	Date
William Rudolph	Property Manger	Cordage Commerce Center	7/24/2008
Name	Title/Position	Organization	Date
Derrick Golden	Task Order Project Manager	USEPA	7/28/2008
Name	Title/Position	Organization	Date
(Information exchanged throughout the course of the project; date cited was a communication informing Mr. Golden of the Site status.)			
Jay Naparstek	Chief-Bureau of Wastesite Cleanup	MADEP	8/6/2008
Name	Title/Position	Organization	Date
Various Individuals	--	Town of Plymouth Economic Development/Planning Department, Building Department, and Zoning Board of Appeals	8/11/2008
Name	Title/Position	Organization	Date

INTERVIEW RECORD

Site Name: Cannon Engineering/Plymouth Harbor		EPA ID No.: MAD980525232	
Subject: Fourth Five-Year Review		Time: 10:00 am	Date: 7/24/08
Type: Telephone Visit Other	Incoming Outgoing		
Location of Visit: Plymouth, MA			

Contact Made By:

Name: Denis McGrath	Title: Project Scientist	Organization: Nobis Engineering, Inc.
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Individual Contacted:

Name: Joseph Jannetty	Title: Principal	Organization: JANCO Development, LLC
Telephone No: 508-747-8822	Street Address: 10 Cordage Park Cir. Suite 235	
Fax No:	City, State, Zip: Plymouth, MA 02360	
E-Mail Address:		

Summary Of Conversation

Q1: Has there been any environmental sampling since the previous five year review?
A1: No additional sampling completed.

Q2: What are the redevelopment plans for the Site?
A2: At the moment, Mr. Jannetty has entertained the idea of clearing and grading the Site for use as a boat storage yard to expand the Plymouth Boat Yard's storage capacity.

Q3: Has there been any flooding/fires in the previous five years?
A3: No.

Q4: What are the redevelopment plans for abutting property?
A4: The master plan for the area is to raze the existing vacant buildings and construct condominiums along the waterfront.

INTERVIEW RECORD

Site Name: Cannon Engineering/Plymouth Harbor	EPA ID No.: MAD980525232
--	---------------------------------

Subject: Fourth Five-Year Review	Time: 10:00 am	Date: 7/24/08
---	-----------------------	----------------------

Type: Telephone Visit Other	Incoming Outgoing
Location of Visit: Plymouth, MA	

Contact Made By:

Name: Denis McGrath	Title: Project Scientist	Organization: Nobis Engineering, Inc.
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Individual Contacted:

Name: William Rudolph	Title: Property Manager	Organization: Cordage Commerce Center
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Telephone No: 508-746-7707	Street Address: 10 Cordage Park Cir.
Fax No:	City, State, Zip: Plymouth, MA 02360
E-Mail Address:	

Summary Of Conversation

Q1: Has there been any environmental sampling since the previous five year review?
A1: No additional sampling completed.

Q2: Has there been any evidence of trespassing at the Site?
A2: No, not at the Site, but in surrounding properties, yes.

INTERVIEW RECORD

Site Name: Cannon Engineering/Plymouth Harbor	EPA ID No.: MAD980525232
Subject: Fourth Five-Year Review	Time: 15:30 PM Date: 8/6/08
Type: X Telephone Visit Other	Incoming Outgoing X
Location of Visit:	

Contact Made By:

Name: Denis McGrath	Title: Project Scientist	Organization: Nobis Engineering, Inc.
----------------------------	---------------------------------	--

Individual Contacted:

Name: Jay Naparstek	Title: Chief-Bureau of Waste Site Cleanup	Organization: MADEP
Telephone No: 617-292-5697	Street Address: One Winter Street; 2nd Floor	
Fax No:	City, State, Zip: Boston, MA 02180	
E-Mail Address:		

Summary Of Conversation

Q1: Have any public interest or other public groups approached MADEP regarding the Site?
A1: No, not recently and certainly not within the previous 5 years.

Q2: Does the State have any concerns regarding the Site?
A2: Not at the moment as there has not been much activity at the Site in many years.

Q3: Does the State feel well-informed about the Site?
A3: Yes, especially since there has been little activity at the Site. The MADEP requests that additional lead-time be provided prior to completing the Site walk, so as to allow MADEP personnel to participate.

Q4: Are there any issues or is there anything MADEP would request EPA do regarding management of the Site?
A4: No.

Mr. Naparstek was updated on the status of the Site, the observations made during the Site walk, and the possibility that the Site may be redeveloped at some time into a boat storage facility (though this is not even in the planning stages yet, just a concept).

INTERVIEW RECORD

Site Name: Cannon Engineering/Plymouth Harbor		EPA ID No.: MAD980525232	
Subject: Fourth Five-Year Review		Time: 14:00	Date: 8/11/08
Type: X Telephone Visit Other		Incoming Outgoing X	
Location of Visit:			

Contact Made By:

Name: Denis McGrath	Title: Project Scientist	Organization: Nobis Engineering, Inc.
----------------------------	---------------------------------	--

Individual Contacted:

Name: Various Individuals	Title: --	Organization: Plymouth Economic Development/Planning Department, Zoning Board of Appeals, and Building Department
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Telephone No: 508-747-1620	Street Address: 11 Lincoln Street
Fax No:	City, State, Zip: Plymouth, MA 02360
E-Mail Address:	

Summary Of Conversation

Q1: Is the Economic Development/Planning Department aware of any proposed development at the Site?
A1: No, there are no proposed plans on file with the Department. There also is nothing on file with the Zoning Board of Appeals.

Q2: Is the Building Department aware of any proposed development at the Site?
A2: The Building Department stated that there were no proposed plans on-file for the Site.

Individual names of the department representatives were not obtained.

APPENDIX D
RISK ASSESSMENT MEMORANDUM



To: Scott Harding
Nobis Engineering, Inc.

From: Cynthia Woods
Avatar Environmental, LLC.

Date: July 28, 2008

Subject: Addendum to Plymouth Harbor/Cannon Engineering Corporation Five-Year Review

I have reviewed the 1998 "Second Five-year Review" and the 2003 "Third Five-year Review" for Cannons Engineering Corporation, Plymouth Harbor Superfund Site, Plymouth, Massachusetts, the addendum provided by Sarah Levinson of EPA Region 1, as Attachment 4 to the Second Five-year Review, and the addendum provided by myself, formerly of TetraTech NUS, as Appendix D to the Third Five-year Review.

As Sarah pointed out in 1998 the original data collected at Cannon 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. Similarly, I performed updated risk calculations for the third year review.

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 previous two five-year reviews. 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 two five-year reviews. 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 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 July 2004 (EPA, 2004). 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 had undergone some revisions between Sarah's assessment and the 2003 review, but have not changed since. These changes were incorporated in the 2003 review.

The presumed scenarios for this site are an adult commercial worker and an older child trespasser.

The previous two reviews utilized recommended default exposure frequencies and exposure durations for evaluations of exposures to industrial/commercial workers provided by EPA since the 1989 Endangerment Assessment to update risk calculations for industrial/commercial workers. These default exposure assumptions have not changed since the last five-year review.

Since the previous five-year review, EPA has updated its *Guidelines for Carcinogen Risk Assessment* (EPA, 2005a) and issued *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA, 2005b). The later provides new direction on evaluating cancer risks to children from exposures to carcinogens that act via a mutagenic mode of action. Carcinogenic PAHs are considered to act via a mutagenic mode of action. As such an age-dependent adjustment factor of 10 for children less than 2 years of age or 3 for children between 2 and 16 years of age is applied to cancer risk calculations. This guidance does not impact calculations of risks to industrial/commercial workers or calculations of non-cancer hazard indices for older child trespassers at this site, but does impact calculations of cancer risks to older child trespassers.

The Endangerment Assessment presented risk calculations 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 and prior reviews are summarized in Table 1, attached to this memorandum.

In light of the *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA, 2005b), and to address the stated older child trespasser scenario, cancer risk computations are provided below for older child trespassers potentially exposed via dermal contact and ingestion pathways. 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 and this review. This minor difference has little impact on the calculations presented below.



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.

Incidental Soil Ingestion Exposure Assumptions:

Older child and adult soil ingestion rate: 100 mg/event

Older child exposure frequency: 50 days/year

Older child exposure duration: 10 years

Older child body weight: 45 kg

Exposed carcinogenic PAH concentration: 49 mg/kg (highest composite)

Older Child Trespasser Soil Ingestion Cancer Risk for cPAHs =

$$\frac{7.3 \text{ (mg/kg-day)}^{-1} \times 3 \times 49 \text{ mg cPAHs/kg soil} \times 100 \text{ mg/kg} \times 10^{-6} \text{ kg soil/mg soil} \times 50 \text{ events/yrs} \times 10 \text{ yr}}{45\text{kg} \times 365 \text{ days/yr} \times 70 \text{ yr}}$$

Older Child Trespasser Soil Ingestion Cancer Risk for cPAHs = 4.7×10^{-5}

Dermal Contact Exposure Assumptions:

Dermal absorption cPAHs: 0.13

Older child exposed surface area: 4,650 cm²/day

Older child soil adherence factor: 0.4 mg/cm²

Older child exposure frequency: 50 days/year

Older child exposure duration: 10 years

Older child body weight: 45 kg

Exposed carcinogenic PAH concentration: 49 mg/kg (highest composite)

Older Child Trespasser Soil Dermal Contact Cancer Risk for cPAHs =

$$\frac{7.3 \text{ (mg/kg-day)}^{-1} \times 3 \times 49 \text{ mg cPAHs/kg soil} \times 0.13 \times 4650 \text{ cm}^2/\text{day} \times 0.4 \text{ mg soil/cm}^2 \times 10^{-6} \text{ kg soil/mg soil} \times 50 \text{ events/yr}}{45\text{kg} \times 365 \text{ days/yr} \times 70 \text{ yr}} \times 10 \text{ yr}$$

Older Child Trespasser Soil Dermal Contact Cancer Risk for cPAHs = 1.1×10^{-4}

Combined risk for Trespasser exposure to cPAHs (ingestion + dermal) = 1.6×10^{-4}

The combined cancer risk estimate for an older child trespasser is at the high end of the acceptable range, slightly above EPA’s target cancer risk range of 1×10^{-4} to 10^{-6} . EPA considers the older child trespasser exposure as within the protective range, based on current exposure assumptions and the use of data over 20 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.

References:

EPA, 2004. *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* U.S. Environmental Protection Agency, Washington, DC, EPA/540/R/99/005, July 2004.

EPA, 2005a. *Guidelines for Carcinogen Risk Assessment*, U.S. Environmental Protection Agency, Risk Assessment Forum, National Center for Environmental Assessment, Washington, DC. EPA/630/P-03/001F, March 2005.



EPA, 2005b. *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens*, U.S. Environmental Protection Agency, Washington, DC, EPA/630/R-03/003F, March 2005.

Sincerely,

A handwritten signature in cursive script that reads "Cynthia L. Woods".

Cynthia Woods

Senior Risk Assessor

Cc: S. Harding (Nobis Engineering)
J. Walsh (Avatar Environmental)

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

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 AND RATES

Exposure Assumptions for Soil Ingestion and Dermal Contact Older child/trespasser soil	Value	Reference
Older child/trespasser soil ingestion rate	100 mg/event	2
Dermal absorption cPAHs	0.13	1
Older child exposed surface area	4,650 cm ² /day	3
Older child soil adherence factor	0.4 mg/cm ²	1
Older child exposure frequency	50 days/year	4
Older child exposure duration	10 years	4
Body weight – older child	45 kg	3
Exposed cPAH concentration	49 mg/kg	5

* References:

1. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final Guidance (July 2004).
2. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, USEPA, OSWER 9355.4-24 (March 2001) and estimates of RME exposure.
3. Exposure Factors Handbook Volume I, USEPA, EPA/600/P-95/002Fa (August 1997).
4. Professional judgment.
5. USEPA, 1998, Attachment 4.

APPENDIX E
DECLARATION OF RESTRICTIONS

Received & Recd
PLYMOUTH COUNTY
REGISTRY OF DEEDS
21 APR 1992 103
JOHN D. RICHARD
REGISTER

892-194

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 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 was 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,

mail

John G. Casagrande, Jr.
Palmer & Dodge
One Beacon St.

Boston, MA 02108

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 from 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 of the Town of Plymouth, SWT hereby grants the following restrictions to the USEPA, its successors and assigns, and 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 soil 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 assessments 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 additional 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, determines 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

SWT or its successors or assigns. Such action shall be performed in accordance with CERCLA, the NCP, and all other applicable federal and state laws and regulations. Following completion of such response action, SWT or its successors or assigns shall submit to USEPA and MADEP a written report signed by a professional engineer certifying that such action has been fully performed and completed. Within 120 days after receipt of such written report and certification, USEPA, in consultation with MADEP, shall certify, in a form recordable by SWT or its successors or assigns, one of the following: (i) that the portion of the Premises proposed to be used for such Restricted Use may be used without limitation or restriction, effective upon the recording of such certification in Deeds; (ii) that additional work must be performed in order to complete the response action; or (iii) that USEPA and MADEP require a reasonable additional period of time or additional information in order to review the performance of the response action. Failure by USEPA to provide such certification within 120 days shall not constitute a determination that the portion of the Premises proposed to be used for such Restricted Use may be used without limitation or restriction.

(2) Nothing contained in this Declaration of Restrictions is intended to limit or restrict or otherwise effect use of the

Premises for any commercial, industrial or other use now or hereafter permitted under Section 401.16 (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 purposes 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 soil 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.

Executed as a sealed instrument this 16th day of April, 1992.

SALT WATER TRUST

By Arthur B. Blackett
Arthur B. Blackett, Trustee

By Konrad Gesner
Konrad Gesner, Trustee

By Francis C. Rogerson, Jr.
Francis C. Rogerson, Jr., Trustee

COMMONWEALTH OF MASSACHUSETTS

Plymouth, ss.

April, 1992

On this 16th day of April, 1992, before me appeared Arthur F. Blackett, Konrad Gesner and Francis C. Rogerson, Jr., to me personally known, who, being by me duly sworn, did say that they are Trustees of Salt Water Trust, and that said instrument was signed on behalf of Salt Water Trust as their free act and deed.

Carroll Ann Veneiros
Notary Public
My commission expires: June 5, 1998

Rec'd April 21 1992 at 3:24 PM and recorded.
The foregoing is a true copy from the
Plymouth County Registry of Deeds,
Instrument # 40583

Attest:

John B. Larkin Register

APPENDIX F
PUBLIC NOTIFICATION

EPA Starts 'Five-Year Review' of Plymouth Harbor/Cannons Engineering Corp Superfund Site

The U.S. Environmental Protection Agency (EPA) is beginning its fourth Five-Year Review of the Plymouth Harbor/Cannons Engineering Corp Superfund Site, Plymouth, MA. Five-Year Reviews are required by law and occur every five years. The reviews determine if the cleanup is protective of human health and the environment. This Five-Year Review will be completed by September 30, 2008 and the results will be publicly available.

This five-year review is a comprehensive evaluation of the cleanup activities which may include interviewing local officials and community members, checking current site conditions, assessing records and reports and reviewing site redevelopment plans.

The Plymouth Harbor/Cannons Engineering Corp Superfund Site cleanup plan included removal and disposal of hazardous waste and storage tanks and associated piping, and soil excavation. Once removal was completed, EPA sampled soil, groundwater, surface water and sediments to confirm that cleanup goals were met. The cleanup actions at the site were based on levels which are protective of commercial/industrial redevelopment only. Deed restrictions were put in place to prevent the site from being redeveloped for residential uses. The site was deleted from the National Priority List on November, 19, 1993.

Contaminants at the site included polynuclear aromatic hydrocarbons (PAH), pesticides, lead and some metals.

More information about the cleanup can be found on-line at www.epa.gov/region1/superfund/sites/plymouth or at the Plymouth Public Library, 132 South Street, Plymouth, MA, 02360



For more information, contact:
Derrick Golden Toll Free 1-
888-372-7341, ext. 81448
golden.derrick@epa.gov
www.epa.gov/region1/superfund/sites/plymouth

APPENDIX G

RISK CALCULATIONS FOR SOIL OUTSIDE BERMED AREAS

Email Correspondence:

To: Golden.Derrick@epamail.epa.gov

From: Suggatt.Rick@epamail.epa.gov

RE: Calculation of Risk Outside of Bermed Areas

I calculated the ingestion and dermal risks of 2 mg/kg carcinogenic PAH in soil to a child age 6 to 16. The following assumptions were made, based on the assumptions in the original Endangerment Assessment for exposure duration (10 years) and exposure frequency (50 days/yr) and current EPA guidance concerning incidental ingestion and dermal exposure:

Exposure Duration = 10 years

Exposure Frequency = 50 days/yr

Body Weight = 43 kg (average for males and females age 6 to 16) All PAH was benzo(a)pyrene Skin surface area = 12,000 cm² (50% of total average surface area for males and females age 6-16) Soil adherence factor = 0.2 mg/cm²-event Dermal Absorption Fraction = 0.1 Oral slope factor = 7.3 per mg/kg-day (IRIS value for benzo(a)pyrene

The results are that the elevated lifetime cancer risk is 6.6E-07 for ingestion and 1.6E-06 for dermal, for a total cancer risk of 2.3E-06.

This is similar to the risks calculated in the Endangerment Assessment.

This is conservative because all of the PAHs were assumed to be benzo (a)pyrene, the most carcinogenic PAH.

(See attached file: Soil PAH risks.xls)

Soil risks

Cannon Engineering Corp-Plymouth Harbor Superfund Site

Ingestion of PAH (assumed 100% benzo(a)pyrene)

Csoil (mg/kg)	IR (mg/d)	EF day/yr	ED yr	CF (kg/mg)	BW (kg)	AT (days)	LADD (mg/kg/day)	SF (mg/kg/day) ⁻¹	ELCR
2	100	50	10	1.00E-06	43	25550	9.10E-08	7.3	6.64E-07

$LADD = C_{soil} * IR * EF * ED * CF * 1/BW * 1/AT$

$ELCR = LADD * SF$

Csoil = concentration in soil

IR = Ingestion Rate

EF = Exposure Frequency

ED = Exposure Duration

CF = Conversion Factor

BW = Body Weight

AT = Averaging Time

LADD = Lifetime Average Daily Dose

SF = Slope Factor

ELCR = Elevated Lifetime Cancer Risk

Soil risks

Cannon Engineering Corp-Plymouth Harbor Superfund Site

Dermal exposure to soil PAH (assumed 100% benzo(a)pyrene)

Csoil (mg/kg)	CF (mg/kg)	AF (mg/cm ² -event)	ABSd (unitless)	DA-event (mg/cm ² -event)	EF (d/yr)	ED (yr)	EV (event/d)	SA (cm ²)	BW (kg)	AT (days)	DAD (mg/kg-day)	SF (mg/kg/d) ⁻¹	ELCR (unitless)
2	1.00E-06	0.2	0.1	4.00E-08	50	10	1	12000	43	25550	2.18E-07	7.3	1.59E-06

DA event = Csoil * CF * AF * ABSd

DAD = DA-event * EF * ED * EV * SA *1/BW* 1/AT

ELCR = DAD * SF

Csoil = concentration in soil

CF = Conversion Factor

AF = Adherence Factor

ABSd = dermal absorption fraction

DA-event = absorbed dose per event

DAD = Dermal Absorbed Dose

SA = Surface Area

EV = event frequency

ED = Exposure Duration

BW = Body Weight

AT = Averaging Time

ELCR = Elevated Lifetime Cancer Risk