RECORD OF DECISION SUMMARY

NEW BEDFORD HARBOR/
HOT SPOT OPERABLE UNIT

NEW BEDFORD, MASSACHUSETTS

APRIL 1990

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

Site Name and Location

New Bedford Harbor/Hot Spot Area
New Bedford, Massachusetts

Statement of Purpose

This Decision Document presents the selected remedial action for this Site developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and to the extent practicable, the National Contingency Plan (NCP), 40 CFR Part 300 et seq., 50 Federal Register 47912 (November 20, 1985).

The Commonwealth of Massachusetts concurs with the selected remedy. A copy of the concurrence letter is included as Appendix C.

Statement of Basis

This decision is based on the Administrative Record which was developed in accordance with Section 113 (k) of CERCLA and which is available for public review at the information repositories located at the New Bedford Free Library, in New Bedford, Massachusetts, and at the EPA offices at 90 Canal Street in Boston, Massachusetts. Appendix B to this document identifies the items contained in the Administrative Record upon which the selection of this remedial action is based.

Assessment of the Site

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

Description of the Selected Remedy

The selected remedial action for the New Bedford Site/Hot Spot Area is the Hot Spot Operable Unit, the first of two operable units planned for the New Bedford Harbor Superfund Site. The Hot Spot Operable Unit consists of source control measures, which will also control the continuing migration of contaminants from the Hot Spot to other portions of the Site. The major components of the Hot Spot remedial measures include:

- *Dredging*. Approximately 10,000 cubic yards of contaminated sediments will be removed using a cutterhead dredge. Dredging will occur in the Hot Spot Area at depths of up to four feet to remove sediments with PCB concentrations of 4,000 ppm or greater. Various control options will be used to minimize and control sediment resuspension.

- *Transportation and Dewatering*. The dredged sediments will be transported to the Pilot Study cove area by a floating hydraulic pipeline, where the sediments will be dewatered. Effluent produced during the dewatering process will be treated to reduce PCBs and heavy metals using best available control technology prior to discharge back into the Harbor.

- *Incineration*. The dewatered sediments will be incinerated in a transportable incinerator that will be sited at the Pilot Study cove area. The extremely high temperatures achieved by the incinerator will result in 99.9999% destruction of PCBs. Exhaust gases will be passed through air pollution control devices before being released into the atmosphere to ensure that appropriate health and safety and air quality requirements are met.

- *Stabilization*. Following incineration, the Toxicity Characteristic Leaching Procedure (TCLP), a leaching test, will be performed on the ash to determine if it exhibits the characteristic of toxicity and is, therefore, considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA). If the TCLP test reveals that the ash is a RCRA hazardous waste, the ash will be solidified such that metals no longer leach from the ash at concentrations that exceed the standards set forth for determining the toxicity of a material.

During remedial activities, (solidified) ash will be temporarily stored in an area adjacent to the existing Confined Disposal Facility (CDF), a containment structure built on the New Bedford Harbor shoreline during previous Site studies. Following completion of the remedial activities, the (solidified) ash will be stored in the secondary cell of the CDF. Storage of the treated material will comply with the solid waste requirements. Ultimate disposition of this material will be addressed in the second operable unit for the Site.

Sediment removal and incineration will provide significant progress toward long-term protection of public health and the environment. Incineration is a proven technology that permanently destroys PCBs and is readily implementable for this volume of material. The selected remedy will permanently reduce the mobility, toxicity and volume of PCBs in the Hot Spot and will also reduce the amount of PCBs and heavy metals affecting the remainder of the Harbor. Short-term protection will be achieved by engineering controls to limit the emission of contaminants during excavation and treatment.

This interim action will comply with levels or standards of control equivalent to legally applicable or relevant and appropriate standards, requirements, criteria, or limitations (ARARs) specific to this action, including but not limited to, operation of the incinerator. However, this interim action will not attain certain levels or standards of control that might be ARARs. This interim remedial action is only part of a total remedial action that will attain ARARs when completed.

Declaration

This interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements directly associated with this action, and is cost-effective. This action utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and this action satisfies the statutory preference for treatment as a principal element of the remedy. This action does not, however, constitute the final remedy for the entire New Bedford Harbor Site. Subsequent actions are planned to address fully the remaining threats posed by this Site.

April 6, 1990
Date

Julie Belaga
Julie Belaga
Regional Administrator
EPA Region I

NEW BEDFORD HARBOR/
HOT SPOT OPERABLE UNIT

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I. SITE NAME, LOCATION AND DESCRIPTION

New Bedford, Massachusetts, is a port city located at the head of Buzzards Bay, approximately 55 miles south of Boston (Figure 1). New Bedford is nationally known for its role in the development of the whaling industry in the early 1800's. Today, the harbor is home port to one of the largest commercial fishing fleets in the United States.

In the course of developing Feasibility Studies (FS) for the Site, EPA divided the Site into three geographical study areas: the Hot Spot Area, the Acushnet River Estuary, and the Lower Harbor and Upper Buzzards Bay (Figure 2). The Hot Spot is an area of approximately five acres located along the western bank of the Acushnet River Estuary, directly adjacent to an electrical capacitor manufacturing facility, the Aerovox facility. EPA has defined the Hot Spot as those areas where the sediment PCB concentration is 4,000 parts per million (ppm) or greater. PCB concentrations in this area range from 4,000 ppm to over 200,000 ppm. Contamination at levels of 4,000 ppm and greater are found at depths up to four feet, but for the most part, within the top two feet. In addition to PCBs, heavy metals (notably cadmium, chromium, copper, and lead) are found in the sediment. The remedial volume for this area is approximately 10,000 cubic yards of sediment, and it contains approximately 48 percent of the total PCB mass in sediment from the Estuary portion of the Site, and approximately 45 percent of the total PCB mass in sediment from the entire Site. Refer to Sections IV and V for further discussion of the Hot Spot, including the scope and role of the Hot Spot operable unit and site characteristics. The remainder of the Site to be addressed in a subsequent operable unit is described below.

The Acushnet River Estuary is an area of approximately 230 acres (excluding the Hot Spot), extending from the Wood Street Bridge to the north, to the Coggeshall Street Bridge to the south. Sediment PCB concentrations in this area (excluding the Hot Spot area) range from below detection to approximately 4,000 ppm. Sediment metals concentrations range from below detection to over 7,000 ppm.

The Lower Harbor area consists of approximately 750 acres, extending from the Hurricane Barrier, north to the Coggeshall Street Bridge. Sediment PCB concentrations range from below detection to over 100 ppm. Sediment metals concentrations range from below detection to approximately 3,000 ppm.

The Upper Buzzards Bay portion of the Site area extends from the Hurricane Barrier to the southern boundary of Fishing Closure Area III, and includes an area of approximately 17,000 acres. Sediment PCB concentrations here range from below detection up to 100 ppm in localized areas along the New Bedford shoreline near combined sewer and stormwater outfalls.

A more complete description of the Site can be found in Section 2 of the Feasibility Study.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Response History

In 1976, the U.S. Environmental Protection Agency (EPA) conducted a New England-wide survey for polychlorinated biphenyls (PCBs). During this survey, high levels of PCB contamination were discovered in the marine sediment over a widespread area of New Bedford Harbor. In addition to PCBs, heavy metals (notably cadmium, chromium, copper, and lead) were found in the sediment. The survey and subsequent field studies also revealed that PCB contamination was not limited to sediment. Marine biota were also affected. Concentrations of PCBs in fish and shellfish were found to be in excess of the U.S. Food and Drug Administration (FDA) tolerance limit of 5 parts per million (ppm) for edible tissue. (FDA has subsequently reduced the PCB tolerance level to 2 ppm in 1979.) In 1977, the Massachusetts Department of Public Health (DPH) issued a public warning against consumption of shellfish or bottom fish from within the harbor and eastern sections of Buzzard's Bay to protect public health.

As a result of the widespread PCB contamination and the accumulation of PCBs in marine biota, the Massachusetts Department of Public Health established three fishing closure areas in New Bedford Harbor in September 1979 (Figure 3). These closures remain in effect. Area I is closed to all fishing, including finfish, shellfish, and lobsters. Area II is closed to the taking of lobsters and bottom-feeding finfish, such as eels, flounders, scup, and tautog. Area III is closed to lobstering only. Closure of the New Bedford Harbor and upper Buzzards Bay area to lobstering has resulted in the loss of approximately 18,000 acres of productive lobstering ground.

Two electrical capacitor manufacturing facilities, the Aerovox facility and the Cornell-Dubilier Electronics facility located on the Harbor, were major users of PCBs from the time their operations commenced in the 1940s until 1978, when EPA banned the use of PCBs. These manufacturers released PCBs onto the adjoining shoreline mudflats of the plants and into New Bedford

Harbor, through discharged wastewaters containing PCBs and through alleged intentional dumping.

The New Bedford Harbor Site was added to the EPA Superfund National Priorities List (NPL) in July 1982. Also in 1982, the Coast Guard placed warning signs along the shoreline of the Site. These signs, written in both English and Portuguese, served to notify the public of the restrictions against fishing and swimming. Additional warning signs were installed by EPA and the City of New Bedford in 1984 and 1985.

Remedial Studies

Numerous investigations have been conducted over the last decade to physically characterize the New Bedford Harbor Site, to determine the extent of PCB and metals contamination, and to assess the fate and transport of these contaminants. The major studies are summarized below. Other investigations, which were used as reference material for these studies, have been made publicly available in the Administrative Record.

Remedial Action Master Plan (1983)

The results of studies completed through early 1983 were compiled into a Remedial Action Master Plan (RAMP) for the Site in May 1983. This assessment included an area-wide air monitoring program; a sediment PCB profile for the Estuary and the Harbor; biota sampling for the Estuary, Harbor and Bay; and a study of the contamination within the New Bedford sewer system. The plan included recommendations for studies to further define the nature and extent of contamination.

Acushnet River Estuary FS (1984)

The results and recommendations of the RAMP led to a "fast-track" Feasibility Study (FS) for the 200-acre estuary area north of the Coggeshall Street Bridge. Four of the five remedial options presented in this FS involved dredging of the contaminated sediments. During the public comment period, concerns were raised surrounding the ability to dredge the contaminated sediments without causing additional impacts, both short- and long-term. As a result, the remedy selection process was extended until studies could be completed to address these concerns.

Engineering Feasibility Study (1989)

To answer questions regarding the potential impacts of dredging the contaminated sediment, the Corps of Engineers was asked to complete a dredging and disposal study. This

Engineering Feasibility Study (EFS) was conducted by the Corps' Waterways Experiment Station. The EFS consisted of bench and field scale experiments to address sediment and contaminant releases during dredging, efficacy of shoreline and aquatic disposal locations, leachate production from disposal facilities, and physical/chemical sediment profiles.

Pilot Dredging and Disposal Study (1989)

The Pilot Dredging and Disposal study, an outgrowth of the EFS, was a field test of three dredges and two disposal techniques for 9,000 cubic yards of sediment from the Estuary. The focus of this study was an attempt to verify whether the dredging and disposal techniques could be implemented without causing releases that could adversely impact public health or the environment. Additionally, the study was used to determine the optimal operating parameters for the dredging equipment and to develop monitoring programs to detect and evaluate contaminant releases.

Hot Spot Feasibility Study (1989)

The Hot Spot Feasibility Study was completed for the Hot Spot Area of the Site. The response objectives and a summary of the alternatives evaluated are provided in Sections VIII and IX of this document.

Overall Feasibility Study (ongoing)

This feasibility study was designed to combine the previous studies described above and to address the Estuary and Lower Harbor/Bay areas of the New Bedford Site. This study is scheduled to be released in June 1990.

B. Enforcement History

A number of enforcement actions have been taken related to PCB contamination of New Bedford Harbor and adjacent properties. These actions are briefly summarized below.

Cornell-Dubilier Electronics, Inc. (Cornell-Dubilier) and EPA signed a consent agreement and final order under the Toxic Substances Control Act (TSCA) in May 1982 (TSCA Docket No. 81-1001). This agreement addressed PCB handling procedures, discharges and releases to the municipal sewer system and surrounding areas, and groundwater monitoring requirements. Subsequently, EPA issued an administrative order to Cornell-Dubilier under section 106 of CERCLA in September 1983 (Docket

No. 83-1047) regarding releases of PCBs into the municipal sewer system.

Aerovox Incorporated (Aerovox) signed a consent order under section 106 of CERCLA in May 1982 (Docket No. 81-964), regarding contamination on their property adjacent to the Harbor. This order called for a cut-off wall and cap system to isolate contaminated soil, groundwater monitoring, and maintenance requirements.

EPA issued an administrative order to the City of New Bedford under section 309 of the Clean Water Act in December 1982 (Docket No. 83-06), regarding violations of the City's National Pollutant Discharge Elimination System (NPDES) permitted discharge from the municipal wastewater treatment plant (WWTP) into the Harbor. EPA issued another administrative order to the City under section 106 of CERCLA in September 1983 (Docket No. 83-1048), regarding releases of PCBs into the municipal sewer system.

On December 9, 1983, the United States filed a complaint on behalf of the National Oceanic and Atmospheric Administration (NOAA) under section 107 of CERCLA, seeking damages for injury to natural resources in New Bedford Harbor from releases of PCBs. The next day, the Commonwealth of Massachusetts filed its own section 107 action. The cases have been consolidated. On February 28, 1984, the complaint was amended to include claims on behalf of EPA for recovery of response costs incurred or to be incurred, under section 107 of CERCLA and for injunctive relief under Section 106 of CERCLA and other environmental statutes.

The United States brought the action against six companies which, at various times, owned and/or operated one of the two electrical capacitor manufacturing plants adjacent to New Bedford Harbor. The two plants are located approximately two miles apart. One of the plants, the Aerovox plant, is at the northernmost end of the inner Harbor on the Acushnet River Estuary, where the Acushnet River flows into the Harbor. The other plant, the Cornell-Dubilier plant, is a short distance south (i.e., seaward of) a hurricane barrier, which separates the inner Harbor from the outer Harbor.

Those entities which are potentially liable for the damages to the Harbor and for EPA's response costs (the PRPs) have been involved throughout the RI/FS and remedy selection process. The PRPs submitted extensive comments during the public comment period. A summary of the PRPs' comments and EPA's responses to those comments are included in the Responsiveness Summary as Appendix A to this document. All of the PRPs' comments, the summary of the comments, and EPA's responses to the comments are included in the Administrative Record.

Additionally, the EPA held an informal public hearing in New Bedford on August 22, 1989 at the specific request of AVX Corporation (AVX), one of the PRPs. In response to EPA's Proposed Plan for remediation of the Hot Spot, AVX developed its own proposal for addressing contaminated sediments in the Hot Spot and Estuary. AVX requested an opportunity to present its proposal to the EPA and the State. EPA granted AVX such an opportunity at the August 22, 1989 meeting. The transcript of this hearing is included in Attachment B to the Responsiveness Summary.

III. COMMUNITY RELATIONS

Throughout the Site's history, community concern and involvement have been and continue to be high. Consistent with its statutory obligations, EPA has kept the local community and other interested parties apprised of the Site activities through its participation at numerous meetings and its dissemination of various press releases and fact sheets. In order to better communicate with the local Portuguese community, EPA produced Portuguese translations of all public information fact sheets and provided a translator at all public hearings and meetings.

Concerns in the bordering communities initially focused on potential public health impacts as a result of living near the Harbor or eating fish caught in the Harbor, potential impacts on the local fishing industry, and potential limitations on waterfront development activities. Community concerns now also include the environmental, economic and health impacts of remedial alternatives evaluated for the Hot Spot portion of the Site, and ensuring that, following Hot Spot remediation, remaining Harbor contamination will be addressed.

EPA has presented the plans for and the subsequent results of site investigations and feasibility studies at a series of public meetings sponsored by EPA and at regular meetings of the Greater New Bedford Community Work Group (CWG). EPA also awarded a $50,000 Technical Assistance Grant in November 1988 to the CWG to hire a consultant to review the studies conducted by EPA.

In June 1989, EPA made the Administrative Record available for public review at EPA's offices in Boston and at the New Bedford Public Library. EPA published a notice and a brief analysis of the Proposed Plan in two local newspapers of general circulation, The Standard Times and The Portuguese Times, on July 27, 1989. EPA also made the Proposed Plan available to the public at the New Bedford and Fairhaven public libraries. The Administrative Record was subsequently updated on August 3, 1989 and on September 8, 1989, to include additional documents considered by the EPA for the Hot Spot Operable Unit decision.

EPA held an informational meeting on August 3, 1989 to present the results of the Hot Spot Feasibility Study, to discuss the Proposed Plan, and to answer any questions that interested persons had. This meeting also marked the beginning of the public comment period during which the public, including the PRPs, was invited to comment on the alternatives presented in the Feasibility Study, the Proposed Plan, and on any other documents previously released to the public or included in the Administrative Record.

The EPA held an informal public hearing on August 16, 1989 to accept oral comments. On the following day, August 17, 1989, EPA issued a press release announcing the extension of the public comment period from September 1, 1989 to October 2, 1989.

A second public meeting was held on August 22, 1989, to allow the PRPs an opportunity to present an alternative to EPA's Proposed Plan. Following this meeting, the public comment period was extended for a final time until October 16, 1989. The public comment period lasted a total of 74 days, considerably longer than average.

Finally, on September 25, 1989, the CWG sponsored a meeting to provide an opportunity for its members and members of the public to ask EPA representatives about EPA's Proposed Plan or AVX representatives about their proposed alternative.

A transcript of these public meetings and the comments submitted to the EPA, along with the EPA's response to these comments, are included in the Responsiveness Summary as Appendix A to this document.

A more detailed chronology of EPA's community relations activities for the Site can be found in Section II of the attached Responsiveness Summary.

IV. SCOPE AND ROLE OF OPERABLE UNIT

This Hot Spot Operable Unit is the first of two operable units planned for the New Bedford Harbor Site. Operable units are discrete actions that comprise incremental steps toward a final remedy. They may be actions that completely address a geographical portion of a site or a specific site problem. The Hot Spot Operable Unit addresses both a geographical portion of the Site and a specific Site problem.

The Hot Spot Area is an area of approximately 5 acres along the western bank of the Acushnet River Estuary adjacent to the Aerovox facility. It is noteworthy because of the extremely high levels of PCBs that have been detected in the sediment. Levels of PCBs in the Hot Spot sediments range from 4,000 ppm to over

200,000 ppm. Dermal contact and incidental ingestion of this sediment and ingestion of contaminated fish and shellfish could pose a significant risk to public health. In addition, PCB contamination threatens marine organisms. Potential routes of exposure for marine organisms include direct contact with the sediment, contact with contaminants in the water column, and ingestion of contaminated food. Finally, the Hot Spot continues to act as a source of contamination throughout the entire Site. The Hot Spot Operable Unit is designed to respond to these significant threats.

This interim action is protective of human health and the environment by providing for the removal and treatment of the highly contaminated sediments in the Hot Spot. Subsequent actions are currently being developed and evaluated to address fully the principal threats posed by the remainder of the Site. This interim action is consistent with any planned future actions because this action calls for the removal of approximately 48 percent of the total PCB mass in sediment from the estuary portion of the Site, which acts as a continuing source of contamination throughout the entire Site.

V. SUMMARY OF SITE CHARACTERISTICS

Numerous studies and reports completed for the New Bedford Harbor Superfund Site have outlined the nature and extent of contamination, the location and functional value of the wetland areas, the fate and transport of PCBs in the estuarine environment, and the risks associated with sediment contamination. These reports, which are included in the Administrative Record, highlight the relationship of the PCB contamination in the Hot Spot Area to PCB contamination in the Estuary and the Lower Harbor and Bay. Chapter 2 of the Feasibility Study contains an overview of these studies. The significant findings of the studies are summarized below.

A. Sediment

The following five sediment sampling data sets describe the nature and extent of PCB contamination in sediment in the Acushnet River Estuary, including the Hot Spot Area. These data sets were used to determine the horizontal and vertical extent of PCB contamination in the Estuary, and PCB concentration maps were prepared using these data. A summary of these data sets is presented in Appendix A of the Hot Spot Feasibility Study.

- U.S. Coast Guard Sediment Sampling Program (1982)
- U.S. Army Corps of Engineers (USACE) Field Investigation Team (FIT) Sampling Program (1986)
- Battelle Hot Spot Sediment Sampling Program (1987)

- USACE Wetlands and Benthic Sediment Sampling Program (1988)
- USACE Hot Spot Sediment Sampling Program (1988)

The above five data sets were also used for the contamination assessment and for the development of the PCB concentration maps. Other data sets included in the Administrative Record, but not specifically used in the development of the PCB concentration maps, include:

- DEQE sampling (1981)
- EPA sampling (November 1981)
- Aerovox sampling (March 1982)
- Aerovox/General Electric sampling (June 1986)
- AVX sampling (reported October 1989)

These data are consistent with the magnitude and location of PCB contamination identified in the previously mentioned data sets. These later data sets contain the highest results for any sampling taken in the Hot Spot: 190,000 ppm (EPA, 1981); 130,000 ppm (AVX, 1989); and 247,000 ppm (Aerovox, 1982). These samples were taken in the mudflats near the outfalls of the Aerovox facility.

The results of these data are described in further detail in the following subsections.

PCBs

The distribution of PCBs within the sediments of the Hot Spot Area at the depth of 0 to 12 inches is presented in Figure 4. The vertical and horizontal extent of PCB contamination in the Estuary, including the Hot Spot, is illustrated in the concentration maps prepared for the following three depths: zero to 12 inches (Figure 5), 12 to 24 inches (Figure 6), and 24 to 36 inches (Figure 7).

The sediment data also illustrate the relationship between the quantity of PCBs within the Hot Spot Area as compared to the entire Estuary (Figure 8). Approximately 48% of all the PCBs within the Estuary are located in the Hot Spot. EPA has defined the Hot Spot as those areas where the sediment PCB concentration is 4,000 ppm or greater.

Other Contaminants

In addition to PCBs, other contaminants are present throughout the New Bedford Harbor Site. These contaminants include polycyclic aromatic hydrocarbons (PAHs) and heavy metals (copper, chromium, lead, and cadmium). The extent of PAH and heavy metal contamination is presented in the Hot Spot Feasibility Study and the Additional Contaminants of Concern Report, which are included in the Administrative Record.

Within the Estuary portion of the Site, PAH compounds were found to be co-located with PCBs. However, the range of PAH concentrations in the sediment was significantly less than the range of PCB concentrations. Total PAH sediment concentrations range from below detection limit to 930 ppm, with an average concentration of approximately 70 ppm. The highest PAH concentration of 930 ppm was detected in the Hot Spot Area. Because no discrete areas of elevated levels of PAH compounds were observed, it is probable that PAH contamination is caused by non-point sources such as urban runoff. PAH concentrations detected in the sediment are similar to PAH concentrations detected in other urban and industrialized areas. PAH compounds can be effectively treated by the technologies identified to treat PCB contamination. Thus, the selected method to treat the PCB contamination in the Harbor will effectively treat the PAH contamination.

Similar to PCB contamination, the metals concentrations are greatest in the top foot of sediment and decrease with depth. Metal concentrations have been detected in the PCB Hot Spot Area and extend throughout the 36-inch remediation depth. Many treatment technologies capable of treating the PCBs are ineffective for treating metals. For this reason, an additional treatment step may be required to treat the metals remaining in the sediment after treatment for PCBs (e.g., solidification). However, the area of highest metal contamination in the Estuary is not co-located with the PCB Hot Spot Area. The location of the high metal-contaminated sediment correlates with the location of industrial discharge and/or combined sewer overflow discharge pipes. Contamination outside of the Hot Spot Area will be addressed in the second operable unit for the Site.

<u>Hot Spot PCB Migration</u>

The results of several monitoring programs demonstrate that approximately 2 pounds of PCBs migrate out of the upper Estuary daily. These PCBs are ultimately transported to portions of the Lower Harbor and Buzzards Bay, where they are redeposited, volatilized into the atmosphere, or taken up into the food chain by aquatic biota. The PCBs which leave the Estuary, or the PCB flux, are composed of a dissolved (soluble) fraction and a particulate (sediment) fraction. Assessments of sediment and contaminant migration were based on field, laboratory, and model studies.

Transport of dissolved PCBs throughout the Harbor contributes to PCB migration to a greater extent than erosion and transport of sediment bed material. The following brief discussion focuses on the movement of dissolved PCBs from the bed sediment to the water column, because studies show that the majority of the contaminated suspended solids become contaminated through contact with the water column and not from resuspension activities. A more complete discussion of Hot Spot PCB migration can be found in the following documents in the Administrative Record: Hot Spot FS (see pages 2-17 through 2-22); Corps of Engineers' Engineering Feasibility Study (see Report 2); and several reference articles (see Brown and Wagner, 1986 and Brownawell, 1986).

Within the sediment, many processes are actively moving the PCBs into the overlying water. The following mechanisms contribute to the mobilization of the PCBs:

- desorption, or release of PCBs from the bed sediment and diffusion into the overlying water;
- molecular diffusion of PCBs within the pore water of the sediment; and
- bioturbation, or mixing of the sediment by organisms.

The desorption process is influenced by the sediment organic carbon content, the specific physical and chemical properties of the PCBs, and the absorbed contaminant concentration. This desorption process is apparent by observing the extremely high water column concentrations of PCBs in the vicinity of the Hot Spot. Once into the water column, the PCBs are transported to other areas of the Site. Additionally, PCBs are volatilized into the atmosphere from the surface water and exposed mudflat areas continuously.

During the public comment period for the Hot Spot operable unit, the Potentially Responsible Parties (PRPs) submitted reports that estimate the PCB flux out of the surficial sediments within the Estuary. The results of the PRPs' studies indicate that at least 30% of the entire flux from the Estuary sediments is derived from the areas of contamination in excess of 4,000 ppm PCBs (i.e., the Hot Spot). This information supports the importance of the Hot Spot Area in the migration of PCBs within and away from the Site. Refer to the PRP document "Tidal Cycle Flux Measurement Data" and Section 4 of the Responsiveness Summary for further discussion.

Contaminant Fate in the Environment

The EPA recognizes that biotransformation of PCBs in New Bedford Harbor sediment appears to be occurring. However, studies conducted to date do not provide sufficient data for a reliable estimation of in-situ biochemical decay rates or half-lives, as well as the toxicity of the decay products. This information is crucial to evaluate the length of time that would be required for removal of PCBs from the Hot Spot sediment by natural processes. Research suggests that the half-life of anaerobic degradation of heavily chlorinated PCBs may range from 7 to 50 years (Brown and Wagner, 1986). Based on this half-life estimate and assuming first order decay, the time required for biodegradation to reduce a sediment PCB concentration of 4,000 ppm (the lower limit of the Hot Spot) to 50 ppm would be approximately 50 to 300 years. The EPA finds this time frame for remediation unacceptable, especially when there are other remedial alternatives currently available for implementation.

Therefore, given the quantity and high level of PCB contamination in the Hot Spot sediment, the EPA believes the Hot Spot will remain a source of contamination, and that contaminants will continue to migrate to the entire Site if not addressed. Although the EPA recognizes that PCBs undergo transformation processes to varying degrees in the environment, no scientific data has been provided to the EPA to date, nor is EPA aware of any such data, which documents that the levels of contamination in the Hot Spot would be reduced to levels that the EPA believes would no longer present a risk to human health or the environment within a reasonable timeframe.

B. Surface Water

The mean PCB water column concentrations at the New Bedford Harbor Site range from approximately 3,900 parts per trillion (ppt) in the vicinity of the Hot Spot to 4 ppt in portions of Buzzards Bay. Sampling locations and corresponding mean PCB concentration values are depicted in Figure 9. These values were generated using data obtained by Battelle Ocean Sciences in 1987. In the Hot Spot Area, PCB concentrations grossly exceed the Ambient Water Quality Criteria (AWQC) for PCBs (chronic effects on aquatic life) of 30 ppt. PCB concentrations also exceed the AWQC throughout the remainder of the Estuary and the Lower Harbor.

The water column data also reflect the movement of PCBs from the sediment into the water column. The correlation between water column concentrations and the underlying sediment concentrations is as follows: the higher the sediment concentration, the higher the water column concentration. This correlation demonstrates the movement of the PCBs into the water column. The water column data, combined with EPA PCB flux measurements at the Coggeshall Street bridge, indicate that surface water from within the Estuary is transporting PCBs to other areas of the Site. The extremely high PCB concentrations, the elevated surface water concentrations, the quantity of PCBs within the area, as well as the analytical modeling conducted by the PRPs described in Section V.A above, provide evidence that the Hot Spot is a significant source to the remainder of the Site, in particular, to the Estuary portion.

C. Biota

Sampling data show that aquatic biota are contaminated with PCBs. It is also known that aquatic biota bioaccumulate and bioconcentrate PCBs. Contamination occurs when biota come into contact with contaminated sediment or surface water, or via the ingestion of contaminated organisms. Public health is threatened because contaminated biota from the Harbor may be caught and consumed.

In certain biota samples, the edible portion was found to contain levels of PCBs in excess of the 5 ppm tolerance limit established by the Food and Drug Administration (FDA). This limit was subsequently lowered to 2 ppm by the FDA in 1979.

The Massachusetts Department of Public Health (DPH) determined that under the FDA standard, the biota were "adulterated" within the meaning of state law, and responded to the public health threat by establishing Fishing Closure Areas within the Harbor and portions of Buzzards Bay.

Benthic invertebrates and fish are unable to thrive in the Hot Spot Area. However, because the Hot Spot is a significant point of origin for the migration of PCBs throughout the Harbor, biota in the rest of the Harbor are affected by Hot Spot contamination. Refer to Sections V.A, V.B, and Section 4 of the Responsiveness Summary portion of this document for discussion of the role of the Hot Spot in PCB migration.

EPA has documented fishing that occurs in the Fishing Closure Areas within Buzzards Bay (Greater New Bedford Health Effects Study, 1987). EPA believes that many of the species studied in order to assess public health risks are exposed to contaminants on a site-wide basis, since these fish may move throughout the Site. Because the Hot Spot serves as a source of contamination to the entire Site, and because certain biota may travel throughout the Site, it is necessary and appropriate to consider the levels of contamination within biota on a site-wide basis for determining public health and environmental risks posed by the Hot Spot.

Data collected by the Massachusetts Department of Marine Fisheries from Area III between 1980 and 1986, in accordance with FDA protocol, confirm that the FDA 2 ppm limit in lobsters (Figure 10) continues to be exceeded. Additional biota data, including that generated by Pruell, et al. (1988) and the Massachusetts Division of Marine Fisheries (1987), also demonstrate that the FDA tolerance level continues to be exceeded.

Data obtained in 1987 that show PCB concentrations in the edible portions of lobster, winter flounder, and clams are presented in Table 1. The biota were collected from areas that correspond to the DPH Fishing Closure Areas. The concentrations of PCBs in the lobster do not include concentrations from the tomalley, the lobster's liver, where PCBs tend to bioaccumulate. In order to be consistent with the FDA protocol requiring the tomalley be included as part of the edible portion determination in lobsters, EPA estimated the total edible tissue PCB concentration for a typical lobster from Area II. In so doing, EPA predicted a significant increase in the PCB concentration (i.e., from 0.46 ppm to 2.3 ppm). This methodology is provided on page 2-33 of the Baseline Public Health Risk Assessment.

VI. SUMMARY OF SITE RISKS

A. General Feasibility Study and Risk Assessment Information

In the feasibility study process, remedial alternatives are developed that protect human health and the environment by recycling waste or by eliminating, reducing, and/or controlling risks posed by a site through each exposure pathway. The number and type of alternatives to be analyzed shall be determined at each site, taking into account the scope, characteristics, and complexity of the site problem that is being addressed. In developing and, as appropriate, screening the alternatives, remedial action objectives are developed by specifying contaminants and media of concern, potential exposure pathways, and remediation goals. Initially, preliminary remediation goals are developed based on readily available information, such as chemical-specific ARARs or other reliable information. Preliminary remediation goals are modified, as necessary, as more information becomes available during the RI/FS. Final remediation goals are determined when the remedy is selected. Remediation goals establish acceptable exposure levels that are protective of human health and the environment and are developed by considering applicable or relevant and appropriate requirements under federal and state environmental regulations, if available, and the following factors:

1. For systemic toxicants (i.e., an agent that kills or injures animal or plant systems), acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety.

2. For known or suspected carcinogens (i.e., causes or contributes to the production of cancer), acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} (an additional 1 in 10,000 to a 1 in 1,000,000 chance of the event occurring) using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.

3. Factors related to technical limitations such as detection/quantification limits for contaminants.

4. Factors related to uncertainty.

5. Other pertinent information.

B. Contaminants of Concern

EPA performed a Baseline Public Health Assessment to estimate the probability and magnitude of potential adverse human health effects from exposure to contaminants associated with the Site. The four contaminants of concern for the Site include PCBs and the heavy metals cadmium, copper and lead. These contaminants were selected from the contaminants present at the Site on the basis of frequency of detection, concentration and quantity of contaminant within the Site, environmental mobility, and route-specific toxicity, as specified in the Superfund Public Health Evaluation Manual. PCBs are included on EPA's list of hazardous substances under CERCLA, and PCBs are regulated under the Toxic Substances Control Act (TSCA). EPA has classified PCBs as a probable human carcinogen (B2 classification) based on the inducement of malignant liver tumors in rodents in five studies. In addition, there is suggestive evidence of excess risk of liver cancer in humans by ingestion and inhalation and/or dermal contact. Refer to Section 3 of the Responsiveness Summary for a more complete discussion of PCB toxicity.

Historically, EPA and the State focused on PCBs because of bioaccumulation in the commercial fishing grounds to levels in excess of the FDA's tolerance limit in New Bedford Harbor. The FDA tolerance limit is not solely health-based. As such, the potential risks associated with consumption of biota with PCB concentrations below the FDA limit may still present risk greater than EPA's target risk range of 10^{-4} to 10^{-6}.

C. Public Health Risks/Human Health Evaluation

EPA developed several hypothetical exposure scenarios in order to estimate quantitatively the potential human health effects associated with the contaminants of concern. The exposure scenarios reflect the characteristic uses and location of the Site. Incremental lifetime cancer risks and the potential for noncarcinogenic adverse health effects were estimated for the various exposure scenarios. Based on the results of a screening process designed to identify pathways of exposure, EPA selected direct contact and incidental ingestion of shoreline sediment and ingestion of aquatic biota as the exposure pathways of concern. Consistent with EPA guidance, the public health risk assessment assumes that institutional controls are not effective in preventing the ingestion of biota from the Harbor. For New Bedford Harbor, this assumption is substantiated by interviews conducted by the Massachusetts Department of Public Health (1987) with local residents which revealed that persons consume locally caught seafood with varying degrees of frequency.

Potential noncarcinogenic and carcinogenic risks from exposure to PCBs by direct contact and incidental ingestion of sediment from selected areas of the Estuary, including the Hot Spot Area are presented in Table 2. The corresponding area of exposure is illustrated in Figures 4 and 11. Locations within the Hot Spot Area that were evaluated in the Risk Assessment are accessible to both children and adults. For the risk calculation, EPA used a PCB concentration at a location directly on the shoreline, and assumed that a child (age 6 to 16) would be exposed. This shoreline location, identified on Figure 4, contains a PCB concentration of 9,923 ppm. Based on the direct contact hazard presented by the highly contaminated sediment in the Hot Spot Area, significant public health risks are expected under the assumed conditions of exposure.

In addition to direct contact and incidental ingestion of Hot Spot sediments, EPA examined potential risks from the ingestion of biota on a site-wide basis. These estimates were calculated on the basis of consumption of lobster, winter flounder and clams. EPA estimated risks based on consumption of one fish meal per day, per week, and per month, with a fish meal consisting of an 8-ounce portion for older children and adults and a 4-ounce portion for younger children. The potential carcinogenic risks with their corresponding exposure concentrations are presented in Table 3. Table 3 indicates that monthly consumption of biota contaminated below the FDA limit of 2 ppm results in a public health risk greater than EPA's target risk range.

The concentrations used in this evaluation are from biota caught in the Buzzards Bay portion of the Site, within Area II of the Fishing Closure Areas. The consumption of contaminated biota presents a public health risk under the assumed conditions of exposure. The EPA believes the assumed exposure scenarios to be a reasonable estimate, since the risks were based on consumption of biota from the Bay portion of the Site, where documented fishing occurs.

A more complete discussion of Site risks can be found in the Hot Spot FS on pages 3-1 through 3-8 and in the Public Health Risk Assessment.

D. Ecological Risk

EPA is presently conducting a Baseline Environmental Risk Assessment as part of the overall Feasibility Study for the Estuary and Lower Harbor and Bay Areas. EPA is also examining sediment clean up goals for the protection of aquatic organisms as part of this study. This study is scheduled to be completed in June 1990. For the Hot Spot Operable Unit, the EPA examined potential risks to marine biota due to exposure to PCB contamination in the Hot Spot sediment and in the water column. The extremely high contaminant levels in Hot Spot surface sediment precludes benthic invertebrates and fish from thriving in this area.

Contamination of aquatic biota in New Bedford Harbor occurs through exposure to contaminated sediments and surface water, and the ingestion of contaminated food. While the PCB exposure that biota receive via direct contact with the Hot Spot sediment and the overlying water column is important, the role the Hot Spot plays in the migration and subsequent exposure on a site-wide basis is also of importance.

VII. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA adopted a Proposed Plan for remediation of the Hot Spot on August 3, 1989. The preferred alternative, specified in the Proposed Plan, included the following major provisions:

- dredging of 10,000 cubic yards of contaminated sediments;
- dewatering of the sediments in the pilot study area using the existing Confined Disposal Facility (CDF);
- treatment of the dredged sediments utilizing an on-site incinerator; and
- stabilization of the treated sediment to immobilize metals, if a leaching test indicates it is needed.

EPA will conduct pre-design studies, a normal component of most engineering design projects, to evaluate and select the unit process equipment. These studies will focus on ensuring compliance with ARARs specific to this action identified in Section XI.B of this document.

VIII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements Response Objectives

Prior to the passage of the Superfund Amendments and Reauthorization Act of 1986 (SARA) actions taken in response to releases of hazardous substances were conducted in accordance with CERCLA as enacted in 1980 and the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, dated November 20, 1985. Until the revised NCP to reflect SARA becomes effective, the procedures and standards for responding to releases of hazardous substances, pollutants and contaminants shall be in accordance with Section 121 of CERCLA and to the maximum extent practicable, the current NCP.

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with applicable or relevant and appropriate environmental standards established under Federal and state environmental laws unless a statutory waiver is warranted; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a statutory preference for remedies that permanently and significantly reduce the volume, toxicity or mobility of hazardous wastes over remedies that do not achieve such results through treatment. Response alternatives were developed to be consistent with these Congressional mandates.

EPA analyzed a number of potential exposure pathways for risk and threats to public health and the environment in the Hot Spot Feasibility Study and in the Baseline Public Health Risk Assessment. EPA used guidelines in the Superfund Public Health Evaluation Manual regarding development of design goals and risk analyses for remedial alternatives in the development of response actions. As a result of these assessments, EPA developed remedial response objectives to mitigate existing and future threats to public health and the environment. These response objectives are:

1. Significantly reduce PCB migration from the Hot Spot area sediment, which acts as a PCB source to the water column and to the remainder of the sediments in the harbor.

2. Significantly reduce the amount of remaining PCB contamination that would need to be remediated in order to achieve overall harbor clean-up.

3. Protect public health by preventing direct contact with Hot Spot sediments.

4. Protect marine life by preventing direct contact with Hot Spot sediments.

B. Technology and Alternative Development and Screening

The term "technology" refers, in general, to a category of remedial action activity, such as, chemical treatment or capping. Early in the process of finding an appropriate remedy for a site, EPA screens or reduces the universe of potentially applicable technologies by evaluating the technologies in terms of their technical implementability. EPA then combines remaining technologies into remedial alternatives, which are developed and subsequently screened on the basis of the following three criteria.

1. Effectiveness. This criterion focuses on the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks and affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection. Alternatives providing significantly less effectiveness than other, more promising alternatives may be eliminated. Alternatives that do not provide adequate protection of human health and the environment are eliminated from further consideration.

2. Implementability. This criterion focuses on the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative. Alternatives that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time may be eliminated from further consideration.

3. Cost. The costs of construction and any long-term costs to operate and maintain the alternatives shall be considered. Costs that are grossly excessive compared to the overall effectiveness of alternatives may be considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternatives by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated.

CERCLA, the NCP, and EPA guidance documents including, "Guidance on Feasibility Studies Under CERCLA" dated June 1985, and the "Interim Guidance on Superfund Selection of Remedy" (EPA Office of Solid Waste and Emergency Response [OSWER] Directive No. 9355.0-19) dated December 24, 1986 set forth in detail the process by which EPA evaluates and selects remedial actions. In accordance with these requirements and guidance documents, EPA developed treatment alternatives for the Site ranging from an alternative that, to the degree practicable, eliminates the need for long-term management (including monitoring) at the Site to alternatives involving treatment that reduce the mobility, toxicity, or volume of the hazardous substances as their principal element. In addition to the range of treatment alternatives, EPA developed a containment option involving little or no treatment and a no-action alternative in accordance with Section 121 of CERCLA.

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. In addition to these factors and the other statutory directives of Section 121, the evaluation and selection process was guided by the EPA documents "Additional Interim Guidance for Fiscal Year 1987 Records of Decision" dated July 24, 1987 and "Interim Final Guidance on Preparing Superfund Decision Documents" (OSWER Directive No. 9355.3-02) dated June 1989. These documents provide direction on the consideration of SARA cleanup standards and set forth nine evaluation criteria that EPA should consider in its evaluation and selection of remedial actions. The nine evaluation criteria are:

Threshold Criteria

1. Overall protection of human health and the environment.

2. Compliance with applicable or relevant and appropriate requirements (ARARs).

Balancing Criteria

3. Long-term effectiveness and permanence.

4. Reduction of toxicity, mobility or volume through treatment.

5. Short-term effectiveness.

6. Implementability.

7. Cost.

Modifying Criteria

8. State/support agency acceptance.

9. Community acceptance.

Chapter 5 of the Hot Spot Feasibility Study identified, screened and evaluated technologies based on engineering feasibility, implementability, effectiveness, and technical reliability. Chapter 6 of the Hot Spot Feasibility Study presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories required by OSWER Directive No. 9355.0-19. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated and screened in Chapter 7 of the Feasibility Study. In summary, of the nine remedial alternatives screened in Chapter 6, four were retained for detailed analysis. Table 4 identifies the four alternatives that were retained through the screening process, as well as those that were eliminated from further consideration.

IX. DESCRIPTION/SUMMARY OF THE DETAILED ANALYSIS OF ALTERNATIVES

A brief discussion of capping as an alternative for the Hot Spot is included here to provide the reasoning why this alternative was not carried into detailed analysis for the Hot Spot. Refer to Section 7 of the Responsiveness Summary for a more complete discussion of capping for the Hot Spot.

A. Capping Alternative for the Hot Spot

The identification and initial screening of remedial technologies conducted in 1986-87 identified capping as a potentially applicable containment (or non-removal) technology in each of the Site's three geographical study areas: the Hot Spot, the Estuary, and the Lower Harbor and Bay. Two other containment technologies were also identified: impermeable synthetic membranes and chemical sealants. As a result of the subsequent screening step, which considered effectiveness, feasibility, and implementability, EPA retained capping for further evaluation.

During 1987, EPA conducted a detailed evaluation of capping as a remedial technology. EPA evaluated capping based on three major criteria: effectiveness (including technical reliability and potential impacts to public health and the environment); implementability (including technical, institutional, and administrative feasibility of installing, monitoring and maintaining a cap); and cost. Because capping satisfied these three criteria, EPA retained capping as an applicable technology for all three geographical study areas of the Harbor.

EPA combined remedial technologies retained from the screening process into complete remedial alternatives for each of the three study areas during 1987-88. In accordance with the amendments to CERCLA which require consideration of on-site containment alternatives, EPA developed a capping alternative for the Hot Spot. This alternative consisted of installing an embankment around the Hot Spot, stabilizing the sediment, and installing a synthetic cap over the Hot Spot Area.

EPA then screened all of the remedial alternatives for the Hot Spot based on the effectiveness, implementability and cost criteria. At this step, in accordance with EPA guidance on screening of remedial alternatives, evaluation under the effectiveness criterion requires the inclusion of consideration of the alternative's ability to meet ARARs and its long-term reliability. As a result of this screening step, EPA eliminated the capping alternative because, in EPA's judgment, the long-term effectiveness of the cap for the Hot Spot sediment was uncertain. The lack of information to substantiate the appropriate thickness and effectiveness of a cap over sediment that contains extremely high levels of PCBs such as those found in the Hot Spot, contributed to the elimination of capping in the remedial alternative screening process.

EPA was concerned about the inability of the cap to provide a permanent barrier to migration of highly contaminated sediment. EPA considers breaching of the cap likely in the Hot Spot Area, since capping this area would increase accessibility by creating an upland area. In the event of failure, highly contaminated sediment that has not diminished in toxicity or volume would contaminate cap material, increasing the volume of contaminated material, and would migrate throughout the Site.

The implementation problems likely to be encountered with a capping alternative also contributed to EPA's decision to screen out capping for the Hot Spot. The difficulty in installing an embankment around the Hot Spot to allow for installation of the cap, as well as the difficulty in deploying the cap itself, because of the poor sediment stability, indicated that capping was not an appropriate alternative for the Hot Spot.

Finally, capping the highly contaminated Hot Spot sediment is not appropriate because of the levels of contamination that would remain. EPA is currently evaluating capping as an alternative for the Estuary, excluding the Hot Spot, and has retained capping as a viable alternative for portions of the Lower Harbor and Bay.

B. Summary of the Detailed Analysis of Alternatives

This section presents a narrative summary and brief evaluation of each alternative according to the evaluation criteria described above. A detailed tabular assessment of each alternative is presented in Table 5.

The alternatives analyzed for the Hot Spot include a non-removal alternative (Hot Spot [HS]-1) and three removal alternatives (HS-2, HS-3, HS-4).

Non-Removal Alternative

Alternative Hot Spot (HS)-1: Minimal No Action

This alternative would involve no remedial action on any of the contaminated sediments in the Hot Spot. This alternative would, however, entail restricting Site access to the west, north and south by installing chain-link fences to ensure that there would be no access to the Hot Spot Area via the adjacent shoreline. Limiting access to the Hot Spot Area would limit the potential for direct contact with contaminated sediments. In addition to warning signs currently posted on the eastern and western shorelines, additional warning signs regarding swimming, fishing and shellfish harvesting restrictions would be posted along the western shoreline. Annual sediment and surface water sampling and analysis of PCB and heavy metal levels would be conducted.

Under this alternative, contaminants would continue to migrate from the Hot Spot Area to the Estuary and Lower Harbor. This alternative is readily implementable and provides short-term effectiveness in protecting public health, but would not protect the environment from risks posed by contaminated sediments. This alternative would not provide overall protection of human health and the environment and would not result in reduction in PCB levels. This alternative would not reduce the toxicity, mobility, or volume of contaminants in Hot Spot sediments. The Minimal No Action alternative would not provide a long-term permanent remedy that would reduce the nature and magnitude of risk to public health and the environment within the New Bedford Harbor Site since the Hot Spot Area would continue to serve as a source of PCBs to the Estuary and Lower Harbor/Bay. EPA evaluated this alternative in detail in the FS to serve as a comparison to other remedial alternatives under consideration.

Estimated Time for Implementation:	less than 1 year
Estimated Direct Capital Cost:	$35,000
Estimated Indirect Capital Cost:	$13,000
Estimated Operation & Maintenance Cost:	$407,000
Estimated Time for Operation:	30 years of maintenance
Estimated Total Cost:	$455,000

Removal Alternatives

After the screening procedure, EPA retained three alternatives (HS-2, HS-3 and HS-4) that require removal of contaminated Hot Spot sediments for detailed evaluation. EPA used results of the EFS and the Pilot Study to examine the dredging, treatment, disposal and monitoring techniques proposed for each of these three alternatives. EPA determined that a substantial reduction in cleanup costs would result from use of the existing Pilot Study area to support the treatment operations being considered. All of the removal alternatives considered in the FS make use of this area (Figure 12).

All three removal alternatives contemplate excavation of approximately 10,000 cubic yards of contaminated sediments at depths up to four feet using dredging equipment, and transportation of the dredged material by a floating hydraulic pipeline (approximately 1 mile long) to the Pilot Study area. After settling, sediments would be pumped to a nearby secondary facility for dewatering using a filter-press unit. Effluent from the dewatering process would be treated to remove PCBs and heavy metals prior to discharge back into the harbor. Sediment treatment techniques differ in each alternative and are described in detail below.

Alternative HS-2: Incineration

EPA has selected this alternative to address the Hot Spot Area of the Site. It is discussed in Section X entitled "Description of Selected Remedy" on pages 26 through 32.

Alternative HS-3: Solidification/Disposal

In this alternative, contaminated sediments would be dredged and dewatered, and on-site solidification of the dewatered sediment would be conducted to immobilize PCBs and heavy metals. The solidified material would be transported to an off-site Federally-approved landfill for disposal.

Solidification combined with disposal of sediments in a secure landfill would reduce the mobility of PCBs and metals. However, solidification would increase the volume of contaminated sediment, and its effectiveness on extremely high levels of organic contamination is uncertain. Solidification would not reduce the toxicity of contaminants in the sediments. This alternative would provide short-term effectiveness and is implementable, provided an off-site disposal facility is available. Off-site disposal of contaminated sediments in an approved landfill would provide long-term protection of human health and the environment. This alternative would provide significant progress toward overall protectiveness of public health and the environment since it would result in the removal of approximately 48 percent of the PCBs in the Estuary.

Estimated Time for Remediation:	1 year
Estimated Direct Capital Cost:	$9,738,500
Estimated Indirect Capital Cost:	$3,561,700
Estimated Total Cost:	$13,300,200

<u>Alternative HS-4: Solvent Extraction</u>

In this alternative, contaminated sediments would be dredged and dewatered, and solvent extraction would be used to treat the contaminated sediment. After the treatment process, tank trucks would transport the PCB-enriched solvent extract to an off-site federally-approved facility for incineration. Solidification of remaining waste material would be used to immobilize metals prior to storage in the CDF.

Solvent extraction is an innovative technology, a specific version of which was demonstrated at the Site during the Pilot Study. This technology, combined with incineration of the solvent and solidification of the treated sediment, would significantly reduce the mobility, toxicity, and volume of PCB-contaminated sediment. This alternative would provide significant progress toward overall protectiveness of public health and the environment because it would remove 96 to 99 percent of the PCBs from the Hot Spot sediments. Preliminary tests indicate some reduction in the mobility of metals. Because solvent extraction is an innovative technology, additional testing would be required to demonstrate its effectiveness on highly contaminated sediment. Concerns remain over the reliability of this technology for the levels of contamination of the Hot Spot sediment and the higher residual concentrations that may remain after treatment (i.e., 96 to 99% reduction versus 99.9999% reduction with incineration). This alternative would provide long-term effectiveness because it would permanently treat PCB contamination, and the technology appears to reduce the mobility of heavy metals.

Estimated Time for Remediation:	1 year
Estimated Direct Capital Cost:	$7,806,350
Estimated Indirect Capital Cost:	$4,362,300
Estimated Total Cost:	$12,168,650

X. THE SELECTED REMEDY

The selected remedial action for the New Bedford Harbor Site/Hot Spot Area consists of source control measures.

A. Description of the Selected Remedy

1. Remedial Action Objectives

The selected remedy was developed to satisfy the following remedial objectives. These objectives will guide the design of the remedy, and they will be used to measure the success of the remedy.

- Significantly reduce PCB migration from the Hot Spot area sediment, which acts as a PCB source to the water column and to the remainder of the sediments in the harbor.

- Significantly reduce the amount of remaining PCB contamination that would need to be remediated in order to achieve overall harbor clean-up.

- Protect public health by preventing direct contact with Hot Spot sediments.

- Protect marine life by preventing direct contact with Hot Spot Area sediments.

2. Description of Remedial Components

The source control remedial measures include:

- Dredging. Approximately 10,000 cubic yards of contaminated sediments will be removed using a dredge. Dredging will occur in the Hot Spot Area at depths of up to four feet to remove sediments with PCB concentrations of 4,000 ppm or greater.

  Contaminated sediments will be excavated using a small cutterhead dredge. EPA recommended this type of dredge for use in the Hot Spot Area based on results of the Pilot Study conducted by the Corps of Engineers. This study demonstrated that the cutterhead dredge minimizes sediment resuspension and subsequent migration of contaminated sediments. The Corps of Engineers developed operational procedures for the dredge that will be followed to ensure dredging efficiency.

  In addition to using the controls examined in the pilot study which were effective, as an added protective measure, EPA will examine other control options during the design phase, such as physical barriers (floating booms and silt curtains) to formulate appropriate control options for the dredging process to minimize and control sediment resuspension.

- Transportation and Dewatering. The dredged sediments will be transported to the Pilot Study cove area by a floating hydraulic pipeline, where the sediments will be dewatered. Dewatering of sediments will increase the efficiency of the incinerator. Effluent resulting from the dewatering process will be treated to reduce PCBs and heavy metals using best available control technology prior to discharge back into the harbor.

  During design, EPA will determine the proper procedures necessary to ensure that use of the CDF in the dewatering process will comply with the State hazardous and solid waste requirements (e.g., permeability standards).

- Incineration. The dewatered sediments will be incinerated in a transportable incinerator that will be sited at the Pilot Study cove area. The extremely high temperatures achieved by the incinerator will result in 99.9999% destruction of PCBs. Exhaust gases will be passed through air pollution control devices before being released into the atmosphere to ensure that appropriate health and safety and air quality requirements are met.

  As a part of the design phase, incineration technologies will be carefully examined to determine the optimum equipment configuration and incinerator operating parameters for the Hot Spot sediment. This examination will include conducting a test burn on the Hot Spot sediment, to assist in the development of plans and specifications for treating the material specific to this Site.

- Stabilization. Incineration of PCB-contaminated sediment will produce residual ash. Following incineration, the Toxicity Characteristic Leaching Procedure (TCLP) test will be performed on the ash to determine if it exhibits the characteristic toxicity and is, therefore, considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA). If the TCLP test reveals that the ash is a RCRA hazardous waste, the ash will be solidified such that metals no longer leach from the ash at concentrations that exceed the standards set forth for determining the toxicity of a material.

  EPA investigated the technical feasibility of applying solidification/stabilization technology to New Bedford Harbor sediment in laboratory studies as a part of the EFS. Several processes were examined, and physical and chemical tests were conducted on the material. Additional testing will be conducted during the design process to tailor a solidification process for the treated Hot Spot sediment (ash) and to determine the material's chemical characteristics after treatment.

  During remedial activities, (solidified) ash will be temporarily stored in an area adjacent to the CDF. Following completion of these activities, the (solidified) ash will be stored in the secondary cell of the CDF and covered. Storage of the treated material will comply with the solid waste requirements. Ultimate disposition of this material will be addressed in the second operable unit for the Site.

Estimated Time for Remediation:	1 year
Estimated Direct Capital Cost:	$9,143,700
Estimated Indirect Capital Cost:	$5,235,600
Estimated Total Cost:	$14,379,300

B. Comparative Analysis and Rationale for Selection

The rationale for choosing the selected alternative is based on the assessment of the ability of the alternatives retained for detailed evaluation to satisfy each of the nine evaluation criteria mention above in Section VIII.B of this document. To reiterate, the evaluation criteria are:

1. Overall protection of human health and the environment.

2. Compliance with applicable or relevant and appropriate requirements (ARARs).

3. Long-term effectiveness and permanence.

4. Reduction of toxicity, mobility or volume through treatment.

5. Short-term effectiveness.

6. Implementability.

7. Cost.

8. State/support agency acceptance.

9. Community acceptance.

The first two criteria are threshold determinations that must be satisfied in order for an alternative to be eligible for selection. To evaluate the overall protectiveness of an alternative, EPA focuses on how the specific alternative achieves protection over time, if at all, and how site risks are reduced. To evaluate whether an alternative is able to comply with ARARs, EPA considers whether, after the remedial action specified in the alternative is implemented, applicable or relevant and appropriate requirements under federal and state environmental laws are achieved. EPA may also consider whether a waiver of any ARAR is warranted.

EPA uses the next five criteria, the balancing criteria, to weigh the major tradeoffs among alternatives. In evaluating the long-term effectiveness and permanence of an alternative, EPA considers the degree of certainty that the alternative will attain the response objectives, the magnitude of residual risk caused by untreated waste or treatment residuals remaining at the conclusion of the remedial activities, and the adequacy and reliability of controls that are necessary to manage treatment residuals and untreated waste. EPA also considers the potential impacts on human health and the environment should the remedy need replacement.

In evaluating alternatives under the reduction of toxicity, mobility, or volume of contaminants through treatment criterion, EPA considers the treatment process used and the materials treated, the amount of hazardous materials destroyed or treated, the degree of expected reductions in toxicity, mobility or volume, and the type and quantity of residuals remaining after treatment.

To determine how an alternative satisfies the short-term effectiveness criterion, EPA considers the impacts on the community and the environment during the construction and implementation phases of the remedial actions and the time required until the remedial objectives are achieved.

The ease or difficulty of implementing an alternative is assessed by considering its technical and administrative feasibility, and the availability of services and materials. Costs assessed under the cost criterion include capital costs, annual operation and maintenance costs, and present worth costs.

The final two criteria, state and community acceptance, the modifying criteria, are generally taken into account after EPA has received public comment on the RI/FS and the Proposed Plan.

Alternative HS-2 (Incineration) is protective of human health and the environment. The removal of PCBs from the Hot Spot Area and subsequent destruction by incineration will permanently reduce the mobility, toxicity, and volume of the PCBs. Public health and environmental risks directly associated with the Hot Spot will be significantly reduced. Removal of the Hot Spot will also serve to reduce PCBs affecting the remainder of the Site.

Incineration is technically feasible and has been proven to be an effective technology for the destruction of organics, including PCBs at levels similar to those in Hot Spot Area sediment. Mobile incineration units capable of treating 75 tons of sediment per day are currently available. Moreover, incineration systems are highly reliable because of the proven technology employed and the degree of monitoring and control practiced.

Table 5 presents a comparative summary of the four remedial alternatives that were carried through detailed analysis. A narrative discussion of EPA's evaluation of these alternatives under the evaluation criteria appears below.

Of the four alternatives, HS-1 (Minimal No Action), does not satisfy the threshold criterion of being protective of human health and the environment. Therefore, it cannot be selected as the remedial alternative for the Hot Spot sediments. Nevertheless, it provides a useful yardstick for comparison for the other alternatives.

Alternatives HS-2 and HS-4 (Solvent Extraction) would provide the greatest long-term effectiveness and permanence among the alternatives, because they both involve the ultimate destruction of PCBs. However, the reliability of HS-2 is higher than that of HS-4, since solvent extraction is a less certain method of treatment than is incineration for the high concentrations of PCBs found in the Hot Spot sediment. In contrast to these two alternatives, HS-3 (Solidification) would only immobilize the

PCBs, and its effectiveness on extremely high levels of organic contamination is uncertain, especially over a long period of time. Alternative HS-1 would not destroy, immobilize, or remove the PCBs. They would continue to provide a source of contamination to the rest of the harbor and continue to pose significant risk from direct contact in shoreline areas.

Alternatives HS-2 and HS-4 also would provide the greatest reduction in mobility, toxicity, and volume among the alternatives. Alternative HS-2 provides for removal of a greater percentage of all PCBs from the sediment, 99.9999%, as compared to 96 to 99% removal of the PCBs by Alternative HS-4, a significant difference at the levels of contamination found in the Hot Spot. While HS-3 would reduce the mobility of the PCBs in the Hot Spot sediment, the volume of the contaminated material would increase. Alternative HS-1 would provide no reduction in toxicity, mobility, or volume.

Alternatives HS-2, HS-3, and HS-4 are not distinguishable in terms of their short-term effectiveness, and each can be implemented in approximately one year. Each of these alternatives would employ dredge controls and air quality controls to minimize and control resuspension of sediments and releases of contaminants. However, some additional risk to workers may arise under these three removal alternatives during the treatment process since the contaminated sediments are being removed and treated. These risks may be minimized through training in the proper use and operation of safety equipment. EPA does not believe that the three alternatives would pose significant risk to the public because the contemplated control options have proven to be effective. Alternative HS-1 would have minimal short term effectiveness since minimal action would be taken.

Alternative HS-1 would be the simplest alternative to implement because it would involve minimal construction with no removal or treatment activities. Both HS-2 and HS-4 would require testing to verify treatment and to determine the need for solidification of residuals. While treatability testing in the form of a test burn would need to be conducted for HS-2, this testing would be for the purpose of determining optimum equipment configuration and operating parameters, and is not needed to determine effectiveness. Solvent extraction is an innovative technology. Thus, under HS-4, in addition to testing required to establish operating parameters, pilot studies would be required to initially determine the efficacy of the process on the highly contaminated Hot Spot sediment. Transportation of the PCB-solvent enriched extract to a federally-approved off-site incinerator is an implementation problem not found in HS-2.

Both HS-2 and HS-4 would require special equipment and operators. However, the equipment necessary for HS-4 may be more difficult to obtain than that necessary for HS-2. Treatability testing would be required under HS-3, and questions regarding long-term stability would remain for the high levels of organic contamination. Additional implementation problems peculiar to Alternative HS-3, are the necessity of obtaining disposal permits under RCRA and TSCA and the necessity of transport of the solidified material over long distances. The nearest disposal site permitted to accept the contaminated sediment is approximately 500 miles from New Bedford, and the disposal site's capacity to accept the contaminated material is not guaranteed.

Alternative HS-1 is the least costly alternative. Alternatives HS-2, HS-3, and HS-4 have similar costs within the accuracy of cost estimates for Feasibility Studies.

The primary criteria that differentiate these alternatives are their long-term effectiveness and permanence and implementability. Alternative HS-2 satisfies all of the selection criteria. In contrast, Alternatives HS-3 and 4 fail to satisfy certain of the selection criteria, or do not satisfy the criteria with the consistency or performance level of Alternative HS-2. Since Alternative HS-2 has the highest reliability and involves relatively few implementation difficulties for the volume of material to be treated, it provides the best balance of tradeoffs among the protective alternatives.

EPA considered state and community acceptance of the selected remedy. The State has concurred in the selection of the remedy. Community concerns over the selected remedy are focused on the operation of the incinerator, the impacts of dredging, and storage of the treated material. EPA believes these concerns are addressed by specifying compliance with the RCRA and TSCA incinerator standards, as well as requiring air monitoring to ensure that all federal and state air standards are attained. Various monitoring and/or controls will be required during the dredging operation, which EPA believes will be effective in minimizing and controlling releases. Additionally, the use of the CDF and the storage of the treated material will comply with federal and state requirements. Based upon this assessment, taking into account the statutory preferences of CERCLA, EPA has selected this alternative as the remedial approach for the Site.

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Hot Spot Area of New Bedford Harbor is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment for the Hot Spot Area, and is cost effective. This interim action will comply with ARARs specific to this action. However, this interim action will not attain certain levels or standards of control that might be

ARARs. This interim remedial action is only part of a total remedial action that will attain ARARs when completed. The selected remedy also satisfies the statutory preference for the use of treatment which permanently and significantly reduces the volume, toxicity, or mobility of contaminants as a principal element. Additionally, the selected remedy utilizes alternative treatment technologies to the maximum extent practicable. The Hot Spot contamination represents a principal threat at the New Bedford Harbor Site and will be treated under the selected remedy.

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

The selected remedy is protective of human health and the environment for the Hot Spot Area. The remedy for the Hot Spot will permanently reduce the risks presently posed to human health and the environment in the Hot Spot area by dredging and treating the heavily contaminated sediments. Further, by removing approximately 48% of the mass of the PCBs in the Estuary, these contaminated sediments will no longer continue to migrate and contaminate other portions of the Site.

There are no short-term threats associated with the selected remedy that cannot be controlled with existing, available control technologies. Incineration is a proven technology for the destruction of PCBs, and air pollution control devices are routinely used to meet allowable levels of air emissions.

B. The Selected Remedy Attains ARARs to the Extent Required by Section 121 of CERCLA

Due to the limited scope of this interim action, standards or levels of control associated with final cleanup levels will not be achieved. This action will comply with those ARARs specific to this interim action. For example, compliance with RCRA facility and incinerator regulations will be achieved. Chemical-specific ARARs associated with final cleanup levels (e.g., Water Quality Criteria and Food and Drug Administration PCB tolerance level) are not specific to this action and are outside its scope. ARARs such as these will be addressed by subsequent actions at the New Bedford Harbor Site.

This interim action is consistent with any planned future actions because this action calls for the removal of approximately 48 percent of the total PCB mass in sediment from the estuary portion of the Site, which acts as a continuing source of contamination throughout the entire Site. EPA believes that the implementation of a permanent remedy for the Hot Spot is an appropriate and necessary first step toward remediating the harbor overall. The Hot Spot operable unit is the first step in the remedial action for the entire Site, which when complete, will attain all ARARs.

ARARs which are specific to the selected remedial action for the Hot Spot are:

Toxic Substances Control Act (TSCA)
Resource Conservation and Recovery Act (RCRA)
Clean Air Act (CAA)
Clean Water Act (CWA)
Executive Order 11988 (Floodplain Management)
Executive Order 11990 (Protection of Wetlands)
Occupational Safety and Health Administration (OSHA)

310 CMR 30.00	Hazardous Waste Management Requirements
310 CMR 19.00	Solid Waste Management Requirements
310 CMR 6.00	Ambient Air Quality Standards
310 CMR 7.00	Air Pollution Control Regulations
310 CMR 10.00	Wetlands Protection Requirements
314 CMR 4.00	Surface Water Quality Standards
314 CMR 9.00	Certification for Dredging and Filling
314 CMR 12.00	Wastewater Treatment
301 CMR 20.00	Coastal Zone Management
310 CMR 33.00	Employee and Community Right To Know Requirements

Table 6 lists the ARARs specific to this action, a summary of the requirement, whether the requirement is applicable or relevant and appropriate, and the action necessary to attain the ARAR. A brief narrative summary of the ARARs specific to the selected remedy follows.

The Toxic Substances Control Act (TSCA), the Resource Conservation and Recovery Act (RCRA), and the State Hazardous Waste Management Regulations (310 CMR 30.00) are considered applicable to the remedial action for the Hot Spot. As such, the on-site incinerator will be required to operate in accordance with these requirements. Additionally, remedial activities may be subject to the Land Disposal Restrictions under RCRA. Following incineration, the Toxicity Characteristic Leaching Procedure (TCLP) test will be performed on the ash to determine if it exhibits the characteristic of toxicity and is, therefore, considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA). If this test reveals that the ash is a RCRA hazardous waste, the ash will be solidified such that metals no longer leach from the ash at concentrations that exceed the standards set forth in the requirements, and to comply with the Land Disposal Restrictions.

The PCB disposal requirements promulgated under TSCA are considered to be relevant and appropriate for the heavily contaminated sediments from the Hot Spot. Under TSCA, soils contaminated with PCBs at concentrations greater than 50 ppm that are disposed of after February 17, 1978 must be disposed of in accordance with 40 CFR Part 761, Subpart D. PCBs may be disposed of in an incinerator meeting the standards of 40 CFR §761.70, or in a landfill meeting the requirements of §761.75. Under the provisions of §761.71(c)(4), the EPA Regional Administrator may waive one or more of the specified landfill requirements upon finding that the requirement is not necessary to protect against an unreasonable risk of injury to health or the environment from PCBs. Such a waiver is not appropriate for the heavily contaminated (4,000 ppm and above) Hot Spot sediments being addressed by this operable unit. Since incineration is selected as the source treatment technology, treatment and disposal of the 10,000 cubic yards of PCB-contaminated sediment will be in accordance with the criteria of 40 CFR §761.70. In addition, disposal of dredged material will be in accordance with 40 CFR §761.60(a)(5).

Regarding the floodplains, the remedy will comply with Executive Order 11988 - Protection of Floodplains to the extent practicable. EPA finds that there is no practicable alternative to excavation of the contaminated sediments, some of which are located in the floodplain, since it is the sediments themselves that are contaminated from the historical disposal and discharges. Implementation of the remedy will utilize measures to minimize potential harm to the floodplain. However, excavation is a temporary disruption, and the design will examine ways to minimize this disruption.

Similarly for the wetlands, the remedy will comply with Executive Order 11990 - Protection of Wetlands, the Clean Water Act Section 404(b)(1) Guidelines, Wetland Protection Requirements (310 CMR 10.00), Certification for Dredge and Fill (314 CMR 9.00), and Coastal Zone Management (301 CMR 20.00). The Hot Spot sediments have been affected by the historical disposal and discharges and act as a continuing source of contamination to the remainder of the Harbor, and they will be affected by the remedy. These sediments will be dredged for thermal treatment. EPA finds that there is no practicable alternative to these actions since it is the sediments themselves that are contaminated. Implementation of the remedy will utilize measures to minimize potential harm to the surrounding areas. The design phase will examine physical controls, as well as monitoring of the area.

During dredging and treatment of contaminated sediments, air emissions will be monitored and all applicable or relevant and appropriate federal and state standards will be attained. Specifically, the National Ambient Air Quality Standards (NAAQS), the State Ambient Air Quality Standards (310 CMR 6.00), and the Air Pollution Control Regulations (310 CMR 7.00) will be met through specified techniques for the dredging activities, as well as required air emission controls and monitoring for the incinerator, to ensure that health and safety and air quality requirements are met.

Dewatering of sediments will increase the efficiency of the incinerator. Effluent resulting from the dewatering process will be treated to reduce PCBs and heavy metals using best available technology prior to discharge into the Harbor (314 CMR 4.00 and 314 CMR 12.00). Use of the CDF, whether for dewatering or storage purposes, will comply with the hazardous and solid waste regulations (310 CMR 19.00).

During the dredging and treatment of contaminated sediments, Occupational Health and Safety Administration (OSHA) regulations will be followed, as well as the Employee and Community Right To Know Requirements (310 CMR 33.00). In particular, 29 CFR §1910.120 specifies standards for handling hazardous wastes and sets allowable ambient air concentrations for activities which involve release of volatile organic compounds (VOCs) in the workplace. VOCs are not expected to be a problem during dredging, since the sediments to be dredged are submerged, and will then be brought to the CDF area via pipeline for dewatering prior to incineration. However, air monitoring will be conducted to ensure that proper health and safety measures are followed.

C. The Selected Remedial Action is Cost-Effective

Once EPA has identified alternatives that are protective, EPA analyzes those alternatives to determine a cost-efficient means of achieving the cleanup. The costs of the alternatives are within the +50% to -30% accuracy required for Feasibility Study estimates.

EPA believes the selected remedy is cost-effective because the remedy provides overall effectiveness proportional to its costs. The slightly greater cost of the selected remedy is justified because the process used in the alternative is more reliable for the Hot Spot sediments than those called for in the other removal and treatment alternatives. While the other removal and treatment alternatives appear to be slightly less expensive, they do not assure destruction of the high levels of PCBs in the Hot Spot sediment to the same degree as the selected remedy. Finally, it is highly probable that additional costs may be incurred from the need for managing the treatment residuals which would be derived from the other alternatives.

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

The selection of treatment for the highly contaminated sediment is consistent with mandates of CERCLA that highly toxic and mobile wastes are a priority for treatment, and that treatment is often necessary to ensure the long-term effectiveness of a remedy.

Incineration, the principal remedial component of the selected remedy, is a treatment technology that will provide a permanent solution to the contaminated sediment problem in the Hot Spot Area. Dredging of the Hot Spot sediments and treatment by incineration will reduce the risks posed to public health from direct contact with contaminated sediments in this area, as well as address the environmental risks in this area.

Thus, the selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, as mandated by statute.

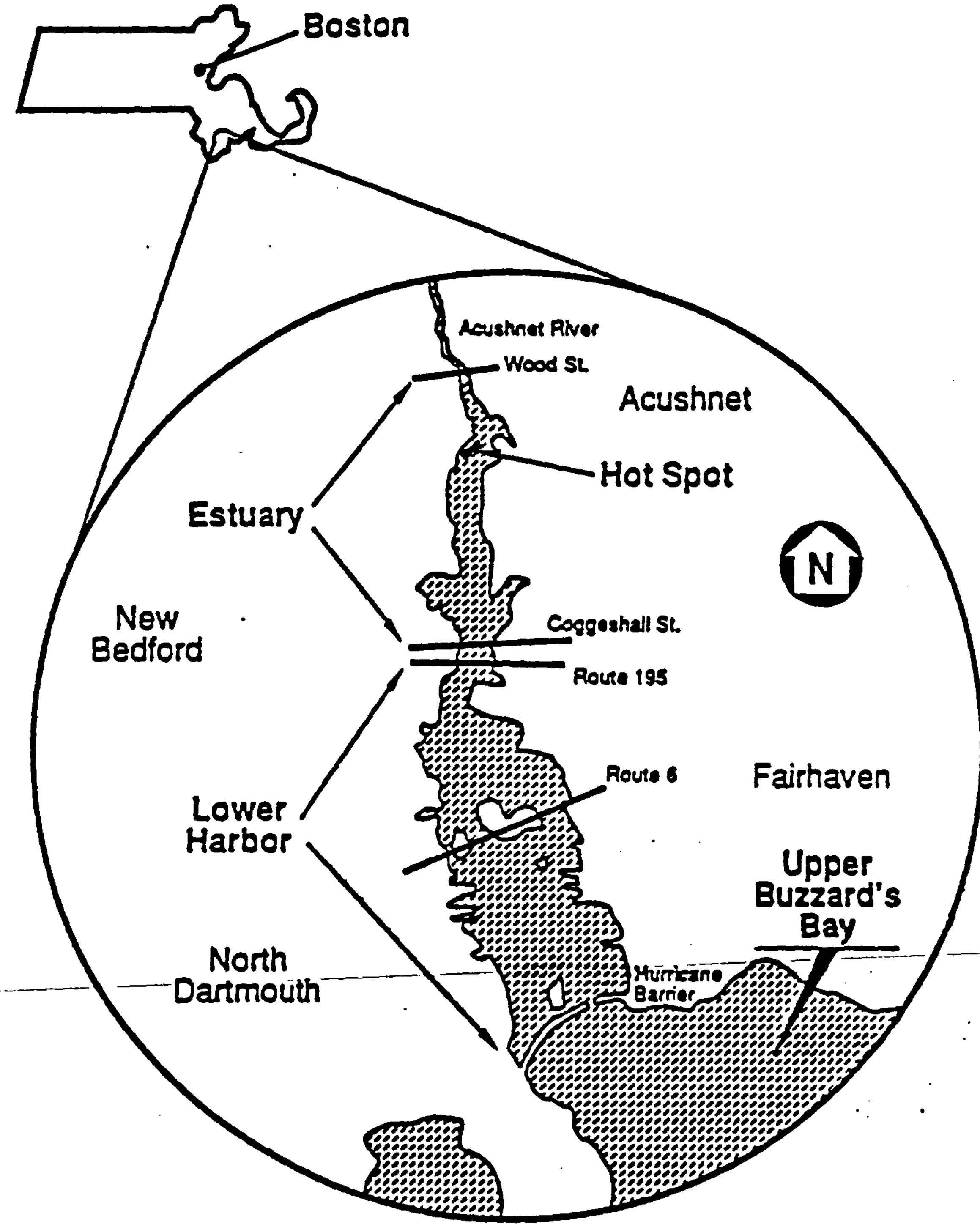
E. The Selected Remedy Satisfies the Preference for Treatment as a Principal Element

The principal element of the selected source control remedy consists of removal and on-site incineration of the contaminated Hot Spot sediments. The selected remedy thus addresses the principal threat at the Hot Spot Area through the use of a treatment technology. Therefore, the selected remedy satisfies the statutory preference for treatment as a principal element that permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances.

XII. STATE ROLE

The Massachusetts Department of Environmental Protection (DEP) has reviewed the various alternatives and fully supports the selected remedy. The Commonwealth of Massachusetts has also reviewed this Record of Decision to determine if the selected remedy will comply with State action-specific ARARs. The Commonwealth concurs with the selected remedy for the New Bedford Harbor/Hot Spot Area. A copy of the declaration of concurrence is attached as Appendix C.

FIGURE 1
SITE LOCATION MAP



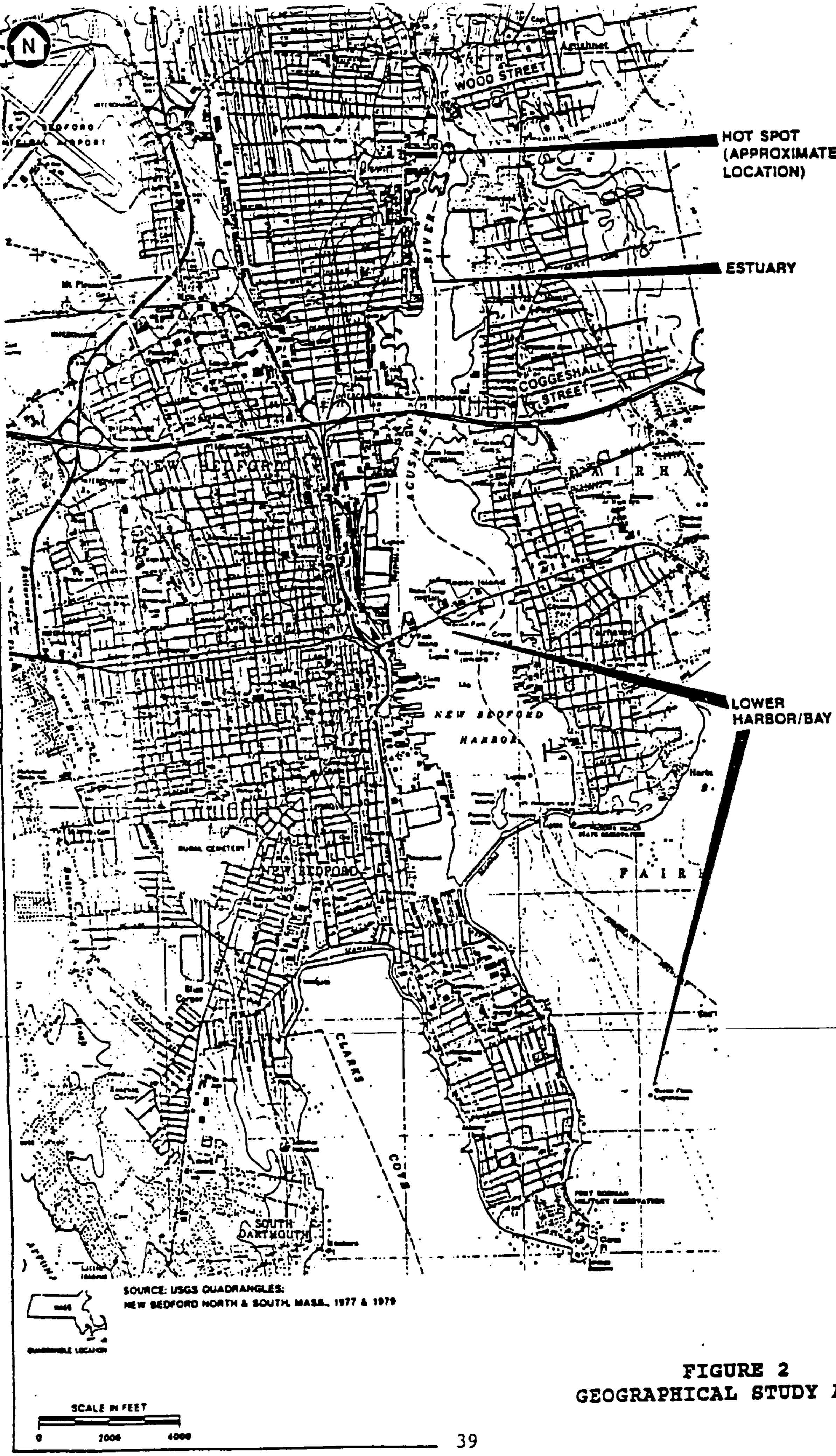


FIGURE 2
GEOGRAPHICAL STUDY AREAS

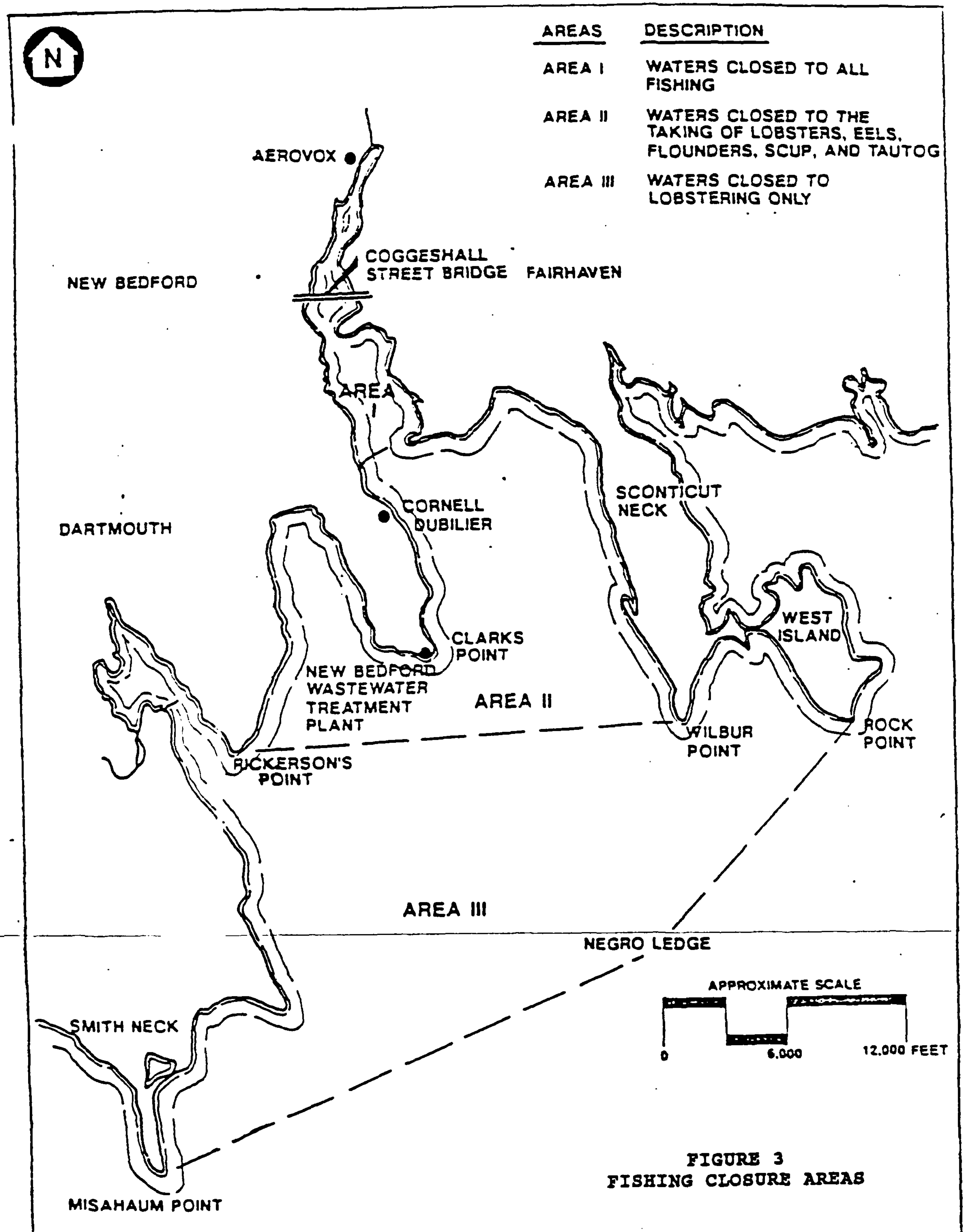


FIGURE 3
FISHING CLOSURE AREAS

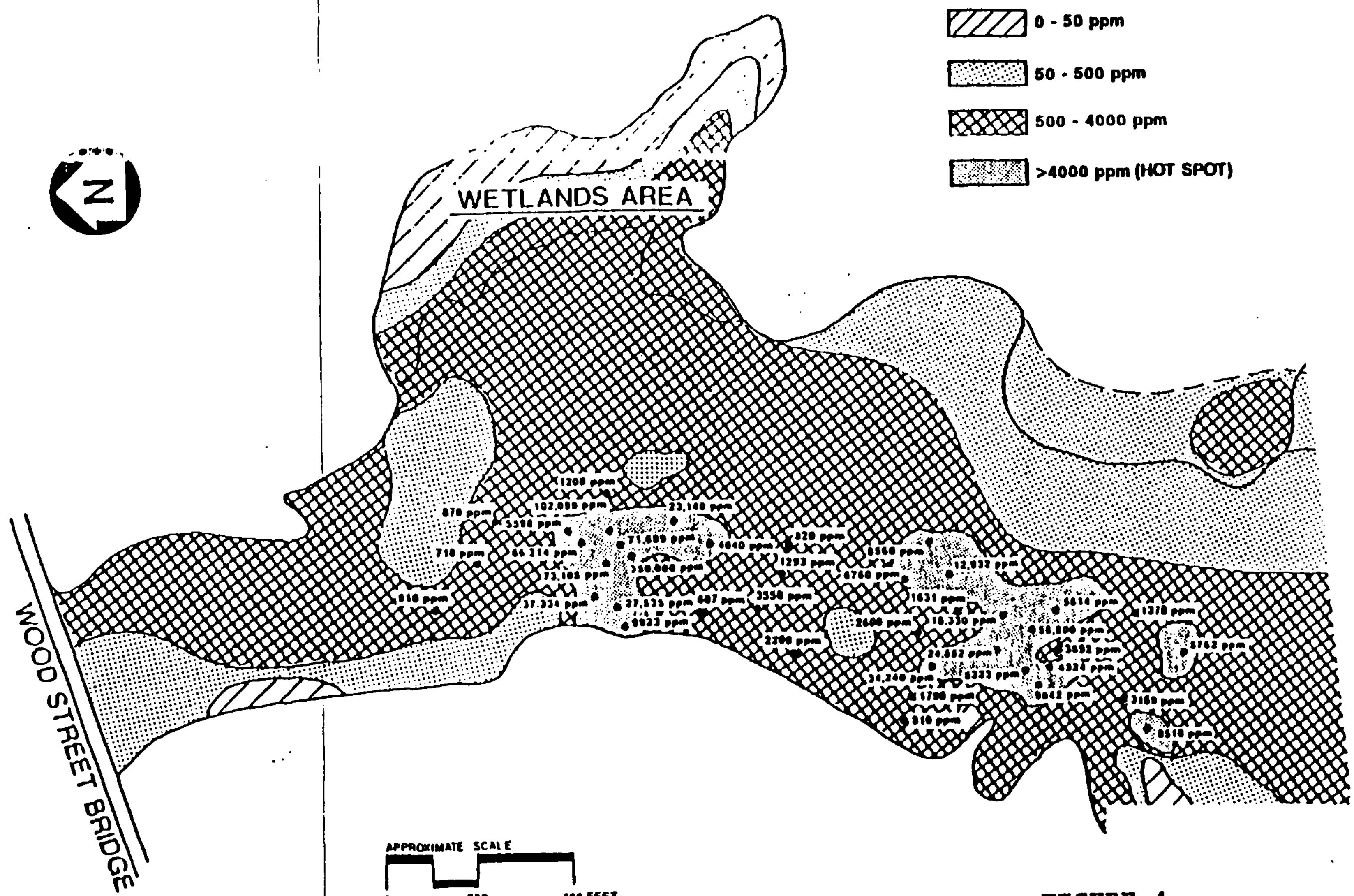


FIGURE 4
HOT SPOT SEDIMENT PCB CONCENTRATIONS; 0 - 12 INCHES

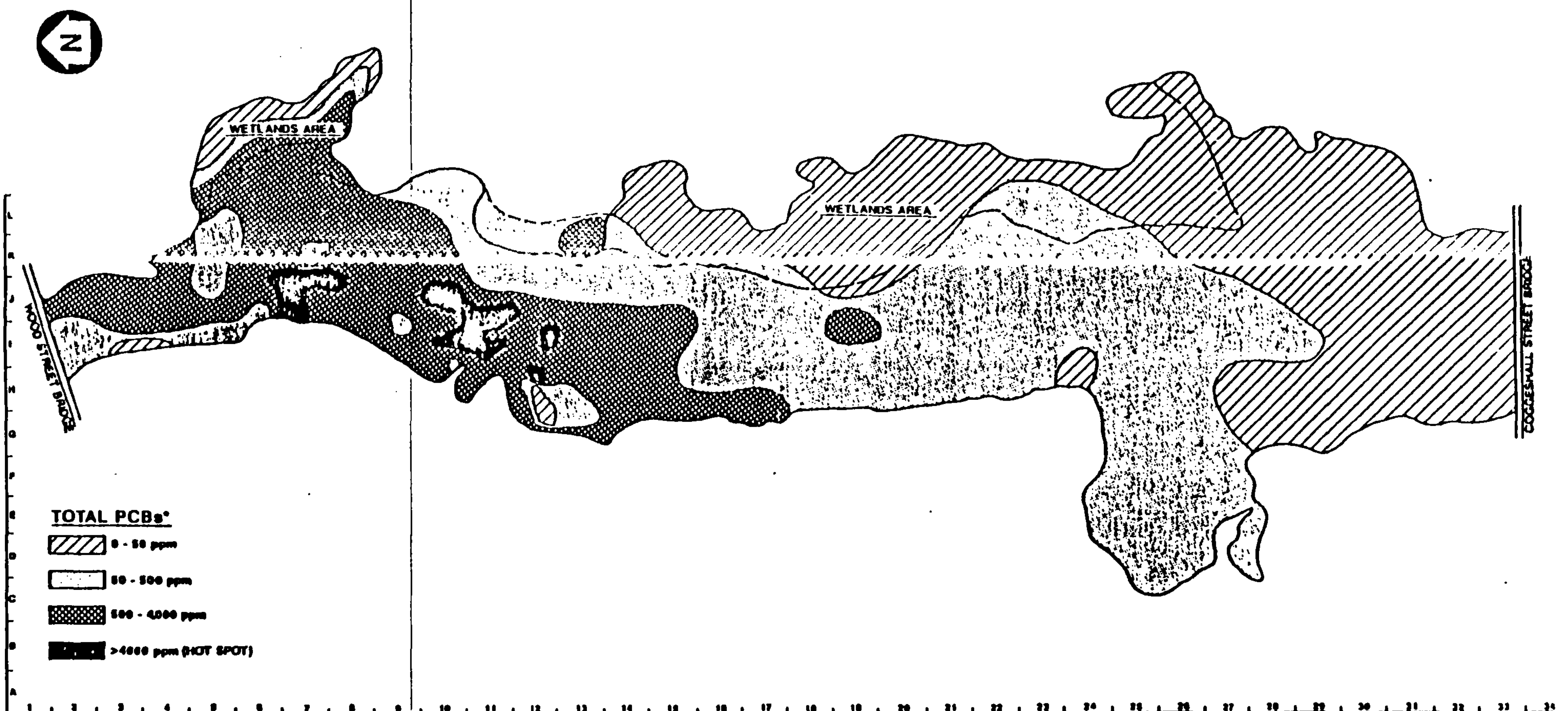


FIGURE 5

INTERPRETATION OF TOTAL PCB CONCENTRATIONS* DEPTH: ZERO TO 12 INCHES HOT SPOT FEASIBILITY STUDY NEW BEDFORD HARBOR

* SUM OF AVAILABLE AROCHLOR DATA

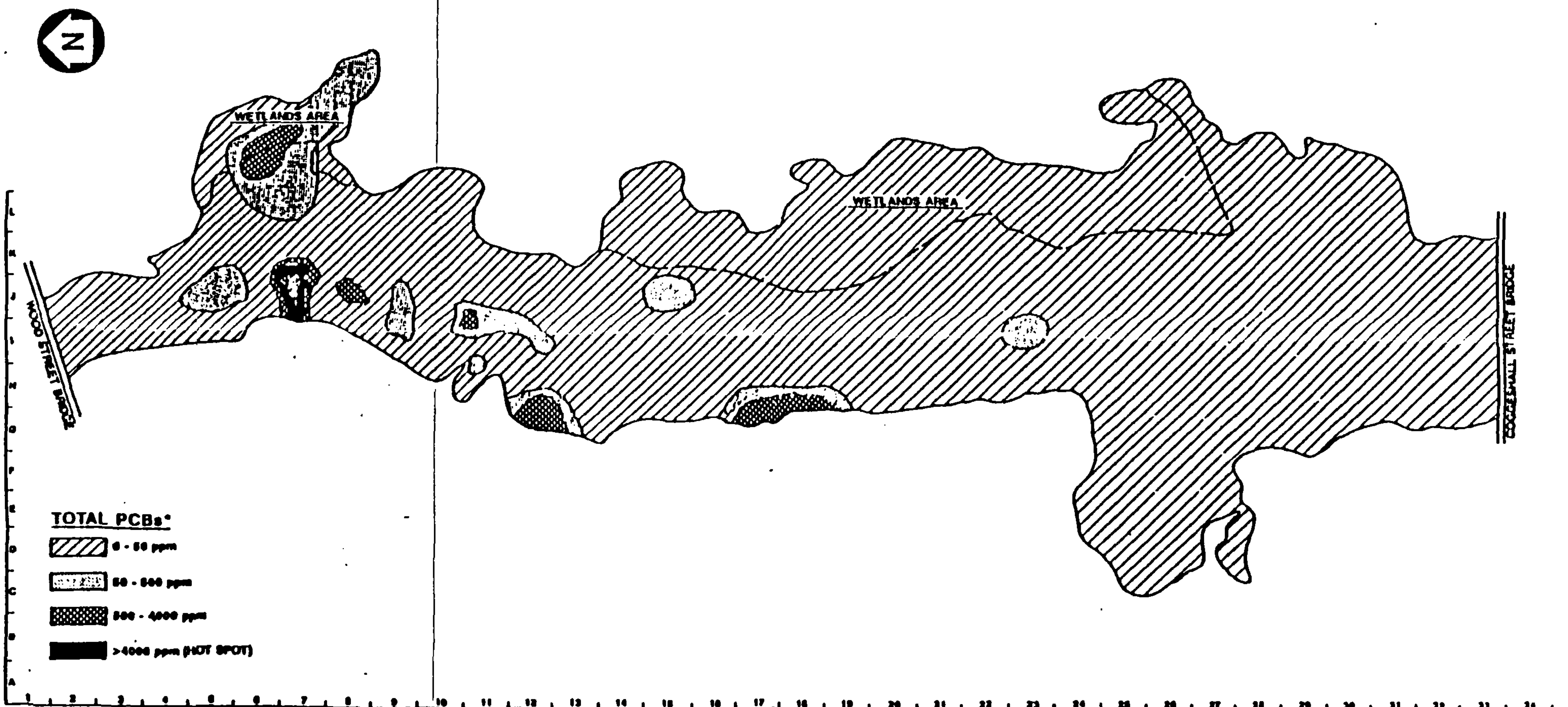


FIGURE 6

INTERPRETATION OF
TOTAL PCB CONCENTRATIONS*
DEPTH: 12 TO 24 INCHES
HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR

* SUM OF AVAILABLE AROCHLOR DATA

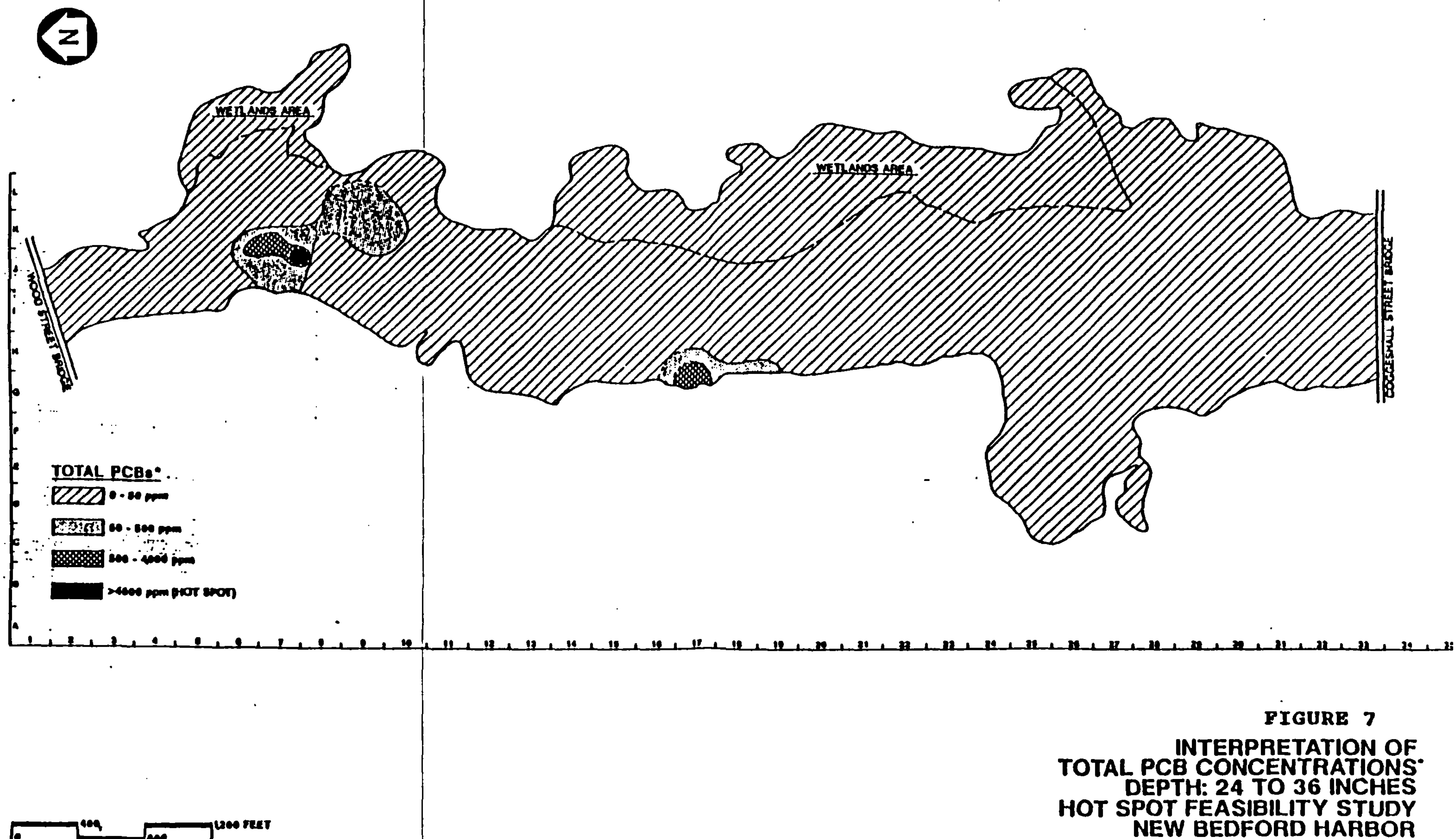


FIGURE 7

INTERPRETATION OF TOTAL PCB CONCENTRATIONS*
DEPTH: 24 TO 36 INCHES
HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR

FIGURE 8
PCB MASS VERSUS VOLUME

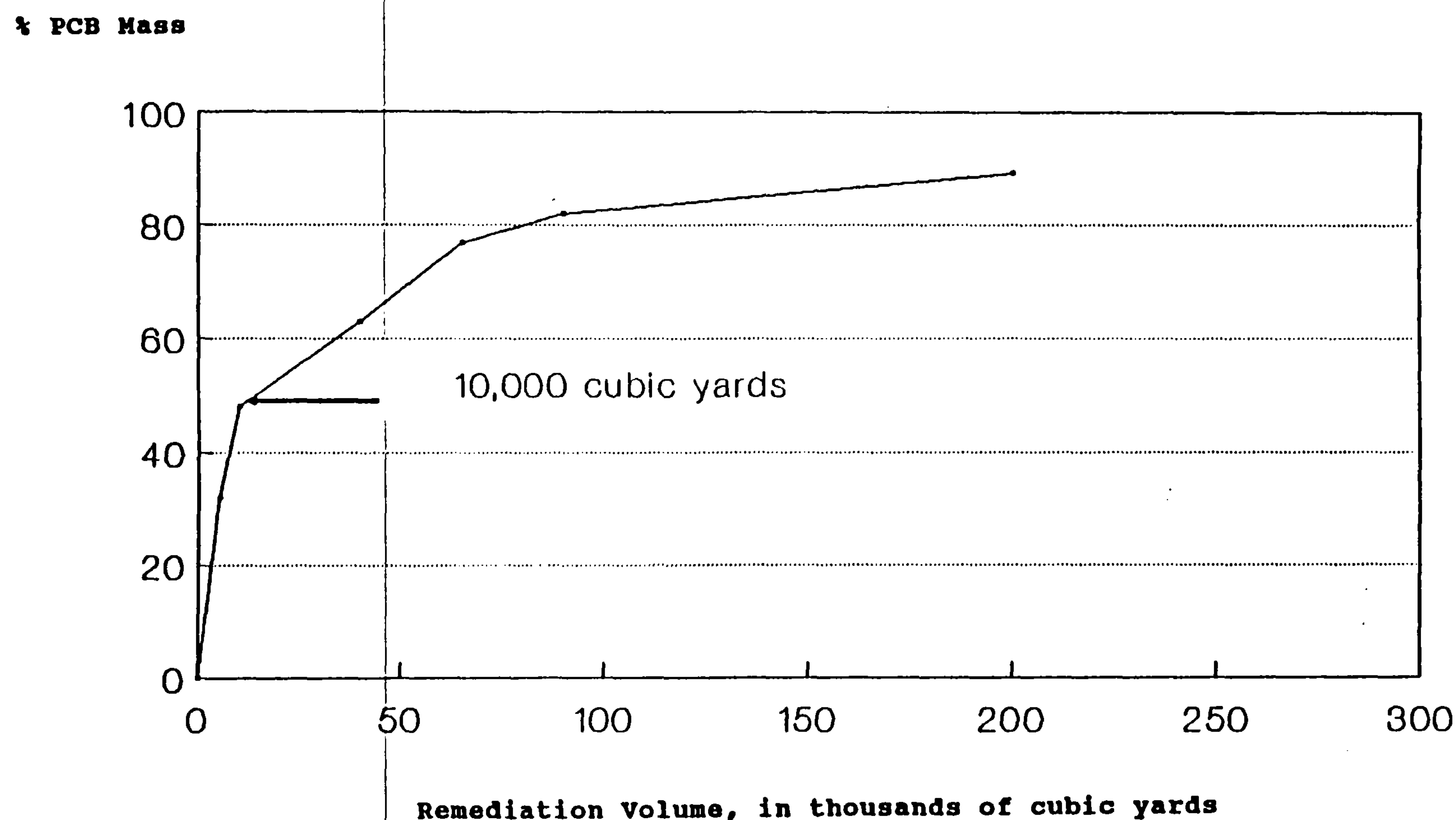
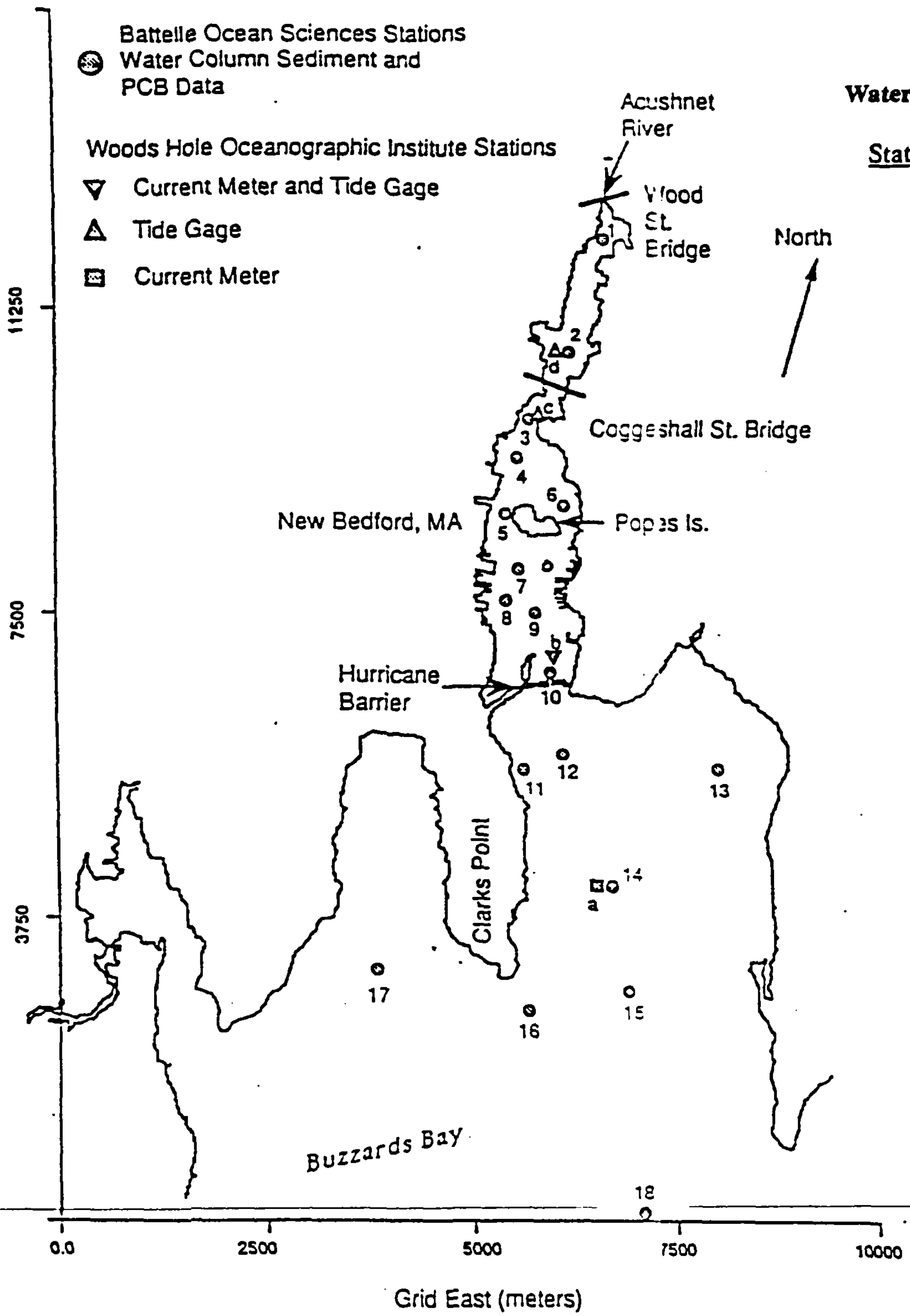


FIGURE 9

SURFACE WATER PCB CONCENTRATIONS



Water Column PCB Concentrations

Station No.	PCB Conc. (ng/ℓ)[1]
1	7635
2	1021
3	269
4	209
5	170
6	318
7	93
8	142
9	91
10	111
11	90
12	46
13	15
14	26
15	14
16	25
17	12
18	5

Notes:

1. Water column PCB concentrations are based on the sum of geometric mean values for particulate and dissolved samples obtained from the respective sampling stations.

Reference:

"New Bedford Harbor Database," Battelle Ocean Sciences/Ebasco, 1989.

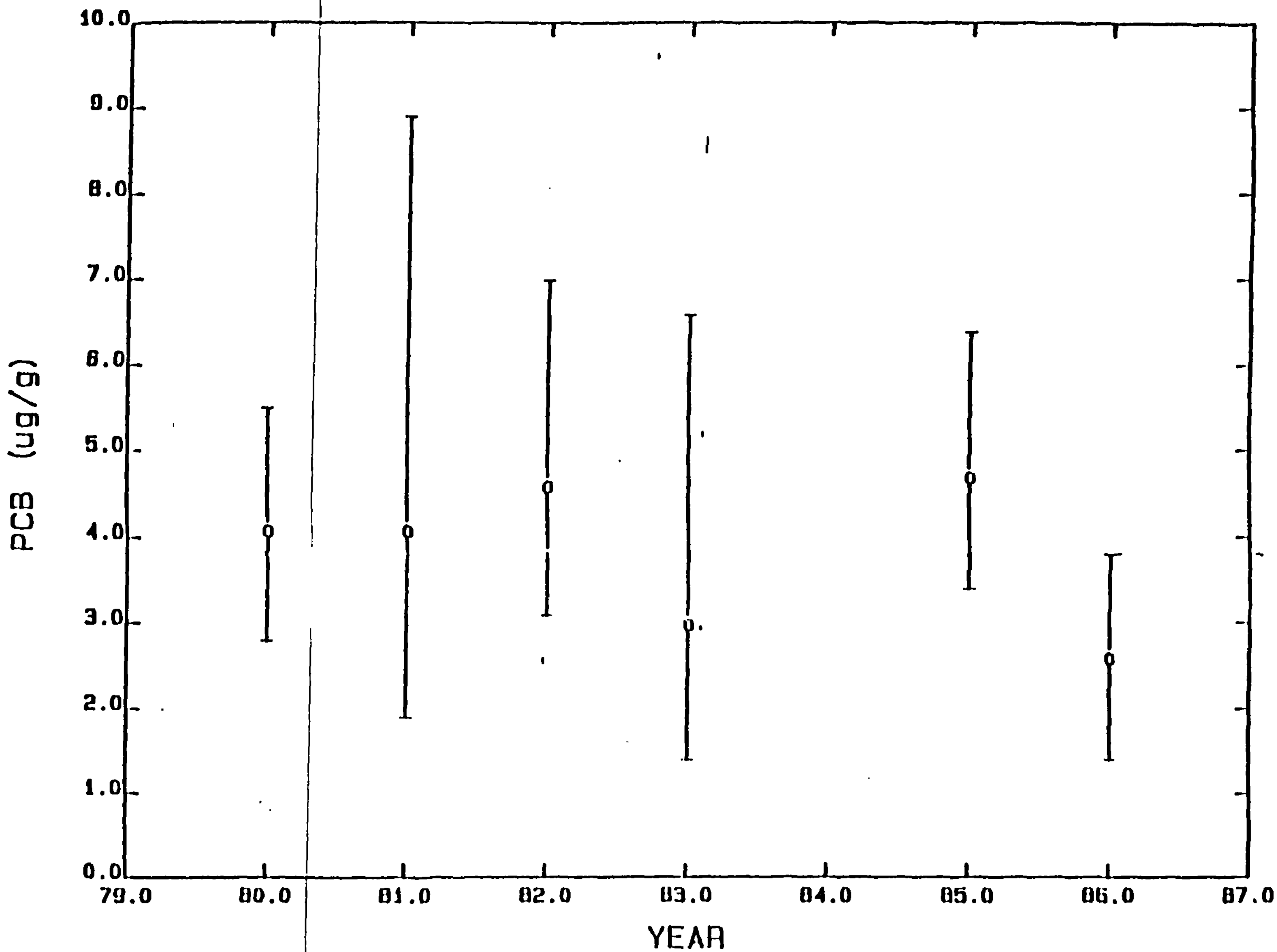


FIGURE 10

PCB CONCENTRATIONS (INCLUDING TOMALLEY) FROM LOBSTERS IN AREA 3: 1979-1987

Source: Dept. of Marine Fisheries; Spring Sampling

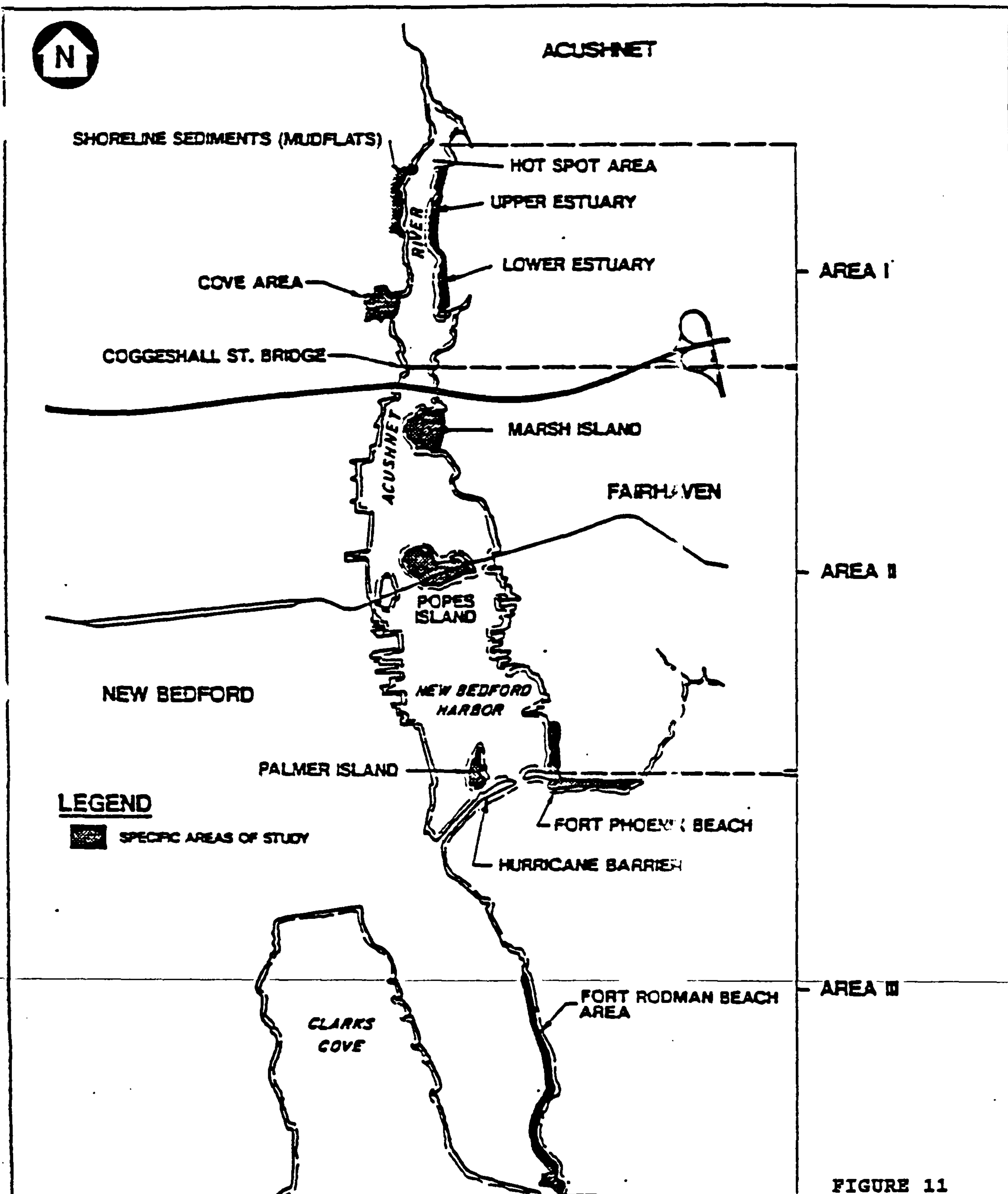


FIGURE 11

LOCATIONS EVALUATED FOR DIRECT CONTACT AND INGESTION EXPOSURE TO CONTAMINANTS IN SEDIMENTS HOT SPOT FEASIBILITY STUDY NEW BEDFORD HARBOR

4959-22

FIGURE 12

Preferred Alternative for Hot Spot Sediments

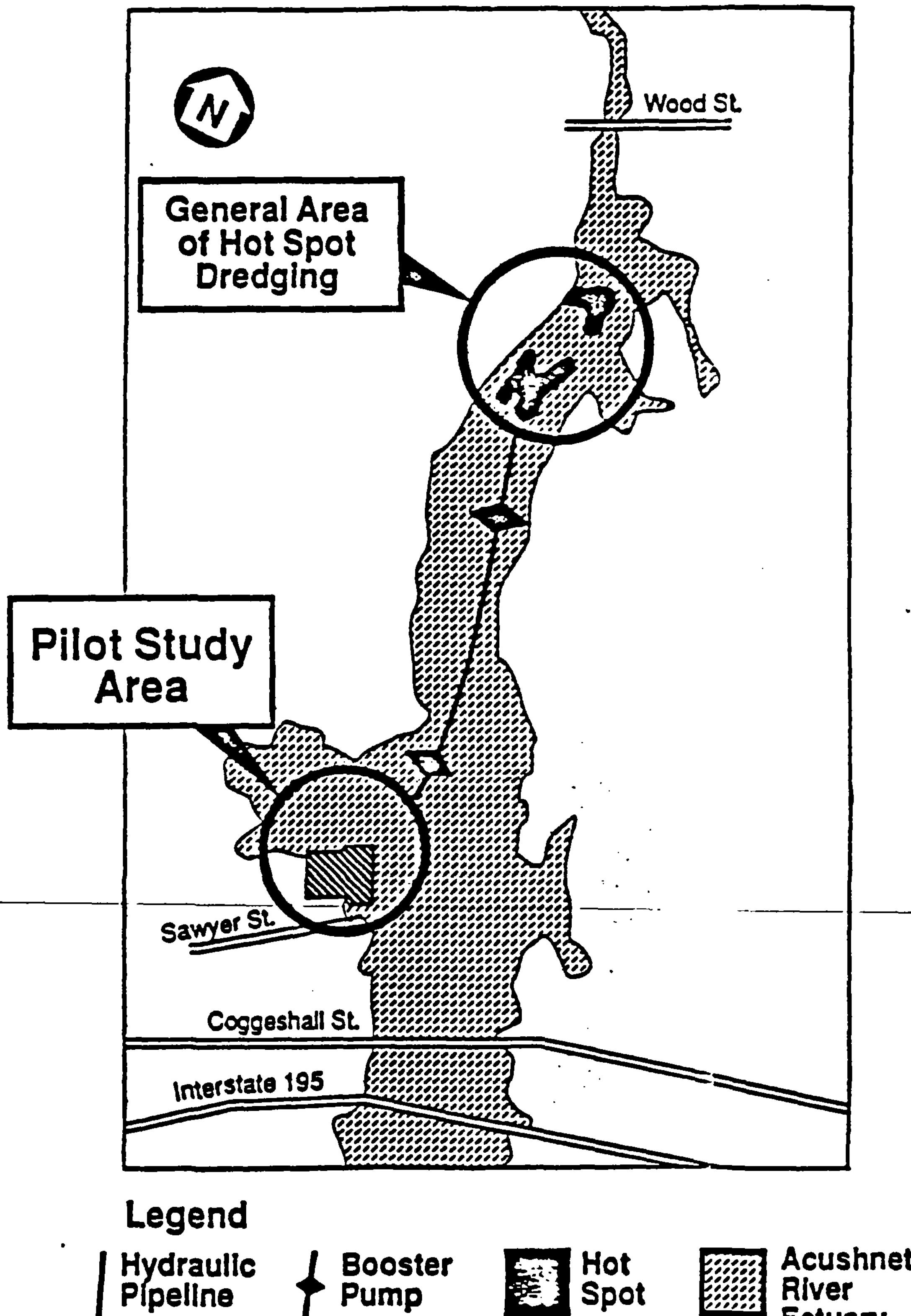


TABLE 1

CONCENTRATIONS OF TOTAL PCBs (ppm) IN EDIBLE TISSUE OF BIOTA COLLECTED FROM NEW BEDFORD HARBOR NEW BEDFORD, MASSACHUSETTS

Species	Area I[1]	Area II[1]	Area III[1]	Outside of Closure Areas[1]
American Lobster[2]				
Mean	NC	0.568	0.231	0.064
Maximum	NC	1.234	0.351	0.176
Winter Flounder[3]				
Mean	1.039	0.371	0.278	0.101
Maximum	2.629	1.048	0.825	0.340
Clam				
Mean	0.689	0.231	0.156	0.039
Maximum	2.121	1.181	0.478	0.137

Notes:

1 = Areas refer to DPH Fishing Closure Areas.
2 = Lobster concentrations do not include tomalley.
3 = The edible tissue concentration was estimated using a whole body/edible tissue ratio of 0.13 (Batelle, 1987).
NC = Not Collected; lobsters were not collected from Area I.
Mean = Arithmetic mean value of all samples collected.
Maximum = Maximum value detected in each Area.

Reference:

"Draft Final Baseline Public Health Risk Assessment," EC Jordan/Ebasco, 1989.

TABLE 2

SUMMARY OF RISK ESTIMATES FOR PCB CONTAMINATED SEDIMENT, DIRECT CONTACT-CHRONIC EXPOSURE[1]

	SEDIMENT PCB CONCENTRATION (ppm)		NONCARCINOGENIC RISKS		CARCINOGENIC RISKS	
LOCATION	Mean Conc.	Max. Conc.	Mean Conc.	Max. Conc.	Mean Conc.	Max. Conc.
Hot Spot[2]	9923	NA	63	NA	7×10^{-3}	NA
Upper Estuary[3]	378	6393	2.4	40	3×10^{-4}	4×10^{-3}
Lower Estuary[3]	149	399	0.9	2.6	1×10^{-4}	2×10^{-4}
Cove Area[3]	286	399	1.8	2.6	2×10^{-4}	2×10^{-4}

Notes:

1 Direct Contact exposure for direct contact only. Hypothetical exposure for an older child, age 6-16 over a 10 year period. Exposure frequency of 20 times per year.

2 Hot Spot concentration from one sample for an area of probable exposure along western shore of the Acushnet River Estuary. (See Figure 4 for location)

3 Exposure locations for Upper Estuary, Lower Estuary and Cove Areas are depicted on Figure 11.

NA = Not Applicable

References: "Draft Final Hot Spot Feasibility Study", EC Jordan/Ebasco 1989 and "Draft Final Baseline Public Health Risk Assessment", EC Jordan/Ebasco 1989.

TABLE 3

LIFETIME CARCINOGENIC PUBLIC HEALTH RISKS
INGESTION OF CONTAMINATED BOITA

Source	PCB Conc. (ppm[1])	Frequency of Exposure	Lifetime Risk (70 years)
Lobster[2]	2.3	Daily	7.3×10^{-2}
		Weekly	1.0×10^{-2}
		Monthly	2.5×10^{-3}
Flounder	0.371	Daily	1.2×10^{-2}
		Weekly	1.7×10^{-3}
		Monthly	3.9×10^{-4}
Clam	0.231	Daily	7.3×10^{-3}
		Weekly	1.1×10^{-3}
		Monthly	2.4×10^{-4}

Notes:

1. All biota concentrations are mean values from the DPH Fishing Closure Area II.
2. Lobster edible tissue includes the tomalley.

Reference:

"Draft Final Baseline Public Health Risk Assessment," EC Jordan/Ebasco, 1989.

TABLE 4

SUMMARY OF HOT SPOT ALTERNATIVES

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

ALTERNATIVE DEVELOPMENT (SUBSECTION 6.1)		ALTERNATIVES ELIMINATED DURING SCREENING (SUBSECTION 6.3)	ALTERNATIVES REMAINING FOR DETAILED EVALUATION
HS-NA-1	No-action		HS-NA-1 (HS-1)
HS-CONT-1	Capping	HS-CONT-1	
HS-CONT-2	Embankment/Capping	HS-CONT-2	
HS-DISP-1	Confined Aquatic Disposal	HS-DISP-1	
HS-DISP-2	Out-of-State TSCA/RCRA Disposal	HS-DISP-2	
HS-TREAT-1	On-site Incineration		HS-TREAT-1 (HS-2)
HS-TREAT-2	Solidification		HS-TREAT-2 (HS-3)
HS-TREAT-3	Solvent Extraction		HS-TREAT-3 (HS-4)
HS-TREAT-4	Off-site Incineration	HS-TREAT-4	

TABLE 5

COMPARATIVE ANALYSIS SUMMARY TABLE

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

ASSESSMENT FACTORS	ALTERNATIVE HS-1 NO-ACTION	ALTERNATIVE HS-2 INCINERATION	SOLIDIFICATION/DISPOSAL	SOLVENT EXTRACTION
• Reduction of Toxicity, Mobility, or Volume	No reduction in toxicity, mobility, or volume since no treatment is employed.	Reduction in toxicity and mobility of PCB-sediments. Volume also reduce unless ash is solidified to prevent metals leaching.	Reduction in mobility of the Hot Spot Sediments. No reduction in toxicity. Volume increased by solidification.	Reduction in toxicity and mobility of PCB sediments. Volume will increase if solidification is employed. to prevent metal leaching.
• Short-term Effectiveness				
- Time Until Protection is Achieved	Reduction in public health risk due to direct contact could be achieved in one month. No reduction in environmental risk.	Reduction in public health and environmental risk should occur within one year after remedial action is initiated.	Same as Alternative HS-2.	Same as Alternative HS-2.
- Protection of Community During Remedial Actions	No impact to community during remedial action.	Dredge controls and air quality controls will minimize community impacts.	Same as Alternative HS-2.	Same as Alternative HS-2.
- Protection of Workers During Remedial Actions	Minimal risk to workers during fence/sign installation.	Protection required against dermal contact with dredged sediments and fugitive dust from dewatered sediments and ash.	Protection required against dermal contact with dredged sediments and fugitive dust from dewatered sediments and solidification process.	Protection required against dermal contact with dredged sediments and fugitive dust from dewatered and treated sediments.
- Environmental Impacts	No significant adverse environmental impact from fence installation.	Minimal environmental impact expected from dredging or construction.	Same as Alternative HS-2.	Same as Alternative HS-2.
• Long-term Effectiveness				
- Magnitude Of Residual Risk	Significant risks remain for public health associated with direct contact of surface soils. Environmental risks would continue unmitigated.	After sediments have been incinerated and the ash solidified (if needed). There will be minimal risk associated with the treated sediments.	After sediments have been solidified and disposed off-site, there will be minimal residual risk.	After sediments have been treated and solidified (if needed), there will be minimal residual risk.
- Adequacy of Controls	No direct engineering controls; fence subject to vandalism; annual monitoring and repair required.	Incineration is a proven technology; no long-term management of treatment residuals required.	TSCA/RCRA landfill is a proven technology; annual monitoring and maintenance is required.	Treatment by solvent extraction is expected to produce a treated sediment that will not need long-term control.

(continued)
COMPARATIVE ANALYSIS SUMMARY TABLE

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

ASSESSMENT FACTORS	ALTERNATIVE HS-1 NO-ACTION	ALTERNATIVE HS-2 INCINERATION	SOLIDIFICATION/DISPOSAL	SOLVENT EXTRACTION
- Reliability of Controls	Sole reliance on fence and institutional controls to prevent exposure; high level of residual risk.	Remedy will be highly reliable due to removal of sediment causing risk.	Likelihood of landfill failure is small as long as O&M is performed.	Same as Alternative HS-2.
• Implementation				
- Technical Feasibility	Fence/signs are easily constructed; environmental monitoring well-proven.	Incineration would require special equipment and operators; treated residuals would require testing to verify treatment effectiveness; technology has been demonstrated at other sites.	TSCA/RCRA Landfill easy to implement; dewatering and solidification of sediments proven during bench- and pilot-scale tests.	Solvent extraction would require special equipment and operators; treated residuals would require testing to verify treatment effectiveness; technology ha been pilot-tested on Hot Spot sediments.
- Administrative Feasibility	No off-site construction; therefore, no permits required.	Same as Alternative HS-1.	Same as Alternative HS-1.	Same as Alternative HS-1.
- Availability of Services and Materials	Services and materials locally available.	Dredge, dewatering, and mobile incinerator equipment and operators needed; available services in eastern United States.	Dredge, dewatering, and solidification services available in eastern United States. TSCA/RCRA disposal facility not locally available.	Solvent extraction equipment available from vendors but not readily. Equipment construction or pilot-scale tests may be required.
• Cost				
- Capital Cost	$ 48,000	$14,397,300	$13,300,200	$12,168,650
- O&M Cost	407,000	--	--	--
- Present Worth Cost	455,000	14,397,300	13,300,200	12,168,650
• Compliance with ARARs/TBCs				
- Compliance with ARARs	AWQCs will not be attained.	AWQCs will not be attained. All other ARARs will be met.	Same as Alternative HS-2.	AWQCs will not be attained. Solvent extraction will nee to achieve equivalent performance standards.
- Appropriateness of Waivers	Not justifiable.	Justifiable based on interim remedy.	Same as Alternative HS-2.	Same as Alternative HS-2.

(continued)
COMPARATIVE ANALYSIS SUMMARY TABLE

HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR, MASSACHUSETTS

ASSESSMENT FACTORS	ALTERNATIVE HS-1 NO-ACTION	ALTERNATIVE HS-2 INCINERATION	SOLIDIFICATION/DISPOSAL	SOLVENT EXTRACTION
- Compliance with Criteria, Advisories, and Guidance	Does not meet FDA level for PCBs in fish and shellfish.	Is not expected to achieve FDA level for PCBs in fish and shellfish.	Same as Alternative HS-2.	Same as Alternative HS-2.
• Overall Protection of Human Health and the Environment				
- How Risks are Reduced, Eliminated, or Controlled	Risks to public health are reduced by restricting site access; environmental risks are not mitigated.	Risks to public health and the environment are significantly reduced by the removal and treatment of the Hot Spot.	Same as Alternative HS-2.	Same as Alternative HS-2.

TABLE 6

**ALTERNATIVE HS-2 ACTION-SPECIFIC ARAR EVALUATION
DREDGING AND ON-SITE INCINERATION OF HOT SPOT SEDIMENT**

1. **Authority** - Federal Regulatory Requirements (FRR)

Requirement
RCRA - General Facility Standards (40 CFR 264.10 - 264.18)

Status
Relevant and Appropriate

Requirement Synopsis
General facility requirements outlining general waste analysis, security measures, inspections, training, and location standards.

Corresponding Remedial Action(s)
Facility will be constructed, fenced, and operated in accordance with this requirement. All workers will be properly trained. A written waste analysis plan must be developed and maintained on-site. Site entry must be prevented by a 24-hour surveillance system and appropriate signs posted. A written inspection program must be developed, and all personnel must complete an on-the-job training program to ensure facility compliance.

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2. **Authority** - FRR

Requirement
RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.37)

Status
Relevant and Appropriate

Requirement Synopsis
This regulation outlines requirements for safety equipment and spill control.

Corresponding Remedial Action(s)
Safety and communication equipment will be installed on-site; local authorities will be familiarized with the site.

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3. **Authority** - FRR

Requirement
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56)

Status
Relevant and Appropriate

Requirement Synopsis
Every hazardous waste facility must have a contingency plan that is implemented immediately upon fire, explosion, or release of harmful hazardous waste constituents.

Corresponding Remedial Action(s)
Plans will be developed during remedial design. Copies of the plans will be kept on-site and will be distributed to the appropriate persons.

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4. Authority - FRR

Requirement
RCRA - Incinerators (40 CFR 264.340 - 264.599)

Status
Applicable

Requirement Synopsis
This regulation specifies the performance standards, operating requirements, monitoring, inspection, and closure guidelines of any incinerator burning hazardous waste.

Corresponding Remedial Action(s)
The transportable on-site incinerator will be operated in accordance with the applicable RCRA requirements.

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5. Authority - State Regulatory Requirements (SRR)

Requirements
DEP - Hazardous Waste Regulations (310 CMR 30.00)

Status
Relevant and Appropriate

Requirement Synopsis
These regulations specify the Massachusetts requirements for hazardous waste facilities.

Corresponding Remedial Action(s)
During remedial design, these regulations will be compared to the corresponding federal RCRA regulations, and the more stringent requirements will be addressed.

6. **Authority** - SRR

Requirement
DEP - Solid Waste Management Regulations (310 CMR 19.00)

Status
Applicable

Requirement Synopsis
These regulations outline the Commonwealth of Massachusetts' procedures for regulating solid waste activities.

Corresponding Remedial Action(s)
During remedial design, the use of the CDF for storage of treated material will address these requirements.

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7. **Authority** - FRR

Requirement
TSCA - Storage and Disposal (40 CFR 761.60 - 761.79)

Status
Applicable

Requirements
These regulations specify the disposal/destruction requirements of PCB materials in excess of 50 ppm. Dredged materials with PCB concentrations greater than 50 ppm may be disposed by alternative methods which are protective of human health and the environment, if shown that incineration or disposal in a chemical landfill is not reasonable or appropriate.

Corresponding Remedial Action(s)
The requirements of this regulation will be attained during remedial action. A test burn will be conducted to determine optimum equipment configuration and operating parameters to achieve the required PCB destruction removal efficiencies.

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8. **Authority** - FRR

Requirement
Clean Water Act (CWA) - 40 CFR, Parts 125, 230, and 307

Status
Applicable

Requirement Synopsis
These regulations specify that a best management program (BMP) be developed to minimize release of pollutants from the facility. These requirements also state that no alternative that impacts a wetland shall be allowed if there is a practicable alternative. If there is no practicable alternative, impacts must be mitigated. Effluent standards incorporated by reference are considered for target levels.

Corresponding Remedial Action(s)
A BMP will be developed and will include sedimentation control around the excavation/dredging area. Since dredging of the Hot Spot sediments is necessary since it is the sediments themselves that are contaminated, dredging will be conducted to minimize impacts to the Estuary and adjacent wetland areas. Dewatering effluent levels will utilize best available control technology to reduce contaminant levels prior to discharge.

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9. **Authority** -Federal Criteria, Advisories, and Guidance (FCAG)

Requirement
Federal Ambient Water Quality Criteria (AWQC)

Status
Applicable

Requirement Synopsis

Federal AWQC are health-based criteria that have been developed for 95 carcinogenic and noncarcinogenic compounds.

Corresponding Remedial Action(s)
AWQC are incorporated into Massachusetts DEP surface water quality standards. Levels for effluent generated by dewatering will reflect current guidance.

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10. **Authority** - SRR

Requirement
DEP - Massachusetts Surface Water Quality Standards (310 CMR 4.00) and Wastewater Treatment (310 CMR 12.00)

Status
Applicable

Requirement Synopsis
DEP Surface Water Quality Standards incorporate the federal AWQC as standards for the state surface water.

Corresponding Remedial Action(s)
Dredging will be implemented to minimize sediment resuspension and subsequent PCB mobility. Effluent from the dewatering of the sediments will also use these standards as target levels and will utilize best available control technology.

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11. **Authority** - FRR

Requirement
Clean Air Act (CAA) - National Ambient Air Quality Standards (NAAQS) (40 CFR Part 40)

Status
Relevant and Appropriate

Requirement Synopsis
These standards were primarily developed to regulate stationary stack and automobile emissions.

Corresponding Remedial Action(s)
Incinerator emissions will be controlled by Best Available Control Technology such that the regulations are met. In addition, fugitive dust in the work area will be controlled by water sprays or other dust suppressants, as required.

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12. **Authority** - SRR

Requirement
DEP - Air Quality and Air Pollution Control (310 CMR 6.00 - 8.00)

Status
Relevant and Appropriate

Requirement Synopsis
These standards were primarily developed to regulate stationary stack and automobile emissions.

Corresponding Remedial Action(s)
Incinerator emissions will be controlled by best available control technology so that the regulations are met. In addition, fugitive dust in the work areas will be controlled by water sprays or other dust suppressants, as required.

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13. **Authority** - Federal Executive Order

Requirement
Wetlands Executive Order (EO 11990)

Status
Applicable

Requirement Synopsis
Under this regulation, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and beneficial values of wetlands.

Corresponding Remedial Action(s)
Dredging in the wetland is required to remove the Hot Spot contamination. However, dredging of Hot Spot sediment will attempt to minimize impacts to the extent practicable.

****

14. **Authority** - Federal Executive Orders

Requirement
Floodplains Executive Order (EO 11988)

Status
Applicable

Requirement Synopsis
Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial value of floodplains.

Corresponding Remedial Action(s)
Dredging of sediment from the Hot Spot is expected to have minimal impact on the floodplain of the Acushnet River.

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15. **Authority** - SRR

Requirement
DEP - Wetlands Protection (310 CMR 10.00) and
Certification for Dredge and Fill (314 CMR 9.00)

Status
Applicable

Requirement Synopsis
These regulations are promulgated under Wetlands Protection Laws, which regulate dredging, filling, altering, or polluting inland wetlands. Work within 100 feet of a wetland is regulated under this requirement. The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated.

Corresponding Remedial Action(s)
Dredging in the wetland is required to remove the Hot Spot contamination since it is the sediments themselves that are contaminated. However, dredging of Hot Spot sediment will attempt to minimize impacts to the extent practicable.

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16. Authority - SRR

Requirement
Coastal Zone Management (301 CMR 20.00)

Requirement Synopsis
Under these regulations, agencies are required to minimize the destruction, loss, or degradation of wetlands, and beneficial values of wetland.

Corresponding Remedial Actions
Dredging is required to remove the Hot Spot contamination. However, dredging of Hot Spot sediments will utilize various control options and will attempt to minimize impacts to the extent practicable.

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17. Authority - FRR

Requirement
OSHA - General Industry Standards (29 CFR Part 1910)

Status
Applicable

Requirement Synopsis
These regulations specify the 8-hour, time-weighted average concentrations for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.

Corresponding Remedial Action(s)
Proper respiratory equipment will be worn, if necessary, if it is impossible to maintain the work atmosphere below the allowable concentrations. Workers performing remedial activities will be required to have completed specified training requirements. Air monitoring will be conducted during remedial activities.

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18. Authority - FRR

Requirement
OSHA - Safety and Health Standards for Federal Service Contracts (29 CFR 1926)

Status
Applicable

Requirement Synopsis
This document contains instructions concerning worker safety at RCRA or Superfund hazardous waste facilities.

Corresponding Remedial Action(s)
All appropriate safety equipment will be maintained on-site, and appropriate safety procedures will be followed during remediation.

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19. Authority - FRR

Requirement
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)

Status
Applicable

Requirement Synopsis
This regulation outlines OSHA recordkeeping and reporting regulations for an employer.

Corresponding Remedial Action(s)
This regulation is applicable to the remedial action contractor(s) operating the facility, and compliance with this requirement will be included in the contract.

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20. **Authority** - SRR

Requirement
DEP - Hazardous Substance Right-to-Know (310 CMR 33);
DPH - Hazardous Substance Right-to Know (105 CMR 670)

Status
Applicable

Requirement Synopsis
These regulations outline the informational requirements for hazardous substances that may affect workers associated with the Department of Environmental Protection or the Department of Public Health.

Corresponding Remedial Action(s)
The requirements of these regulations will be attained during alternative implementation.

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HOT SPOT ROD

RESPONSIVENESS SUMMARY

MARY C. SANDERSON

RESPONSIVENESS SUMMARY

NEW BEDFORD HARBOR SUPERFUND SITE

HOT SPOT OPERABLE UNIT

NEW BEDFORD, MASSACHUSETTS

APRIL 1990

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION I

The U.S. Environmental Protection Agency and the
REM III Team assembled this Responsiveness Summary
with assistance from the U.S. Army Corps of Engineers
and the Massachusetts Department of Public Health.
Their assistance is greatly appreciated.

NEW BEDFORD HARBOR SUPERFUND SITE
HOT SPOT STUDY AREA
RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

Preface

The U. S. Environmental Protection Agency (EPA) held a 74-day public comment period from August 4, 1989 to October 16, 1989 to provide an opportunity for interested parties to comment on the draft Feasibility Study (FS) and the July 1989 Proposed Plan prepared for the New Bedford Harbor Superfund Site/Hot Spot Study Area in New Bedford, Massachusetts. The draft FS examines and evaluates various options, called remedial alternatives, to address sediment contamination in the Hot Spot Study Area. EPA identified its preferred alternative for the cleanup of the Study Area in the Proposed Plan issued on August 3, 1989, before the start of the public comment period.

To facilitate Site cleanup, EPA has organized its investigation of the New Bedford Harbor Site into two segments, known as operable units. A Remedial Investigation (RI) and FS for the first operable unit, the Hot Spot Study Area, was conducted between 1988 and 1989. The FS incorporates findings from previous harbor studies including the 1984 FS of the upper Estuary; the 1989 Engineering FS and Pilot Study; and the 1989 Baseline Public Health Risk Assessment -- a study that assesses the potential risks to public health and the environment associated with Hot Spot sediment contamination. An FS addressing overall harbor contamination, the second operable unit or phase of cleanup, is scheduled for completion in 1990.

The purpose of this Responsiveness Summary is to document EPA responses to the questions and comments raised during the public comment period on the Hot Spot Study Area. EPA has carefully considered all of these questions and comments before selecting a final remedial alternative to address Hot Spot Study Area sediment contamination of the New Bedford Harbor Site.

This Responsiveness Summary is organized into the following sections:

I. <u>Overview of Remedial Alternatives Considered in the Feasibility Study, Including the Selected Remedy</u> - This section briefly outlines the remedial alternatives evaluated for the Hot Spot in the FS and the Proposed Plan, including EPA's preferred alternative.

II. <u>Background on Community Involvement and Concerns</u> - This section provides a brief history of community interest and concerns regarding the New Bedford Harbor Site.

III. <u>Summary of Comments Received During the Public Comment Period and EPA Responses</u> - This section summarizes the oral and written comments received during the public comment period and provides EPA responses to them.

In addition, two attachments are included in this Responsiveness Summary. Attachment A provides a list of the community relations activities that EPA has conducted to date at the New Bedford Harbor Site. Attachment B contains copies of the transcripts from the informal public hearings held on August 16, 1989, August 22, 1989 and September 25, 1989.

I. OVERVIEW OF REMEDIAL ALTERNATIVES CONSIDERED IN THE FEASIBILITY STUDY, INCLUDING THE SELECTED REMEDY

Using the information gathered during the 1988-89 Hot Spot FS and Risk Assessment, EPA identified specific objectives for the cleanup of the New Bedford Harbor Site/Hot Spot Study Area. The response objectives are:

1. Significantly reduce polychlorinated biphenyl (PCB) migration from Hot Spot Area sediments to the water column and sediments throughout the Harbor.

2. Significantly reduce the amount of remaining PCB contamination that would need to be remediated in order to achieve overall harbor cleanup.

3. Protect public health by preventing direct contact with Hot Spot sediments.

4. Protect marine life currently in direct contact with Hot Spot Study Area sediments. The second operable unit of the harbor cleanup will include specific target cleanup goals for contaminants throughout the Harbor.

EPA has developed a cleanup program to address sediment contamination at the Hot Spot Study Area. The selected remedy includes: removing contaminated sediments from the Hot Spot using a cutterhead dredge, dewatering the dredged sediments, incinerating the sediments in an on-site transportable incinerator, solidifying the ash residue, if necessary, and providing interim storage of the treated sediments following the completion of the remediation process. Ultimate disposition of the treated material will be addressed in the second operable unit for the Site.

Other Alternatives Evaluated in the Feasibility Study

In the Hot Spot Study Area FS, EPA screened and evaluated a number of potential cleanup alternatives for the New Bedford Harbor Site/Hot Spot Study Area. The FS describes the alternatives, as well as the screening criteria used by EPA to narrow the list to four potential remedial alternatives. Each of these alternatives is described briefly below. The Proposed Plan, which identifies EPA's preferred alternative for the Hot Spot Area, also contains brief descriptions of the alternatives considered in detail in the Hot Spot Study Area FS. A detailed description of remedial alternatives can be found in the Hot Spot Study Area FS and in the Record of Decision Summary. The Hot Spot FS is available as part of the Administrative Record for the

Site, which is available for inspection at the New Bedford Free Library at 613 Pleasant Street in New Bedford, Massachusetts and at the EPA Records Center at 90 Canal Street in Boston, Massachusetts.

Hot Spot Study Area Remedial Alternatives:

1. Minimal No Action: Under this alternative, institutional measures would be taken to restrict Site access and caution against swimming, fishing and shellfishing in the Hot Spot Area. No dredging or treatment of sediments would occur.

2. Sediment Removal and Incineration: This is EPA's selected remedy.

3. Sediment Removal and Solidification/Disposal: Hot Spot sediments would be removed using a cutterhead dredge and transported by hydraulic pipeline to the Confined Disposal Facility (CDF) area. Dredged sediments would be solidified on-site; the solidified material would be transported to an off-site Federally-approved landfill for disposal.

4. Sediment Removal and Solvent Extraction: Hot Spot sediments would be removed using a cutterhead dredge and transported by hydraulic pipeline to the CDF area. Dredged sediments would be treated using solvent extraction, a process that uses a solvent to remove PCBs from contaminated sediments or soils. The PCB-enriched solvent extract would be incinerated at an off-site Federally-approved facility. Solidification of the remaining waste material would be used to immobilize metals, as necessary, prior to temporary storage of the treated sediment.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

The New Bedford Harbor Site is an urban tidal estuary located at the head of Buzzards Bay in southeastern Massachusetts. The harbor is bordered by the towns of New Bedford, Acushnet, Dartmouth and Fairhaven. From the 1940's until the late 1970's, two electrical capacitor manufacturing facilities in New Bedford released PCBs onto the adjoining shoreline mudflats of the plants and into New Bedford Harbor, through discharged wastewaters containing PCBs and through alleged intentional dumping. Field studies conducted by EPA and the Commonwealth of Massachusetts between 1976 and 1982 identified PCBs and heavy metals in sediments and marine life throughout a 1,000-acre area of the harbor and upper Buzzards Bay.

In 1982, the New Bedford Harbor Superfund Site was added to the National Priorities List (NPL), making it eligible to receive federal funds for investigation and cleanup under the Superfund program.

Community involvement in EPA and state investigations of New Bedford Harbor has been high throughout the RI/FS process. Concerns in the bordering communities have initially focused on potential public health impacts as a result of living near the harbor or eating fish caught in the harbor, potential impacts on the local fishing industry, and potential limitations on waterfront development activities. Community concerns now also include the environmental, economic and health impacts of remedial alternatives being evaluated for the Hot Spot portion of the Site, and ensuring that, following the Hot Spot remediation, remaining harbor contamination will be addressed.

Community concerns first surfaced in the mid-1970's, following the discovery of extensive PCB contamination in the harbor (water column and bottom sediments) and in the tissue of fish caught both in the harbor and in adjacent Buzzards's Bay. In 1977, Massachusetts banned construction in the harbor intertidal and subtidal zones to prevent re-suspension of contaminated sediments, and the Commonwealth also banned shellfishing or bottom fishing within the harbor and certain sections of Buzzard's Bay to protect public health.

These bans resulted in high levels of concern from commercial fishermen, who feared that the public's association of New Bedford Harbor with hazardous wastes would negatively impact the local fishing industry. Area residents and commercial enterprises interested in developing commercial space on the harbor, repairing aging wharves, or undertaking other activities were equally concerned about the building moratorium. Further concerns expressed by area residents focused on delays in plans to improve the Route 6 bridge over the Acushnet River Estuary.

In 1982, the U.S. Coast Guard placed signs, in English and in Portuguese, notifying the public of the restrictions on fishing and swimming. These signs were subsequently vandalized.

In 1983, the EPA, the Massachusetts Department of Environmental Protection (DEP) -- formerly known as the Department of Environmental Quality Engineering (DEQE) -- and the Massachusetts Department of Public Health (DPH) held a public meeting on the cleanup plan for the Acushnet River Estuary. The DPH representatives reviewed the results of the preliminary health study conducted in 1981 to evaluate PCB concentrations in area workers and residents, and stated that the tests showed elevated PCB levels in certain area workers and in persons who ate fish caught in the harbor. DPH stated that a more comprehensive follow-up study would be conducted by the DPH, the Massachusetts

Health Research Institute (MHRI), and the U.S. Centers for Disease Control (CDC). Approximately 800 to 1,000 residents of New Bedford, Fairhaven, Acushnet and Dartmouth would be studied to determine whether they had been exposed to PCBs, the level of PCB contamination in the bloodstream, and the correlations between life-style and PCB blood concentrations would be evaluated.

In 1984, EPA received a petition from Fairhaven residents calling for preventing public access to the estuary; a ban on dredging in the Acushnet River; a comprehensive program testing area property for contamination; meetings with EPA officials; and an area-wide health study.

In June 1984, EPA distributed 25,000 informational pamphlets on harbor contamination to schools in New Bedford, Acushnet and Fairhaven, providing information on ways to prevent exposure to contaminants in the harbor area. EPA added to its public information program in July 1984 by placing additional English and Portuguese warning signs around the harbor.

On July 11, 1984, a public meeting, cosponsored by DPH and the League of Women Voters was held to announce the commencement of the DPH, MHRI and CDC health study. The study, which was released in 1987, showed that few of the residents who had participated in the study had elevated levels of PCBs, and that the residents with the highest risk of elevated PCBs (from occupational exposure or eating harbor fish) had PCB levels within the typical range of the U.S. population. The health study also suggested that the Massachusetts regulations banning fishing in the harbor may have contributed to lowering risks to the local population. Following the release of the study, health-related community concerns, which had been very high, were significantly reduced.

In September 1984, EPA released the results of the "fast-track" Feasibility Study. Among the options considered in the FS were dredging of contaminated sediments, channelizing the harbor, and capping areas on either side of the channel. Public concerns over these recommendations centered on the possibility of resuspending contaminated sediments during the dredging operations, public health impacts, and impacts upon the port's commercial operations. EPA responded to these concerns, determining that additional studies of dredging and disposal techniques should be conducted before proceeding with the harbor cleanup.

The New Bedford Area Chamber of Commerce released a "PCB White Paper" in July 1985 to provide the area population with information on the nature of PCBs, their potential health effects, the CDC health study, sources of PCB contamination in the harbor, EPA's investigations, and choices facing New Bedford area residents regarding EPA's future activities.

On April 30, 1987, EPA held a public information meeting to describe plans for a proposed pilot project to evaluate dredging and disposal options in New Bedford Harbor, and to inform the public on the progress of the Feasibility Study for the Site. EPA also distributed an English and Portuguese fact sheet on the Pilot Study to those people on a mailing list that EPA developed for the Site. Approximately 175 people attended this meeting. A question and answer period was held during which the public asked over 50 questions. Questions focused on the physical characteristics of the Site, possible cleanup options, the Pilot Study, public involvement, and the schedule for the RI/FS. Following the conclusion of the EPA meeting, the community group, People Acting in Community Endeavors (PACE) presented a thirty minute videotape they had produced about the Site.

In October 1987, EPA released an information update in English and Portuguese on recently completed plans for the Pilot Study. In addition, a public meeting was held on October 22 to present EPA, DEP, and U.S. Army Corps of Engineers' (COE) plans for construction and operation of the Pilot Study. EPA, DEP and the COE also conducted a public availability session on October 24 to answer questions from the community on a less formal basis than at the public meeting.

Citizen involvement in EPA's decision-making process at the Site increased significantly with the formation of the Greater New Bedford Environmental Community Work Group (CWG) in October 1987. The CWG was formed under the auspices of the Office of the Mayor of New Bedford. Its formation was supported by EPA, which sought to ensure that the public be kept informed about the Site and be able to participate actively in site-related decision making. The CWG has a membership of approximately 25 people, although a core group of approximately 10 to 12 members formed after the group had met a number of times. Members were recruited from each of the surrounding four communities and include representatives from environmental, fishing, business and other interests. From October 1986 through the present, CWG members have met on a regular basis with EPA and other agencies involved in the cleanup and study process, such as the U.S. Army Corps of Engineers.

EPA released an information update in June 1988, again in both English and Portuguese, to inform the public on EPA's proposed testing of an innovative treatment technology, under the auspices of the Superfund Innovative Technology Evaluation (SITE) program, at the New Bedford Site and to invite public comment on EPA's proposal. The information update also provided information on the CWG and on the progress of the Pilot Study. Following the release of the update, EPA held an open house at the SITE demonstration. A large number of local and state officials, CWG members, and members of the general public attended. Following a number of presentations on the SITE program to the CWG, the CWG unanimously endorsed conducting the demonstration.

EPA held a public groundbreaking ceremony on April 7, 1988 to announce the beginning of construction of the Confined Disposal Facility (CDF), as a part of the Pilot Study. The ceremony was well attended and included a representative of the CWG.

Throughout the FS and Pilot Study process, the CWG remained extremely active in providing EPA with information and suggestions. To facilitate their involvement, the CWG applied for and was awarded a $50,000 EPA Technical Assistance Grant (TAG) in November 1988. The CWG, in turn, contracted with an independent consulting firm to assist them in providing EPA with detailed technical comments on the Hot Spot FS and other aspects of the New Bedford Harbor cleanup.

Public interest in the Pilot Study continued, and EPA held two days of site visits in December 1988 to allow the public to view the dredging equipment and Confined Disposal Facility (CDF).

EPA held an informational public meeting on August 3, 1989 on the Hot Spot FS and the Proposed Plan. The meeting was attended by approximately 40 people. The principal community concerns expressed at that time include the following:

- <u>Impacts of Dredging</u>. Residents expressed concern that dredging would spread the contamination in the Hot Spot Area through the Harbor.

- <u>On-Site Incineration</u>. Residents expressed interest in the efficiency of the incinerator and its effect on metals. In addition, residents requested information on what air quality monitoring would be conducted in association with operation of the incinerator.

- <u>Residual Metals</u>. Residents expressed concern that the residual incinerator ash would be considered a hazardous waste and questioned EPA's on-site disposal of the ash. Residents were also concerned that the metals could pose a risk to public health.

An informal public hearing was held on August 16, 1989 to accept oral comments on EPA's Proposed Plan. A second public meeting was held on August 22, 1989 to allow the PRPs and opportunity to present an alternative to EPA's Proposed Plan. Finally, on September 25, 1989, the CWG sponsored a meeting to provide an opportunity for its members and members of the public to ask questions about EPA's Proposed Plan or the PRPs' proposed alternative.

III. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES

This Responsiveness Summary responds to the comments received by EPA concerning the Hot Spot FS and the Proposed Plan for the Hot Spot Study Area of the New Bedford Harbor Superfund Site. EPA received a large number of written comments during the 74-day public comment period (August 4 - October 16, 1989). A number of oral comments were presented at the August 16, 1989 informal public hearing. Copies of the transcripts to all three of the informal hearings that were held are included as Attachment B. Copies are also available at the New Bedford Free Library, the information repository that EPA has established for the Site; and at the EPA Records Center at 90 Canal Street, Boston, Massachusetts, 02114 as a part EPA's Administrative Record.

EPA received a total of 54 documents or "comments" during the public comment period. Due to the large number of documents received, EPA established a "Document Control Number" (DCN) system to track and to refer to specific documents. The "Comment Tracking Sheet" on the following 4 pages lists the DCN, the source, the author, a general description of the document, and the date of the document.

A large number of the documents received during the public comment period from the PRPs are extremely voluminous, and in a number of cases, are over 50 pages in length. It would be extremely wasteful and redundant for EPA to reproduce all of the comments verbatim in this Responsiveness Summary. A number of the documents make similar comments on the same issues. Thus, representative excerpts from a number of documents are presented, including a citation to the document it was taken from via the corresponding Document Control Number (DCN). These excerpts are presented in a lightly shaded block ("redline") to distinguish them from the EPA responses which follow. EPA lifted excerpts from each document to indicate what EPA believes to be the substance of the comment. In a number of instances, cross-references are made to other responses or to the Record of Decision Summary. All of the documents received during the public comment period are included in the Administrative Record for the Site in Section 5.3.

Section A presents the citizen comments that EPA received during the public comment period, and Section B presents the comments that EPA received from the Commonwealth of Massachusetts. Section C contains the PRPs' comments, which are predominantly technical in nature. Because of the large volume PRP documents that addressed similar issues, the comments were divided into ten categories. These categories are presented in the Table of Contents to this Responsiveness Summary and they are reiterated at the beginning of Section C.

NEW BEDFORD HARBOR HOT SPOT COMMENT TRACKING SHEET

DOC	SOURCE	AUTHOR	DESCRIPTION	DATE
PRP Comments:				
1	Ropes & Gray	Galvani	Review of Draft Hot Spot FS	10/16/89
2	Ropes & Gray	Spaulding	Review of Draft Hot Spot FS	07/28/89
3	Ropes & Gray	Spaulding	Review of Draft Hot Spot FS	08/30/89
4	Ropes & Gray	Brown & Wagner	PCB Dechlor. & Detox. in the Acushnet Estuary (Inc. Appen. A)	
5	Ropes & Gray	Hoff & O'Brien	Critique: Draft Hot Spot FS	05/89
6	Ropes & Gray	Dr. Jaeger	Critique: Draft Public Health Evaluation	10/12/89
7	Ropes & Gray	Whysner	Recent Findings RE: T/PCBs Implications for NBH Risk Assessment	10/11/89
8	Ropes & Gray	Whysner	Draft Final Baseline Public Health Risk Assessment NBH FS (Including Appendix E)	10/11/89
9	Ropes & Gray	--	Affididavits of Daniel Granz, Raymond Castio, Raymond Cabral, and Gary Haskins	10/89
10	Ropes & Gray	--	Deposition of David A. Kennedy; Cambra	05/26/86
11	Ropes & Gray	Rose	Aquatic Toxicity & Bioacummulation Potential in Marine Env.	10/89
12	Ropes & Gray	Harris, et al.	Review of Draft Hot Spot FS	10/13/89
13	Ropes & Gray	Terra	New Bedford Harbor Evaluation	
14	Nutt, Mclen & Fish	Balsam	Comments on NBH Hot Spot FS & Proposed Plan	10/16/89
15	Nutt, Mclen & Fish	Balsam	Remedial Action Program NBH	10/16/89
16	Nutt, Mclen & Fish	Balsam	Mass Estimates of PCBs in Upper Estuary Sediment, NBH (Att.A)	07/27/89

DCN	SOURCE	AUTHOR	DESCRIPTION	DATE
1,	Nutt, Mclen & Fish	Balsam	Theoretical Evaluation-Effectiveness of Capping PCB Contaminated NBH Bed Sediment, Draft (Att.B)	10/09/89
18	Nutt, Mclen & Fish	Balsam	Recolonization Dynamics and Bioturbation Process in Marine Sediments; Relationship to Proposed Capping of NBH (Att.C)	03/15/89
19	Nutt, Mclen & Fish	Balsam	NBH Thin Layer Sediment Sampling Program (Att.D)	08/11/89
20	Nutt, Mclen & Fish	Balsam	Hydraulic Study of the Acushnet River Watershed, NBH (Att.E)	08/31/89
21	Nutt, Mclen & Fish	Balsam	Tidal Cycle Flux Measurement Data (Att.F)	
22	Nutt, Mclen & Fish	Balsam	Extreme Velocities in the Upper Acushnet River Estimated By Inlet-Basin Model (Att.G)	09/20/89
23	Nutt, Mclen & Fish	Balsam	Extreme Velocities in the Upper Acushnet River Estimated by the Dambrk Model (Att.H)	09/20/89
24	Nutt, Mclen & Fish	Balsam	Assessment of PCBs in Acusnet River Upper Estuary Wetlands Sediments (Att.I)	10/10/89
25	Nutt, Mclen & Fish	Terra	Toxicant Profile for Polychlorinated Biphenyls (PCBs) (Att.J)	11/88
26	Nutt, Mclen & Fish	Terra	Hazard Evaluation for New Bedford Harbor (Att.K)	10/89
27	Nutt, Mclen & Fish	Terra	New Bedford Exposure Assessment (Att.L)	10/89
28	Nutt, Mclen & Fish	Terra	New Bedford Harbor Risk Assessment (Att.M)	10/89
29	Nutt, Mclen & Fish	Balsam	Use of Simple Box Model to Estimate PCB Water Column Concentrations Before and After Capping in the Upper Estuary, Draft (Att.N)	

DCN	SOURCE	AUTHOR	DESCRIPTION	DATE
3	Nutt, Mclen & Fish	Balsam	PCB Biotransformation in Aquatic Sed.: NBH & Other Sites (2 Vol) (Att.O)	10/16/89
31	Joint Defendants	Rizzo	Comments on Draft Final Hot Spot FS	10/16/89
32	Joint Defendants	Rizzo	Aerial Photo of Pilot Study (ref. on p. 5-27 of DCN #31)	
33	Joint Defendants	Rizzo	List of Principal Issues (NUS internal memo)	pre '85
34	Joint Defendants	Rizzo	Proposed Pilot Study Meeting Minutes (EPA memo)	11/13/89
35	Joint Defendants	Rizzo	Hot Spot Feasibility Study, NBH; Revised Review of Pilot Dredging Report	09/08/89
36	Joint Defendants	Rizzo	Proposed NBH Pilot Dredging Project	
37	Joint Defendants	Rizzo	Comments on the Final Draft Detailed Analysis of Remedial Technologies for the NBH Feasibility Study	06/30/88
38	Joint Defendants	Rizzo	Aerovox Comments on the Draft "Toxicological Profile for Selected PCBs (Aroclor -1260, -1254, -1248, -1242, -1232, -1221 & -1016)"	02/22/88
39	Joint Defendants	Rizzo	AVX Comments on ATSDR's Draft Profile: "Toxicological Profile for Selected PCBs (Aroclor -1260, -1254, -1248, -1242, -1232, -1221 & 1016)	02/22/88
40	Joint Defendants	Rizzo	Memo to Mr. Richard J. Hughto from Robert J. Rossi Regarding NBH PCB Monitoring Data	10/02/89
41	Joint Defendants	Rizzo	Memo Concerning Trip to NBH and Acushnet River Estuary (10/6/89) (Terra Representatives James and Nye)	10/12/89

DCN	SOURCE	AUTHOR	DESCRIPTION	DATE
42	Joint Defendants	Rizzo	Summary of the Deposition of Bernard Gregory Cambra	05/28/89
43	Joint Defendants	Rizzo	Summary of the Deposition of David A. Kennedy	05/28/89
44	Joint Defendants	Rizzo	Affidavit of Raymond Castino	05/28/89
45	Joint Defendants	Rizzo	Affidavit of Gary Haskins	05/58/89
46	Joint Defendants	Rizzo	Affidavit of Raymond Cabral	05/28/89

Massachusetts Comments:

DCN	SOURCE	AUTHOR	DESCRIPTION	DATE
47	Massachussets	Craffey	ARARs & Comments on the Hot Spot Operable Unit & Hot Spot FS	10/16/89

Citizen Comments:

DCN	SOURCE	AUTHOR	DESCRIPTION	DATE
48	Commun. Work Group	Chadwick	Comments on Proposed Plan & Capping Alternatives	10/13/89
49	Commun. Work Group	Environ	Comments on "Baseline Public Health Risk Assessment"	09/22/89
50	Citizen	Handke	Comments on Clean Up Plan for PCB "Hot Spot" Area in New Bedford	10/16/89
51	Citizen	Pereri	Letter in Support of Incineration of PCBs in the Hot Spot	08/11/89
52	Citizen	Hughes	Comments on EPA Alternative for the Hot Spot	10/09/89
53	Citizen	Davis	Comments on EPA Alternative for the Upper Estuary of the Acushnet River	10/16/89
54	Citizen	Sylvia	Comments on EPA's Preferred Alternative	8/30/89

A. CITIZEN COMMENTS

The "citizen" comments that were received, along with EPA responses, are taken from the following documents:

DCN #	Author
48	Greater New Bedford Harbor CWG
49	Greater New Bedford Harbor CWG
50	Handke
51	Pereri
52	Hughes
53	Davis
54	Sylvia

SOURCE: DCN #48; GREATER NEW BEDFORD ENVIRONMENTAL COMMUNITY WORK GROUP

COMMENTS ON: (1) EPA Proposed Plan for Operable Unit 1, New Bedford Harbor Superfund Site

(2) PRP alternative plan of capping for the upper Estuary

DREDGING AND INCINERATION

Six Work Group members support the EPA proposal of dredging and incineration as the remedial alternative for the Hot Spot.

General Statement:

We support the EPA's proposal to dredge the Hot Spot and incinerate the contaminated sediments. We feel this remedy offers an efficient and permanent solution to the cleanup of the Hot Spot, which is the most highly PCB-contaminated area in the entire Superfund Site. We also feel that capping is a feasible technology for less contaminated areas of the Superfund Site and should be included in the choice of remedial alternatives for Operable Unit 2.

Individual Comments:

- Dredging should proceed on an incoming tide and no other, and should cease one hour prior to the change of said tide.

- During all periods of dredging, water quality must be monitored by use of an appropriate indicator species and/or chemical analysis, with sampling to be done in locations that extend to the New Bedford Hurricane Barrier.

- The air quality of communities surrounding the cleanup site should be monitored to detect possible PCB volatilization during dredging operations, as well as possible PCB byproducts or metals volatilization produced during incineration.

- The PCB concentration in effluent water produced during sediment dewatering should be subject to the same discharge requirements as those applied to local industries.

- EPA has not made specific, satisfactory arrangements to deal with the strong possibility that incinerator ash will contain hazardous levels of metals. Considering their plan to temporarily dispose of the incinerator ash on-site, in the unlined CDF, this is a disturbing omission.

The immobilization of metals by solidification of incinerator ash is a new technology without a proven track record. A second point: how "temporary" will temporary disposal be?

EPA RESPONSE TO COMMUNITY WORKGROUP/DREDGING AND INCINERATION

1. The EPA believes that the selected Hot Spot remedy offers a permanent solution for the Hot Spot contamination, as is set forth in this Record of Decision. Further, the statutory preference for treatment, particularly for the highly contaminated sediment of the Hot Spot that continues to act as a source of contamination to the remainder of the Site, is satisfied by this interim action.

2. The EPA believes that capping is a feasible technology for less contaminated areas of the Site. As discussed in Section IX.A of the Record of Decision Summary and Section 7 of this Responsiveness Summary, EPA is currently evaluating capping as an alternative for the Estuary, excluding the Hot Spot, and has retained capping as a viable alternative for portions of the Lower Harbor and Bay. These sections also provide the basis for the elimination of capping for the Hot Spot on the basis of long-term maintenance concerns, as well as the conspicuous lack of permanent and significant reduction in the mobility, toxicity or volume of the Hot Spot contaminants.

3. The results from the Pilot Dredging Study conducted by the Corps of Engineers (COE), in conjunction with the

Engineering Feasibility Study and other reference materials, will be used to guide the remedial design process. Many of the details for actually implementing the dredging and incineration of the Hot Spot sediments will be developed during this design phase.

During the pilot study, resuspension of sediment was also minimized with no plume of resuspended material moving away from the dredging area, and no measured elevated levels of contaminants were detected in the water column outside the immediate vicinity of the dredging operation. The cutterhead dredge has been selected for use at the Site based on its ability to minimize resuspension, as well as several additional operational advantages. These advantages are discussed in detail in the Pilot Study Report (New Bedford Harbor Superfund Pilot Study: Evaluation of Dredging and Dredged Materials Disposal; Interim Report, June 1989). Additional concerns relating to dredging are addressed in Section 8 of this Responsiveness Summary.

There are several considerations for the timing of the dredging activities. A major concern is that there is adequate water depth for the dredge to operate in. The Pilot Study was conducted in a cove where the depth of the water ranged from 0.0 to 0.5 feet at mean low water, similar to the depths found in the Hot Spot Area.

The monitoring program that will be conducted during the dredging will provide the major basis for the dredging operation. However, the feasibility of dredging only during the incoming tide will be examined during the design phase.

4. Water quality will be monitored during dredging in a manner similar to that conducted during the pilot study dredging. During the Pilot Study, EPA conducted monitoring at the Hurricane Barrier, and no adverse impacts to water quality were detected. Therefore, EPA does not believe that monitoring down to the Hurricane Barrier is necessary.

   During the pilot study, monitoring was conducted at the Coggeshall Street bridge, and no contaminants were found to be migrating beyond this point. Since the Hot Spot sediments to be dredged are further north in the Estuary than the pilot study location, EPA believes that monitoring to the Coggeshall Street bridge only is adequate. The design phase will examine the number, location, and type of monitoring stations to be maintained during the dredging operation.

5. Air monitoring will be conducted throughout the period of remediation. Air monitoring will be conducted in the vicinity of the dredging operation, as well as a part of the

incineration operation to ensure that the incinerator meets all applicable standards, particularly for air emissions.

6. The effluent produced as a result of sediment dewatering is subject to ARARs specific to this action, including federal and state requirements under the Clean Water Act and the Surface Water Quality Standards (310 CMR 4.00), respectively. The effluent will be treated to reduce PCBs and heavy metals using best available control technology prior to discharge back into the Harbor.

7. The EPA has considered the possibility that the incinerator ash may contain high levels of metals. As discussed in Section X.A of the Record of Decision Summary, a leaching test will be performed on the ash to determine if it exhibits the characteristic of toxicity and is, therefore, considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA). If the leaching test reveals that the ash is a RCRA hazardous waste, the ash will be solidified such that metals no longer leach from the ash at concentrations that exceed the standards set forth for determining the toxicity of a material. The Hot Spot Feasibility Study considered the additional (unit) cost of stabilization of the incinerated sediment in the overall cost estimate for the incineration alternative.

   EPA does not consider immobilization of metals by solidification to be a new technology. Solidification by a variety of techniques has been taking place for years. Innovative uses of solidification are being examined under EPA's SITE program, but these applications examine immobilization on "untreated" sediment rather than on incinerated ash.

   Refer to Section 9.3.4 of this Responsiveness Summary for further information regarding the solidification process.

UPPER ESTUARY CAPPING

Three Work Group members support the capping alternative for the upper estuary.

General Statement:

Being a community work group, we feel we must decide what is best for the community. We can understand other group members preference for dredging and incineration of Hot Spot sediments, and would agree with them providing that in the Second Operable Unit, capping is the alternative chosen. However, we feel there is a possibility that capping may not even be offered as an alternative to deal with contaminated sediments in the remaining Superfund Site.

Therefore we have to take the worst case scenario, just as EPA did on the Public Health Risk Assessment: The Cleanup of the Upper Estuary, harbor and lower harbor could cost as much a $900 million. At this price tag, we feel Aerovox and Cornell-Dubilier would be out of business, resulting in the loss of more than 1,000 jobs in the Greater New Bedford area.

We feel that capping, the alternative offered by the PRPs through Rizzo Associates, is a complete alternative and we give our support to this plan.

Individual Comments:

- EPA hasn't given a fair shake to all the alternatives and would not have even considered the capping alternative without pressure being brought to bear.

- EPA has seriously underestimated the $15 million price tag for dredging and incineration. Also, treatment of dewatering effluent may be a serious problem.

- EPA should have given biodegradation a closer examination.

- There are doubts concerning PCB incineration as this technology has the potential to contribute to air pollution, as well as the fact that the American public isn't ready to endorse this technology. Lack of public support may cause delay.

GENERAL GROUP STATEMENT

- We insist upon a timely examination of EPA's work plan for the chosen alternative. This work plan should be made available to us and our technical advisor in time to permit thorough examination and comment.

- We insist that failure in any part of the remedial project as it applies to the Hot Spot, resulting in an increase of PCBs in the air or water, is grounds for EPA to cease and desist this project until the problem is clearly identified and corrected.

EPA RESPONSE TO COMMUNITY WORKGROUP/UPPER ESTUARY CAPPING

1. EPA has considered capping for the Hot Spot sediment, as well as for the remainder of the Harbor. As discussed in Section IX.A of the Record of Decision Summary and Section 7

of this Responsiveness Summary, capping was eliminated for further consideration for the Hot Spot and was maintained for the remainder of the Site. EPA eliminated the capping alternative due to the uncertainty of the long-term effectiveness of the cap for the Hot Spot sediment, as well as concerns over implementability. EPA was concerned about the inability of the cap to provide a permanent barrier to migration of highly contaminated sediment. EPA is currently evaluating capping as an alternative for the Estuary, excluding the Hot Spot, and has retained capping as a viable alternative for portions of the Lower Harbor and Bay.

2. The one statement that "EPA has seriously underestimated the $15 million price tag for dredging and incineration" lacks detail or supporting information. EPA is unaware of the specific concerns being raised. Moreover, the supporting cost estimates for each of the alternatives that underwent detailed analysis are included in Section 7 of the Hot Spot FS. As indicated in the EPA publication, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," the level of accuracy of cost estimates is +50 percent/-30 percent. While the actual costs for on-site incineration are difficult to estimate precisely, the $374 per ton estimate used in the FS is within the range provided by guidance, vendor quotes, and actual incineration bids from other sites. Refer to Section 9.4 of this Responsiveness Summary for a more complete discussion of the cost estimates.

3. EPA does not consider treatment of the effluent generated by the dewatering process to be a "serious problem." Various types of water treatment have been conducted in a multitude of industrial and municipal settings for decades, with discharge permits issued nationwide.

   EPA has examined the requirements for treating this effluent prior to discharge back into the Harbor, and EPA believes that existing technologies are capable of treating the effluent to acceptable levels. The design process will examine best available control technology and various treatment options (e.g., coagulants) to achieve the discharge goals.

   Refer to Section 9 of this Responsiveness Summary for a more complete discussion of the treatment processes for the Hot Spot sediment.

4. EPA has examined biodegradation in the Feasibility Study process. Refer to Section 5.0 of this Responsiveness Summary for a detailed discussion of the biodegradation, both as an alternative "remedial action" and as treatment technology examined by EPA.

The EPA recognizes that biotransformation of PCBs in New Bedford Harbor sediment appears to be occurring. However, studies conducted to date do not provide sufficient data for a reliable estimation of in-situ biochemical decay rates or half-lives, as well as the toxicity of the decay products. This information is crucial to evaluate the length of time that would be required for removal of PCBs from the Hot Spot sediment by natural processes. Research suggests that the half-life of anaerobic degradation of heavily chlorinated PCBs may range from 7 to 50 years (Brown and Wagner, 1986). Based on this half-life estimate and assuming first order decay, the time required for biodegradation to reduce a sediment PCB concentration of 4,000 ppm (the lower limit of the Hot Spot) to 50 ppm is approximately 50 to 300 years. The EPA finds this time frame for remediation unacceptable, especially when there are other remedial alternatives currently available for implementation.

Given the quantity and high level of PCB contamination in the Hot Spot sediment, the EPA believes the Hot Spot will remain a source of contamination, and that contaminants will continue to migrate throughout the entire Site if not addressed. Although the EPA recognizes that PCBs undergo transformation processes to varying degrees in the environment, no scientific data has been provided to the EPA to date which documents that the levels of contamination in the Hot Spot would be reduced to levels that the EPA believes would no longer present a risk to human health or the environment within a reasonable timeframe.

5. Incineration has been used at several hazardous sites nationwide. Refer to Section 9.3.1 of this Responsiveness Summary for a listing of the sites where incineration has been used.

   The fundamental concept of incineration is the utilization of extremely high temperatures to volatilize and destroy organic compounds. An afterburner on the incineration unit is used to destroy the volatilized contaminants. The treated material is then tested to ensure that the material no longer has the characteristics of a hazardous waste.

   The PCB disposal requirements promulgated under TSCA are relevant and appropriate for the hot spot sediments. Under TSCA, soils contaminated with PCBs at concentrations greater than 50 ppm may be disposed of in an incinerator or a chemical waste landfill. Since the hot spot sediments are heavily contaminated (greater than 4,000 ppm), incineration is an appropriate technology to remediate the Hot Spot under TSCA.

Refer to Section 9.3 of this Responsiveness Summary for a more complete discussion of incineration technology.

6. The public will be kept informed as the remedial design process proceeds. The COE will be conducting the design of the Hot Spot remedy, with the assistance of an engineering design firm. Remedial designs generally proceed with the development of a 30%, 60%, 90% and 100% plans and specifications design package. The COE has an exhaustive procedure whereby "bidability" and "constructability" reviews are conducted by a team of people with expertise in various fields (e.g., water treatment, incineration). Once the design is complete, the project goes out to bid, and the contract is awarded to the lowest "responsible" and "responsive" bidder. In all, the design phase is estimated to take approximately one year to complete.

   As the plans and specs are developed, EPA will seek public input. However, the actual plan and spec packages are confidential to protect the integrity of the bidding process. EPA is aware of the public interest in the design process and the interest in reviewing material, and EPA will work with the Community Workgroup to establish a mechanism to provide for review, without compromising the integrity of the bidding process.

7. One portion of the design process will examine "decision criteria" in a manner similar to that used during the Pilot Study. Limits will be established for the dredging operation. If the monitoring indicates that these allowable levels are being exceeded due to dredging, the dredging operation will be discontinued until the problem is identified and corrected.

   EPA will establish similar limits for the operation of the incinerator. EPA will establish an air monitoring program to ensure compliance with the emissions requirements. If emissions limits are exceeded, the equipment will be shut down and the operating parameters will be adjusted to meet the emissions requirements. Further, the incinerator will be equipped with automated controls which will be able to monitor a wide variety of operating parameters. The transportable incinerator will have automatic shut-down capability in the event that emissions limits are being exceeded.

   Refer to Section 8.0 of this Responsiveness Summary for a more complete discussion of the dredging operation and its controls, and to Section 9.0 for the operation of the incinerator.

SOURCE: DCN #49; GREATER NEW BEDFORD ENVIRONMENTAL COMMUNITY WORK GROUP

COMMENTS ON: "Draft Final Baseline Public Health Risk Assessment New Bedford Harbor Feasibility Study, August 1989"

Overall Assessment

The "Draft Final Baseline Public Health Risk Assessment; New Bedford Harbor Feasibility Study, August 1989" (Ebasco 1989) (hereinafter referred to as the "Draft Report") is a comprehensive examination of potential risks to public health under baseline conditions from exposure to PCBs, lead, copper, and cadmium detected in the sediment, surface water biota, and air within the New Bedford Harbor site. The risk was quantitatively estimated from potential exposure to the four contaminants through dermal contact and ingestion of sediments, and ingestion of fish. In addition, a quantitative assessment of risk from potential inhalation of airborne contaminants was performed only for PCBs due to limited air data. A qualitative assessment of risk was performed for dermal contact and ingestion of water.

The assessment is a reasonable examination of the potential current risks to human health under the various exposure assumptions presented within the Draft Report. The report evaluates the appropriate exposure pathways for the appropriate populations of concern. The estimates of risk are conservative, but the assumptions used are within the range of those used in assessments of other sites and accepted by USEPA.

However, ENVIRON believes there are some technical flaws and questionable assumptions used in the Draft Report. Even though these flaws and assumptions do not individually affect the risk estimates appreciably, they should be evaluated prior to using the results presented in the Draft Report as the basis to determine the need for and the extent of remediation at the New Bedford Harbor site. The following summarizes the major areas of concern:

- Inhalation of airborne contaminants is considered a principal pathway of exposure. This conclusion was based on an initial screening of pathways based on exposure to PCBs. However, inhalation of airborne contaminants was found to contribute only 0.025 percent of total dose, while ingestion of aquatic biota, direct contact with sediments and ingestion of sediments contribute greater than 99 percent of the total dose (Table 2-2, pg. 2-15). It is therefore not evident why this pathway which contributed such a small percentage of total exposure was considered important.

- Various exposure assumptions (e.g., sediment ingestion rates, gastrointestinal factors for metals) are the upper end of the range of estimated values and thus provide the opportunity for an overestimate of risk. It would be more appropriate to estimate risks for both a "typical case" (or average) and "reasonable worst-case" using separate exposure assumptions in each as proposed in USEPA's recently published Exposure Factors Handbook (USEPA 1989a) (e.g., for sediment ingestion rates an average value of 200 mg/day is recommended by EPA). In addition, sensitivity analyses should be performed on the exposure assumptions to determine the effect of the degree of uncertainty associated with the estimated risks.

- The toxicity profile for PCBs (Appendix D, pgs. D-1 through D-36) has various discrepancies and flaws. These are detailed in an attachment to this memo. However, the flaws do not effect the risk estimates presented in the Draft Report.

- The toxicity profile for cadmium includes discussion of an increased risk of cancer of the prostate in workers exposed to cadmium via inhalation (Appendix D, pg. D-39). That conclusion has been refuted (Doll 1985) and the profile should center on the increased risk of lung cancer. This will not however change the cancer potency factor used in the risk estimations.

- The toxicity profile for lead is incomplete (Appendix D, pgs. D-47+). Recent neurologic and behavior studies in infants and young children should be included. In addition, there is no EPA accepted AIC for lead Table 3-1, pg. 3-4) (USEPA 1988). Work currently in progress in EPA's Office of Air Quality Planning and Standards (OAQPS) supports the use of a biokinetic/uptake model to estimate blood lead levels in children from exposure to specific environmental lead levels (USEPA 1989b). This approach should be developed in this document. The USEPA IRIS (EPA's on-line database) report for lead states the Agency's RfD (reference dose, formerly known as acceptable daily intake or ADI) Group considered it "inappropriate to develop an RfD for inorganic lead" (USEPA 1989c).

EPA RESPONSE TO COMMUNITY WORK GROUP/PUBLIC HEALTH RISK ASSESSMENT

EPA believes that the assessment was performed in accordance with current EPA guidance and is a reasonable examination of the potential current risks to human health under the various exposure assumptions, evaluating the appropriate exposure pathways for the populations of concern. Some of the risk estimates in the Public Health Risk Assessment report are conservative, but the assumptions used are within the range of those used in assessments of other sites and in accordance with EPA guidance.

However, the minor technical flaws in the Public Health evaluation do not affect the risk estimates for the hot spot. The comments presented here will be evaluated prior to using the results as the basis to determine the need for and the extent of remediation for the second operable unit at the New Bedford Harbor Site.

In addition to direct contact and incidental ingestion of Hot Spot sediments, EPA examined risks from the ingestion of biota. Table 1 from the Record of Decision Summary presents the biota concentrations used for the risk calculation. Additionally, Table 2 presents a specific hot spot concentration from an area of probable exposure for the direct contact risk estimate. As can be seen from Table 2 the hot spot concentration of 9923 ppm presents a carcinogenic risk of 7×10^{-3}, which is outside of the EPA target risk range.

SOURCE: DCN #50; HANDKE

COMMENTS ON: Draft Final Baseline Public Health Risk Assessment; New Bedford Harbor Feasibility Study, August 1989.

1. The Executive Summary should be considerably shortened (13 pages is too long) and should emphasize facts and conclusions, not structure of the report and methodology...

2. Tables 2-7 and 2-14 list no references for the exposure assumptions given.

3. ... Given the emphasis on seafood consumption as a route of exposure in this risk assessment, it is essential that the magnitude of the uncertainty regarding the amount of seafood consumed be addressed...

4. The tables in Appendix C which compute a body dose for noncarcinogens use a nonconservative assumption by calculating a time-weighted average. This is not consistent with EPA policy. (It is my understanding that instructions regarding this issue will be included in the Revised Superfund Public Health Evaluation Manual.) The tables in Appendix C calculate an average daily body dose and then compare it to a standard for lifetime daily exposure. The

exposure scenario, for example, is for a child being exposed 20 days/year. Calculating an average daily body dose ignores the fact that on 345 days the child receives a dose of zero and on 20 days receives a dose 15 times greater than the dose calculated in the table. Risk should be evaluated for the actual dose received, not for a time-weighted average dose.

5. ... The term "toxicokinetic factor" is too broad... A more appropriate and accurate term would be "relative absorption factor."

Pp. B-3 through B-5: The development of the gastrointestinal absorption factor for Norback and Weltman (1985) study clearly describes the absorption percents for all six studies considered as "minimum." A discussion should be included which makes clear whether or not the use of minimum absorption percents is a conservative assumption which is protective of public health.

6. ... The Bibliography needs to be proofread...

EPA RESPONSE TO HANDKE

The substantive comments presented are addressed in Section 3.0 of this Responsiveness Summary. The remaining comments speak to stylistic issues, which EPA will not formally respond to here since they do not impact the technical quality of the report and conclusions reached.

SOURCE: DCN #51; PERERI

COMMENTS ON: INCINERATION OF PCBs

I, being a staunch supporter of a clean environment, am in complete accord with the Environmental Protection Agency on the proposed incineration of the polychlorinated biphenyls from the hot spots in the Acushnet River Estuary, and the incineration taking place at shoreline facilities as designated by the United States Environmental Protection Agency.

For those whom are critical and in opposition to this plan, I would kindly urge them to bring forth documents that would give credence to their expertise or basic knowledge in the environmental field where hazardous or toxic waste is concerned, either organic or inorganic.

EPA RESPONSE TO PERERI

The remedial action selected for the Hot Spot is consistent with the requirements of the Superfund program. The selected remedy is protective of human health and the environment for the Hot Spot area. Any short term concerns associated with dredging or incineration can be controlled with existing, available technologies. The remedy also satisfies the statutory preference for the use of treatment as a principal element.

To support the EPA's selected remedy, the EPA has developed an extensive Administrative Record for this site. This record includes a variety of remedial investigations and feasibility studies to address harbor contamination. In addition, a large number of reference documents and technical articles are included to support the EPA's remedy selection process.

SOURCE: HUGHES; DCN #52

COMMENTS ON: PREFERRED ALTERNATIVE

First, I would like to applaud EPA for taking the first concrete steps to remedy this site. For too many years this site has languished as more and more studies were conducted. The time for action is long overdue. Also, I would like to commend E.C. Jordan for the high caliber of the recently issued Feasibility Study.

I am, however, somewhat puzzled by EPA's rationale for selecting the "preferred alternative." I would like to review below the alternative selection process, as I see it. Four alternatives were considered in detail:

1. No Action
2. Incineration
3. Solidification/Disposal
4. Extraction

Clearly, the "no action" alternative does not merit serious discussion as a remedial measure. The solidification/ disposal option does not result in destruction of the PCBs and therefore cannot be considered "permanent". Nor is this option cheap ($13 million). Therefore, it should be eliminated. On that we agree.

Now we are left to choose between incineration and extraction. Both involve dredging, storage and dewatering of the sediments. Both result in nearly complete destruction of the PCBs. However, extraction offers a significant cost advantage (about $2 million). Actually, the cost advantage is probably even greater, since:

1. EPA's incineration costs are relatively low.
2. Costs for fixation (about $500,000) are included in the cost estimate for extraction, even though the extraction residue is not likely to require fixation.

In addition to its cost advantage, I must also point out that extraction has several environmental benefits. Extraction produces a separation of organic contaminants (PCBs) and inorganic contaminants (heavy metals). In this manner, the method of treating each fraction can be fully optimized without sacrificing treatment effectiveness. Extracted oils are destroyed in a liquid incinerator, while metals reside with the solids. Leaching tests (EP Toxicity) conducted on the extracted solids indicate that the heavy metals do not leach to any great extent.

In contrast, the incineration of Hot Spot sediments will likely result in undesirable emissions, especially heavy metals. Incineration also tends to oxidize and thereby "liberate" metals in the residual ash, making them more prone to leach into the environment. Therefore, while both technologies reduce the volume, toxicity and mobility of the PCBs, the extraction process also reduces the mobility of the metals. Incineration, on the other hand, increased the mobility, and possibly the toxicity, of the metals.

E.C. Jordan, in the public meeting held on August 3, 1989, raised reliability as a potential drawback of extraction. The extraction process developed by Resources Conservation Company has been demonstrated in one full-scale application and in several pilot tests. While it has probably not received as much scrutiny as incineration, it is certainly not an unknown technology.

In light of the above, I suggest that EPA reconsider its decision to incinerate the sediments, and employ extraction instead. Keep in mind that EPA is supposed to encourage the use of innovative and alternative technologies. The New Bedford Harbor Hot Spot Operable Unit presents a perfect opportunity to do just that.

EPA RESPONSE TO HUGHES

The "No Action" or minimal action alternative is routinely evaluated in a feasibility study to provide a benchmark for comparison for other remedial alternatives. EPA agrees that the "No Action" alternative does not merit serious consideration for the highly contaminated Hot Spot sediments. With regard to solidification, no destruction of the PCBs would occur, and the volume of the contaminated material would be increased. The solidification alternative assumes the availability of an off-site disposal facility.

The cost estimates developed by EPA in the feasibility study are within the +50% to -30% accuracy level common to feasibility study estimates. However, EPA believes the overall effectiveness and reliability of incineration, as opposed to solvent extraction, for Hot Spot sediments justifies the slightly greater cost. It is not known how many "washes" with solvent extraction are necessary in order to obtain the degree of PCB destruction assured by incineration of the Hot Spot sediment.

EPA acknowledges the viability of solvent extraction for treatment of contaminated sediment. In fact, EPA has selected solvent extraction for remediation at other Superfund sites. However, the levels of contamination for which this technology has been selected are far below those existing at the Hot Spot. Solvent extraction is undergoing detailed analysis for the second operable unit FS where the levels of contamination are distinctly lower than those found in the Hot Spot.

SOURCE: DCN #53; DAVIS

COMMENTS ON: EPA PROPOSED PLAN FOR HOT SPOT

In order to evaluate the EPA proposal it would seem the matter should be put in the context of the whole harbor.... A remediation judgement of the upper estuary should be done with some anticipation of a resolution for the rest of the harbor.

Unlike the balance of the inner harbor, the upper estuary is an ecosystem, with a long term status such to require a resolution consistent with and supportive of the status. The standard of remediation would thus seem to differ from the rest of the inner harbor....

While the segments of the river differ, the surface area of the lower estuary is much larger, by approximately an order of magnitude. PCB transport occurs from the surface area of the underlying sediments. Since it is a primary source of depositions into the outer harbor. It is the ingestion of edible fish in the outer harbor that are consequential to health effects.

No one has calculated the relative influences of the high level but remote & localized PCBs (Hot Spot Area) vs the low level but distributed PCBs immediately facing the outer harbor. Whatever the judgement, each is influential. Levels of PCBs in sediments relative to marine uptake is relative...

The fear of the author is that the rationale to clean up the hop spot area (over 90% of the PCBs) signaled a question on the part of the Agency to the rest of the harbor. The alternative was expressed without giving any indication of a plan for the balance of the harbor...

It would seem that if damages to the natural resources are an issue, then restoration of the resources is an equal issue. And there should be no limit in the means of redress, if the means are proportioned to the causes of the decline. Without prioritizing specific causes, it is near unanimous that access to the inland spawning grounds by anadromous species is a major cause of the decline.

There are a variety of points the author would like to make. One of which is the role of the locality in matters of this sort. It would seem to me that participation is desirable. But it would seem that unless some authority is given to the local level, participation will be limited.... As much as the current local administration has moved in favor of environmental considerations, it has resulted in only one fulltime person for the task...

In the event of the execution of the EPA alternative, there is no need to incinerate the PCBs. Based on the affinity of PCBs to sediments, and their low-water solubility, the PCBs would be relatively encased. With a liner, the containments would be assured. And this would exclude the possible mobilization of the heavy metals. Gidley, an authority on this topic, advocates same. The incineration cost is approximately $5 million, and thus the savings would be approximately one third. The only drawback would be the volume reduction lost through incineration. But this is small (circa 10%), and also excludes any need to remove ash depositions.

It would seem, given the large area to be dredged for the lower estuary, for the area of the upper estuary outside the hot spot area, that any dredging alternative is prohibitive (from one to 3 feet PCBs taper off to negligible levels: at 3 feet, the whole inner harbor contains circa 400,000 cubic yards). Consequently, the only solution for the balance of the harbor is capping...

Indeed the EPA is justified in their concern to remove the high levels in the hot spot areas. It would seem, with the exclusion of incineration, that the cost can be used to integrate both methodologies, such that the total cost may be marginally different. The author has not had time to even begin a cursory comparison, but it would seem that with large scale apparatus in place, with means used to enter/exit the estuary, that a cap could be put in place concurrent with the hot spot removal...

A last point mentioned in my oral testimony, is to test for the presence of PCDFs in marine biota, in view of their presence in the sediments. Further, some specific testing of marine species should be tested for the upper estuary, in particular shellfish and crustaceans, so a time series can be established. This should be easy to do by means of cages.

Attachments are enclosed in support of the above. The document, "Historical Profile: Buzzards Bay" by the author, is still in draft form though essentially complete. It is hoped the final copy can be submitted and included.

EPA RESPONSE TO DAVIS

1. EPA recognizes the different portions of the harbor, and segmented the Site for study accordingly: the Hot Spot, the Estuary, and the Lower Harbor and Bay. These geographical areas are shown on Figures 1 and 2 of the Record of Decision summary.

2. As a part of the Superfund process, EPA evaluates the risks posed by the contaminants present at a site. Exposure scenarios are developed to reflect the characteristic uses and location for specific site. The risk assessment conducted for the Hot Spot followed EPA guidance for conducting such assessments. Refer to section 3.0 of this responsiveness summary for a more complete discussion of site risks.

3. Numerous studies and reports on the harbor present the nature and extent of the PCB contamination and the fate and transport of this contamination in the environment. Sediment data shows that approximately 48% of all the PCBs within the Estuary are located in the Hot Spot. The results of several monitoring programs demonstrate that approximately 2 pounds of PCBs migrate out of the upper Estuary daily. These PCBs are ultimately transported to portions of the Lower Harbor and Buzzards Bay, where they are redeposited, volatilized into the atmosphere, or taken up into the food chain by aquatic Biota.

4. This Hot Spot operable unit is the first of two operable units planned for the New Bedford Harbor site. Operable units are discrete actions that comprise

incremental steps toward a final remedy. They may be actions that completely address a geographical portion of a site or a specific site problem. This Hot Spot remedy addresses both this geographical portion of the site and the specific contamination found in this area. This Hot Spot interim action is consistent with future actions being considered by EPA because this remedy calls for the removal of approximately 48% of the total PCB mass from the Estuary portion of the site, which acts as a continuing source of contamination to the remainder of the site. Refer to Section 1.0 of this responsiveness summary for further discussion of rationale for the Hot Spot as an operable unit.

5. The main vehicle for community involvement has been the greater New Bedford community workgroup (CWG). The CWG has received a $50,000 Technical Assistance Grant from EPA to provide additional resources for review and comment of EPA activities conducted at the site. The CWG holds regular meetings, in addition to public meetings sponsored by EPA and the State, to keep the local community informed about site activities.

6. EPA is currently evaluating capping as an alternative for the Estuary, excluding the Hot Spot, and has retained capping as a viable alternative for portions for the lower harbor and bay.

7. EPA has conducted analysis of sediment for dioxin and PCDFs. Because the results were either extremely low or below detection limits, EPA believes that PCDF analysis of biota is not warranted.

8. A number of other issues alluded to in the comments here are addressed throughout the Record of Decision summary and sections of this Responsiveness Summary. The Attachments the author references are included in the Administrative Record.

SOURCE: DCN #54; SYLVIA

COMMENTS ON: PREFERRED ALTERNATIVE

I Manuel Sylvia, resident of New Bedford at the foot of Coffin Avenue along the Acushnet River, am very concerned about putting dikes in because I feel that any control of the water flow will make the Acushnet River one big mud flat from Wood Street bridge to Coggeshall Street Bridge, therefore the smell of the mud will be so great that we won't be able to stand it in this neighborhood.

I feel that the whole project of capping the PCBs in the upper estuary will be controlled by the dikes only. Without the dikes I do not believe that the capping would last. So I am against diking or capping it in its present areas. I do think that if Riverside Avenue was continued across the cove to Coggeshall Street, it would make a good barrier for anything in the cove. Therefore, I do think that if the PCBs were pumped or dredged from the upper estuary to the cove near Coffin Avenue and Riverside playground where the depth from street level to the mud flat of the cove would be somewhere in the area of 12 ft. or better. There would be sufficient room to pump all the sediments into it then proceed with the capping and covering it with fill or stone dust. It would save a few million dollars plus we could live with it.

I also understand that if PCBs are burned or heated up they have a tendency to cause cancer. Being so close to where you want to burn it, we're afraid the particles that come out of the stacks, we will be breathing them. I think they should be buried in the cove.

There is a pumping station at the foot of Coffin Avenue where the pipes go up Coffin Avenue to Belleville Avenue and there is complete flooding along Belleville Avenue because the pipes can't take the pressure. I suggest that the pipes that run from the pumping station be diverted straight across Riverside Avenue and across the barrier of the cove and on down along the waterfront. I also think that the pipeline that floods Wamsutta Street and Acushnet Avenue should be diverted to the pipeline along the waterfront and that would relieve all the flooding in these areas.

EPA RESPONSE TO SYLVIA

1. EPA does not believe that capping the highly contaminated Hot Spot sediment is an appropriate remedy because of the levels of contamination that would remain in the Harbor. Refer to Section IX.A of the Record of Decision Summary and Section 7 of this Responsiveness Summary for further discussion. The concerns about capping expressed in this comment are being considered in the Feasibility Study currently underway for the remainder of the Site. The issues of long term effectiveness and controls required to maintain a cap will specifically be discussed in this second feasibility study for the site.

2. Incineration of PCBs is a proven technology for addressing the type of contamination found in the Hot Spot. The extremely high temperatures virtually assure

complete destruction of the organic contamination. Any materials not destroyed by the incineration process (e.g., metals) will be controlled through air emissions control devices. Refer to Section 9.0 of this Responsiveness Summary for a more complete discussion of the incineration process.

3. While the EPA is aware of the flooding problems in the vicinity of Belleville Avenue, EPA's jurisdiction under the New Bedford Harbor Superfund Site does not extend to this area. This issue needs to be addressed by the City of New Bedford.

B. COMMONWEALTH OF MASSACHUSETTS COMMENTS

SOURCE: DCN #47; MASSACHUSETTS' DEPARTMENT OF ENVIRONMENTAL PROTECTION

The Department of Environmental Protection has been requested to identify Applicable or Relevant and Appropriate Requirements (ARARs) for the hot spot operable unit of the New Bedford Harbor superfund site... This request established the close of the public comment period as the practical deadline for a timely Agency response to the state's identification of ARARs for this operable unit. Normally the DEP does not specifically submit an "ARARs letter" for each site, prior to the signing of a Record of Decision. The identification of action, location, and chemical specific ARARs is done at every step in the process of remedial assessment selection and implementation for a federal superfund site. We are persuaded, however, that the New Bedford Harbor operable unit presents a number of unique characteristics which warrant a focused effort on our part to identify state laws, regulations, and policies which we feel are applicable or relevant and appropriate to the Proposed Plan for the Hot Spot.

The Hot Spot remedial action proposed by the agency consists of removal by dredging of approximately 10,000 cubic yards of sediments containing PCBs at concentrations greater than 4,000 ppm which are located in the hot spot area of the Acushnet River Estuary. Dredged sediments would be transported by a hydraulic pipeline to a shoreline basin known as the confined disposal facility (CDF) off of Sawyer Street in New Bedford. Sediments would be allowed to settle, be dewatered by plate and frame units, and then incinerated. Incinerator ash would be solidified and stored in a portion of the CDF, until a decision on its final disposal is made later in the project. This operable unit also includes the necessary air quality control and water treatment units.

In viewing this proposed plan the Department has reviewed statutes, regulations, and policies in all three of its Bureaus: Waste Site Cleanup, Resource Protection, and Waste Prevention. In addition we have included the concerns of the EOEA offices of Coastal Zone Management and Massachusetts Environmental Policy Act in enforcing applicable provisions of their standards. Attached to this letter in Attachment 3 is a short list of the laws, regulations and policies which comprise the ARARs identified to date which could apply to the operable unit. Because of specific concerns, we have concentrated on the identification of some specific requirements, and we have summarized these requirements below...

1. Environmental Impacts ARARs

The Massachusetts Environmental Policy Act (MEPA) establishes standards to minimize environmental impact on publicly funded projects. We believe these requirements are applicable to the proposed plan. In addition Federal consistency in the coastal zone requires adherence to applicable standards for the protection of the environment. For the proposed plan, the Department believes the use of silt curtains around the area to be dredged would be an applicable requirement. The Department believes that justification for non-use of silt curtains would be required to be technically well founded by a monitoring program near the dredge, such that water quality impacts are minimized and a level of environmental protection is achieved acceptable to a decision making committee. Monitoring and decision making on dredging operations should achieve a level of control similar to that in the pilot study. This level of control would be relevant to the proposed remedial action to protect coastal resources.

Water pollution control during sediment dewatering and treatment must meet best available technology as the applicable requirement. Wetlands regulations are applicable to this remedial action, where it impacts estuarine areas, as well as inland vegetated wetlands. They are also applicable to alterations and structures located below existing or historical mean high water, whichever is farther landward.

2. Process Control Requirements

Hazardous Waste Regulations, while exempt from applicability to control measures under MGL Chapter 21E per se, contain relevant and appropriate requirements. Specifically, side wall and bottom material in the CDF must achieve a maximum permeability standard of $1X10^{-7}$ cm/sec; the CDF must be covered while it contains hot spot material and all residue hot spot material must be removed from the CDF following the remedial action. Under the provisions of relevant and appropriate sections of 310 CMR 30.000, residual materials from the incinerator must be tested to determine if they are a hazardous waste. Appropriate tests are the EP

Toxicity and TCLP as described in 310 CMR 30.155. If the ash fails one of these tests, it must be solidified or otherwise treated so that the material is no longer a hazardous waste as defined in these regulations.

Solidified ash, if it is to be ultimately discarded and not used for any structural building purpose, must be stored and ultimately disposed of as a solid waste. Applicable standards for storage and disposal of solid waste are contained in sections 19.11 and 19.111 of the solid waste regulations. For storage of solidified ash, as a solid waste, all existing and new landfills shall incorporate environmental control systems into the overall design of the facility to provide protection to groundwater, surface water and air quality. For disposal of the solidified ash, applicable requirements of solid waste regulations require a line material to achieve a $1x10^{-7}$ cm/sec maximum permeability standard. If the ultimate disposal of solidified ash is a section of the CDF, the material on the floor and sidewalls must be demonstrated to meet this applicable standard. The operation of the incinerator and air quality control equipment must achieve air quality control standards contained in 310 CMR 6.00-8.00.

Although the air quality at the site currently exceeds recommended allowable ambient limits (AALs) for PCBs and lead, the effect of remedial actions on AALs must be evaluated by appropriate monitoring and modeling techniques. Remedial actions, including incinerator operation, must be implemented without further adverse impacts on AALs.

EPA RESPONSE TO MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

1. The fact that EPA requested identification of State ARARs for the Hot Spot Operable Unit is not unusual. On the contrary, the State must identify ARARs to the lead agency in a timely manner throughout the remedial investigation and feasibility study process.

   Due to the limited scope of this interim action, standards or levels of control associated with final cleanup levels will not be achieved. This action will comply with those ARARs specific to this interim action. For example, compliance with RCRA facility and incinerator regulations will be achieved. Chemical-specific ARARs associated with final cleanup levels (e.g., Water Quality Criteria and Food and Drug Administration PCB tolerance level) are not specific to this action and are outside its scope. ARARs such as these will be addressed by subsequent actions at the New Bedford Harbor Site.

A more complete discussion of the ARARs specific to this interim remedy is included in Section XI.B and in Table 6 of the Record of Decision Summary.

2. ARARs specific to this interim action will address the major components of the remedy.

   - The dredging process will seek to minimize impacts during operation. Various control options will be examined in detail during the design phase, such as the use of monitoring and/or physical barriers (e.g., floating booms, silt curtains). The results of the Pilot Study conducted by the Corps of Engineers will be utilized during the design process to formulate control options for the dredging process to minimize and control sediment resuspension.

   - Dewatering of the sediments will be conducted to increase the efficiency of the incinerator. Effluent resulting from this dewatering process will be treated using best available technology to reduce contaminant levels prior to discharge back into the harbor.

   - The incinerator will be required to operate in accordance with the TSCA requirements, the RCRA requirements, and the State Hazardous Waste Management Regulations.

   - Incineration of contaminated sediment will produce a residual ash. Following incineration, the Toxicity Characteristic Leaching Procedure (TCLP) will be performed on the ash to determine if it exhibits the characteristic of toxicity and is, therefore, a hazardous waste, thereby necessitating solidification. This treated ash will be temporarily stored in an area adjacent to the confined disposal facility. Ultimate disposition of this material will be addressed in the second operable for the site.

3. EPA will examine the use of the Confined Disposal Facility (CDF) in the dewatering process during design to meet the State hazardous and solid waste requirements (e.g., permeability standards).

4. A brief discussion on the use of silt curtain is provided below, based on information obtained from the pilot study.

   A silt curtain or turbidity barrier is a flexible, impervious barrier that hangs down vertically from the water surface. The silt curtain consists of four major elements: a skirt that forms the barrier, flotation material at the top, ballast weight at the bottom, and a tension cable. The flotation and ballast keep the curtain in a vertical position while the tension cable absorbs stress imposed by currents and other hydrodynamic forces. The fabric material is commonly nylon-reinforced polyvinyl chloride (pvc). The curtains are manufactured in 100-foot long sections that are joined together for the overall curtain length. The curtain may be attached to shore or held stationary with large anchors attached to mooring floats on the ends and smaller anchors at regular intervals along the length of the curtain. The primary purpose of the silt curtain is to reduce turbidity in the water column outside the curtain, not to retain the fluid mud or bulk of the suspended solids. The presence of a silt curtain results in a change of flow patterns in the vicinity of the curtain so that exiting flows are redirected. Under quiescent condition (currents less than 0.5 knots (0.85 ft/sec) with no strong tidal action), turbidity levels outside a properly deployed and maintained silt curtain can be reduced by 80 to 90 percent of the levels inside. The curtain used for the pilot study was to have the skirt anchored to the bottom, with flotation material at the top to allow for adjustments necessitated by the rise and fall of the tide. An oil boom was used along with the silt curtain to contain the thin layer of floating oil or contaminant that appears on the water surface during such operations.

The silt curtains deployed during pilot study dredging sustained substantial damage as a result of severe weather conditions on November 20, 1989. Rather than delay the start of dredging operations, the curtain was allowed to remain in a damaged, and therefore ineffectual, condition for the greater part of the dredging phase. As the suspended solids data (Appendix 1 of the Interim Pilot Study Report) indicates, the levels generated at the point of dredging dropped rapidly down to background levels. Based on visual observation and the suspended solids data, the only phase in which the curtain may have contributed to reducing turbidity would have been during the Confined Aquatic Disposal (CAD), or subaqueous capping operation. As a result of these observations, the curtain was re-deployed during the placement of cap material in the CAD. Aligned in a crescent shape formation to the east and south-east of the CAD cell and located approximately 200 feet from the point of discharge, it was visually apparent that the curtain aided in reducing the turbidity levels. In all probability, however, these levels would have declined prior to reaching the Coggeshall Street Bridge. What was also readily apparent was that the initial deployment, periodic movement and final removal of the curtain resulted in some of the highest levels of sediment resuspension visually observed during the project.

While the use of a silt curtain was not particularly successful during the pilot study, the use of silt curtains will be re-examined in detail during the design process.

C. POTENTIALLY RESPONSIBLE PARTY COMMENTS

As explained previously, the PRP comments were organized into the 10 categories listed below.

CATEGORIES OF PRP COMMENTS

1. Rationale for Hot Spot as an Operable Unit

2. Reliability/Validity of Data
    - 2.1 USACE Analytical Data
        - 2.1.1 Test Protocols
        - 2.1.2 Analytical Methodology
    - 2.2 Combining Data Across Studies
    - 2.3 Contouring Method
    - 2.4 Data Not Included in HSFS
        - 2.4.1 Baseline Environmental Risk Assessment
        - 2.4.2 Sediment Quality Data - 1987 Hot Spot Survey
        - 2.4.3 Air Quality Data
        - 2.4.4 Toxicity Data
        - 2.4.5 Confined Disposal Facility (CDF) Stability Data
        - 2.4.6 Pilot Dredging Operational Data
        - 2.4.7 Results Meeting Decision Criteria

3.0 Risk Assessment/Toxicity of PCBs
    - 3.1 Additional Contaminants of Concern
    - 3.2 Exposure Assumptions
        - 3.2.1 Methodology
        - 3.2.2 Direct Contact Route of Exposure
        - 3.2.3 Incidental Ingestion
        - 3.2.4 Ingestion of Lobster Tomalley
        - 3.2.5 Consumption of Seafood
        - 3.2.6 Uncertainty Analysis
        - 3.2.7 Airborne Route of Exposure
        - 3.2.8 Dermal Absorption of PCBs
        - 3.2.9 General Comments on Exposure Parameters
    - 3.3 Toxicity of PCBs
        - 3.3.1 PCB Epidemiological Studies
        - 3.3.2 Differences in Potency Among Different PCB Mixtures
        - 3.3.3 Initiation versus Promotion
    - 3.4 Risk Evaluation
    - 3.5 Greater New Bedford Health Effects Study
    - 3.6 Ecological Risk
        - 3.6.1 Environmental Risk Assessment
        - 3.6.2 Benthic Survey

4. Fate and Transport
   - 4.1 Migration of PCBs from Hot Spot
   - 4.2 Combined Sewer Overflow (CSO) Locations
   - 4.3 Atmospheric Transport

5. Biodegradation of PCBs
   - 5.1 Natural Biodegradation as an Alternative to Remedial Action
   - 5.2 Biodegradation as a Treatment Technology

6. No Action Alternative/No Action Risk
   - 6.1 No Action Alternative
   - 6.2 No Action Risk

7. Evaluation of Remedial Alternatives for Hot Spot
   - 7.1 Screening/Evaluation of Alternatives
   - 7.2 Evaluation of Capping for the Hot Spot

8. Pilot Study/Dredging
   - 8.1 Pilot Objectives
   - 8.2 Scale up of Pilot Study Results to Hot Spot
   - 8.3 Potential Release of Non-Aqueous Phase Liquids
   - 8.4 Changes in Estuary Hydraulics Due to Dredging
   - 8.5 Volatilization of PCBs during Dredging & Disposal
   - 8.6 Pilot Study Toxicity Testing
   - 8.7 Sediment Resuspension during Pilot Study
   - 8.8 Turbidity Monitoring during Pilot Study
   - 8.9 Dredge Production
   - 8.10 Potential Problem Situations during Dredging
   - 8.11 Potential Environmental Impacts during Pilot Study
   - 8.12 PRP Access to Pilot Study Site
   - 8.13 Confined Disposal Facility
   - 8.14 PCB Removal
   - 8.15 Dredging and Operations
   - 8.16 Other Contaminants
   - 8.17 Cost Estimates
   - 8.18 Equipment Availability
   - 8.19 Confined Aquatic Disposal (CAD)

9. Unit Processes
   - 9.1 System Input Rate
     - 9.1.1 Sediment Flow Into CDF
     - 9.1.2 Estimate of Solids
     - 9.1.3 Solids from Pilot Study
   - 9.2 Sediment Dewatering
   - 9.3 Incineration
     - 9.3.1 Feasibility
     - 9.3.2 Scrubber Water Discharge
     - 9.3.3 Air Pollution Control
     - 9.3.4 Solidification of Ash
   - 9.4 Costs Estimates

10. Evaluation of Alternative Treatment Technologies
    10.1 Alternative Technologies
    10.2 Solvent Extraction
        10.2.1 Toxicity of TEA
        10.2.2 Pilot Testing of New Process Hardware

Section 1

SECTION 1.0 - RATIONALE FOR HOT SPOT AS AN OPERABLE UNIT

DCN #1, Page 4, Paragraph 3

... It is stated that the implementation of remedial action for the hot spot operable unit must be cost-effective and consistent with the overall remedial action selected for the New Bedford Harbor site. But there is no basis in the record to conclude that the proposed remedial action (other than the no action alternative) for the hot spot would be cost effective or consistent with the overall remedial action for the site. Indeed, consistency with the overall remedial action for the site cannot possibly be determined prior to the selection of the remedy. In fact, it is clear that by designating the hot spot as an operable unit and proceeding to treat it as an interim remedy the Agency is simply trying to avoid dealing with the site as whole and also seeks to avoid compliance with the law, including CERCLA, SARA, the NCP and ARARs, as well as the restriction to $2 million on emergency removal measures. The Agency simply has resorted to a ruse to make up for its own deficiencies. Moreover, given the government's determination of the amount of natural resource damages submitted in the District Court action, it would appear that any remedial action involving costs which approach or exceed that amount is not legally or economically justifiable.

DCN #2, Page 2, Comment 2

The definition of the hot spot area is totally arbitrary. Contrary to what is stated in the report (p.2-5) the target level is not necessarily a "common sense" level nor is it an optimization of sediment remediation volume and PCB mass removal/treatment.

DCN #2, Page 7, Comment 3

The use of the word "common sense" to justify the PCB target level is amazing. It implies that there is some universally accepted standard for selection of the target. This is not the case. What is even more disturbing is that no analysis is provided to support the selection.

DCN #31, Section 2.0, Page 2-1

EPA has been arbitrary in its definition of the hot spot as the operable unit for the upper estuary.....

- EPA's rationale for using the 4000 ppm target level is unstated and capricious.
- EPA has disregarded its own "operable unit" guidance by defining the hot spot as 4000 ppm.

- There is no precedent for the use of 4000 ppm target cleanup level for other Superfund sites.
- EPA must undertake a scientifically and legally valid definition of the hot spot.

EPA RESPONSE

This Hot Spot Operable Unit is the first of two operable units planned for the New Bedford Harbor Site. Operable units are discrete actions that comprise incremental steps toward a final remedy. They may be actions that completely address a geographical portion of a site or a specific site problem. The Hot Spot Operable Unit addresses both a geographical portion of the Site and a specific Site problem.

The Hot Spot Area is an area of approximately 5-acres along the western bank of the Acushnet River Estuary adjacent to the Aerovox facility. It is noteworthy because of the extremely high levels of PCBs that have been detected in the sediment. Levels of PCBs in the Hot Spot sediments range from 4,000 ppm to over 200,000 ppm. Dermal contact and incidental ingestion of this sediment pose a potential risk to public health. In addition, potential routes of exposure for marine organisms include direct contact with the sediment, contact with contaminants in the water column, and ingestion of contaminated food. Finally, the Hot Spot continues to act as a source of contamination throughout the entire Site. This Hot Spot Operable Unit is designed to respond to these significant threats.

This interim action is protective of human health and the environment because it provides for the removal and treatment of the highly contaminated sediments in the Hot Spot. Subsequent actions will be undertaken to address fully the principal threats posed by the remainder of the Site. This interim action is consistent with any possible future actions because this action calls for the removal of approximately 48 percent of the total PCB mass in sediment from the estuary portion of the Site, which acts as a continuing source of contamination throughout the entire Site.

EPA recognizes that removal of the Hot Spot will not remediate the estuary and lower harbor water quality PCB concentrations below the Ambient Water Quality Criteria (AWQC). However, the removal of the Hot Spot serves as a necessary first step for achieving these goals.

EPA's rational for separating the Hot Spot into an operable unit is to allow the removal of a highly concentrated mass of PCB contamination from the environment. EPA believes this approach is consistent with the operable unit approach in that it is a discrete portion of a remedial response that eliminates a release or threat of release of PCBs.

Figure 1.1 at the end of this Section depicts the relationship between the percentage of PCB mass and sediment volume in cubic yards for the Upper Estuary. As the number of cubic yards increases, the percentage of PCB mass per cubic yard decreases. The rate of change in the percentage of PCB mass as it relates to volume in cubic yards varies. At 4,000 ppm, or 48% PCB mass, the slope of the curve changes dramatically. Above this point, the rate of increase in percentage of PCB mass, as it relates to sediment volume, markedly diminishes. By using a target level of 4,000 ppm, EPA will remove the greatest percentage of PCB mass for the least volume of sediment. In EPA's judgment, removing sediment at 4,000 ppm and greater takes advantage of the steepest parts of the curve.

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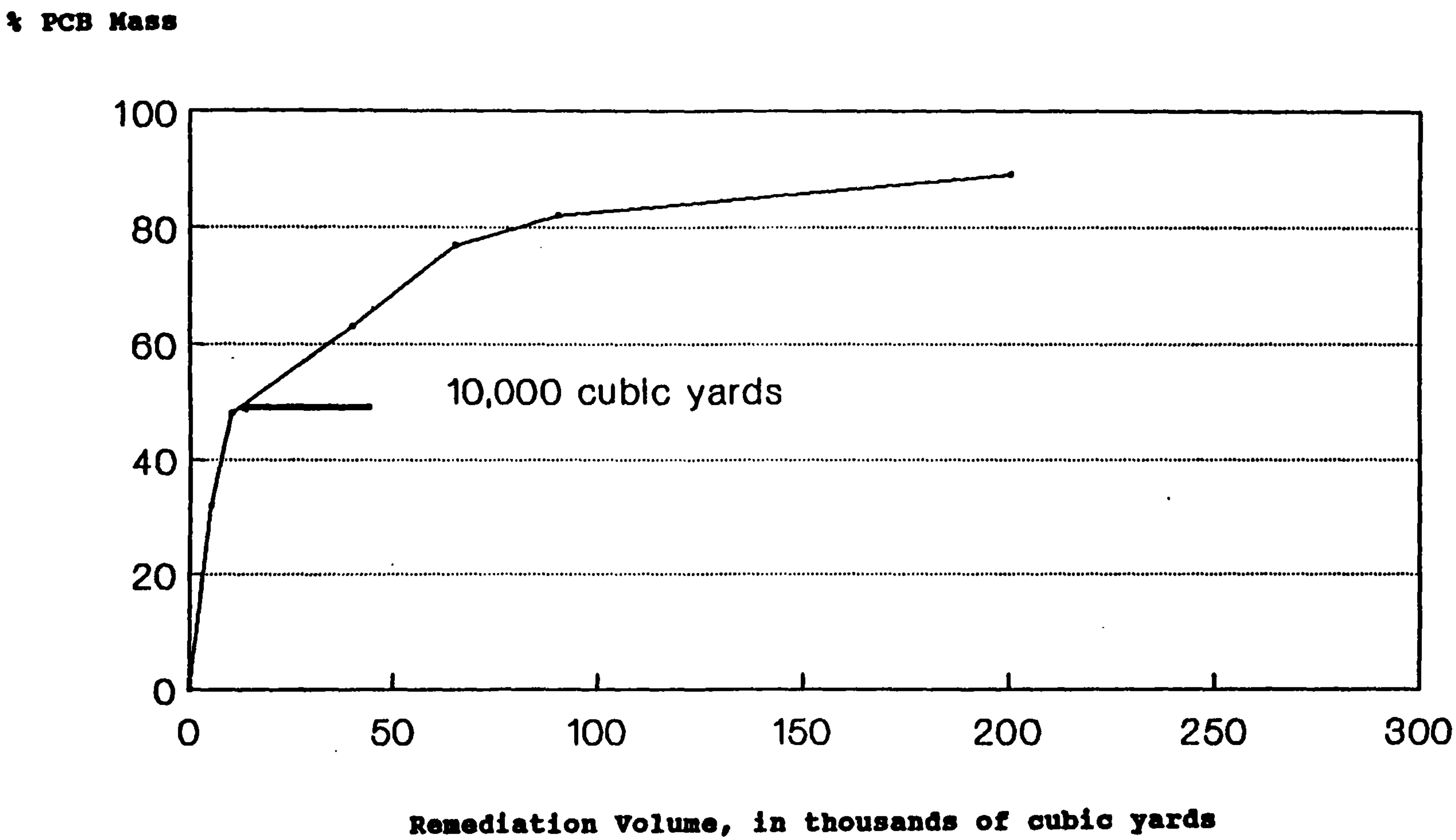
Section 1 References

E.C. Jordan Co./Ebasco, 1989. "Hot Spot Feasibility Study for New Bedford Harbor;" prepared by E.C. Jordan Co. for EPA.

Thibodeaux, 1989. "A Theoretical Evaluation of the Effectiveness of Capping PCB Contaminated Sediment - New Bedford Harbor Sediment." (DCN #17)

FIGURE 1.1

PCB MASS VERSUS VOLUME



Section 2

SECTION 2.0 - RELIABILITY/VALIDITY OF DATA

2.1 USACE ANALYTICAL DATA

2.1.1 TEST PROTOCOLS

DCN #1, Page 5

> In chapter 2, the Agency grossly exaggerates the reliability of the test data. Not only are the test protocols and analyses not all included or available for scrutiny, but it is clear, from the extent to which we have been able to examine any data, that they are not reliable and do not provide a basis for action by the agency.

DCN #30, Appendix II, Page 35

> The magnitude of the effort put into the project as well as designation of the New Bedford Harbor as a Superfund Site should have justified and required the preparation of a site specific Quality Assurance Project Plan (QAPP) covering both the field and laboratory aspects of the project.... The draft QA/QC plan was a good start, but did not qualify as a formalized QAPP.

DCN #30, Appendix II, Page 38

> Ideally, control samples for PCB projects should be completely free from electron-capture responsive components. When "clean" control samples are used, they serve as excellent process blanks for the entire system, from sample collection through final analysis. Unfortunately this was not the case for this study. In fact, the chromatogram for Control 1 Exhibit 27) suggests the presence of degraded Aroclor 1260. As a consequence, the analysis of the 11 control samples served no useful purpose.

> The two areas where this program appeared most deficient were data validation and the lack of use of written standard operating procedures which would have documented the analysis protocol to be followed.

> The analysis of the EPA standard reference materials produced acceptable results and the percent recoveries of the Aroclor 1260 spikes were reasonable for samples of this type. However, these accuracy assessments have very little direct bearing on the accuracy of the actual samples. The pattern alternations which gave rise to the quantitative bids of the samples (the presence of new PCB congeners and the sulfur interferences) were not present in the EPA standard reference materials.

EPA RESPONSE 2.1.1

The purpose of the Draft Quality Assurance/Quality Control (QA/QC) Plan (which upon amendment became a working plan) was to ensure data validity and to document the data quality generated during the study period. The "Review of Hot Spot Feasibility Study" (DCN #12) by the PRPs states that, "...the PCB concentrations reported for individual subsamples in this (the COE) study are reasonably well supported by laboratory Quality Control data..."

The purpose of the control samples was to demonstrate that there was no significant cross-contamination of samples during the air-drying process. A report from another laboratory indicated that cross-contamination could occur when high concentration PCB samples are dried in the presence of low concentration samples. PCBs can volatilize from the high concentration samples and then condense on the low concentration samples, thereby contaminating them. Great care was exercised to prevent this from occurring. Fresh, uncontaminated air was directed over open containers of wet samples by the use of cardboard baffles. Samples were aligned in the direction of the air flow, with no sample in front of or behind another, to avoid cross-contamination. Each physical group of samples which were air-dried in this fashion had one control sample associated with it for the sole purpose of demonstrating that any cross-contamination from volatilization and condensation processes was insignificant. The average PCB concentration of the eleven control samples was 0.01 ppm, ranging from a low of <0.01 ppm to a high of 0.12 ppm. The sediment samples, on the other hand, averaged 2,990 ppm, and ranged from <0.01 ppm to 76,100 ppm. 60 of the 86 samples served their stated purpose of demonstrating no significant cross-contamination problems from the air-drying process.

EPA used standard operating procedures (SOPs) throughout the execution of the analytical program. All data were reviewed, or "validated" prior to release to the data user.

The analysis of spiked samples and of standard reference materials (SRMs) was appropriate and has direct bearing on the accuracy of the actual samples. Testing these QC samples examines the entire analytical process, including extraction efficiency, concentration of the extracts, sample cleanup and chromatography, as well as quantitation and reporting. Since the analytical method employed (USEPA 8080) would not quantitate "new" PCB congeners (e.g., those arising from biotransformation processes), selecting a different SRM for analysis would have had no impact on the QA/QC program.

2.1.2 ANALYTICAL METHODOLOGY

DCN #12, Page 4-5

> Core samples were collected according to a systematic sampling plan. However, the procedures used to select subsamples for the cores (visual classification) for determination of PCB content were subjective and probably biased the results upward. The concentration results reported for this study, therefore do not reflect a statistical design and are unsuitable for drawing inferences about the distribution of PCBs within the estuary. The PCB concentration reported for individual subsamples in this study are reasonably well supported by laboratory Quality Control data. However, no field duplicates were analyzed and no calibration data were provided to allow assessment of the correctness of the quantification.

DCN #30, Appendix II, Pages 40-41

> The analytical methodology proposed for use in the study was appropriate as was the instrumentation employed. The quality of the data suffered, however, because the prescribed sample clean up for sulfur removal was not used.
>
> Peak resolution of the chromatograms was poor. This situation should not have had a negative impact on data quality, however, since both the standards and the samples should have been run under identical analysis conditions.
>
> Poor peak resolution of the original chromatograms presented a problem as it related to the pattern alternation, especially since the corresponding standards were not available.
>
> Aroclor 1260 was found in four samples which came from three different sampling sites. In addition, trace levels of Aroclor 1260 were observed in eight additional samples. Since there is no evidence of alteration of the Aroclor 1260 pattern, laboratory contamination is suspected as the source of Aroclor 1260 in these samples.
>
> The quantitation of the new congeners formed during biotransformation (which are not present in commercial Aroclor mixtures) is beyond the scope of analytical method (EPA Method 8080). Therefore, these PCBs were not included in the total PCB data. When new congeners are present in the samples, the data area biased low.
>
> The QA/QC protocol apparently was not followed as it related to the clean-up of sample extracts for the removal of

sulfur. As a consequence, sulfur interference was present in 60 of the 85 sample chromatograms (70%).

Chromatographic pattern alternations were present in the chromatograms.

The most significant Aroclor pattern alteration observed in USACE sediment samples is that due to anaerobic dechlorination.

EPA RESPONSE 2.1.2

Sample clean-up for sulfur was employed as planned. If it had not been performed, then approximately the first 10 minutes of every chromatogram would have been totally obliterated by the sulfur peak(s). Since the chromatograms are plainly readable and interpretable throughout their length, it is obvious that the sulfur cleanup was performed, and that the sulfur was almost entirely removed from the sample extracts. The clean-up procedure is an iterative process, and must be repeated several times before the sulfur can be reduced to an acceptable level. Of the two small sulfur peaks which might remain after this clean-up was performed, the first, at a retention time (RT) of about 1.7 minutes, is well resolved from and occurs before any of the peaks, and therefore was not an interference. The second sulfur peak, at a RT of about 8.8 minutes, co-elutes with another PCB peak at about the same RT, and therefore could, if present, exert a positive bias on the PCB value. The sulfur clean-up was repeated on each sample extract until either (1) the sulfur was totally eliminated from the chromatogram, or (2) the sulfur was reduced to an "acceptable" level, or (3) additional clean-up repetitions resulted in no further reductions in sulfur levels. By noting the size in area counts of the 1.7 minute RT sulfur peak, the contribution of sulfur to the 8.8 minute RT PCB peak can be approximated. All of the 86 sample chromatograms were examined in this fashion to estimate any positive bias to the PCB results from the presence of sulfur. In several instances at the time of analysis, the chemist eliminated the 8.8 minute RT peak from the quantitation process because of the obvious presence of sulfur. This approach resulted in 50 of the 86 sample chromatograms (58%) being thoroughly free from sulfur interference, while 33 of the remaining 36 sample chromatograms exhibited a positive bias of only 5% or less on the final PCB results. Therefore, 83 of the 86 sample chromatograms (96%) were only minimally impacted by the presence of sulfur with positive biases ranging from only 0 to ≤5%. Only three sample chromatograms had positive biases in excess of 5% (two with 8%, and one with 15%). The average positive bias exerted on the final PCB results due to the presence of sulfur in all 86 sample chromatograms was less than 1%.

Peak resolution of the chromatograms was not poor. Chromatographic "resolution" is defined mathematically as:

$$R = \frac{{}^{t}R,1 - {}^{t}R,2}{0.5\ (W_1 - W_2)}$$

where: ${}^{t}R,1$ & ${}^{t}R,2$ are the retention times in minutes of peaks 1 & 2, and W_1 & W_2 are the peak widths in minutes at the bases of peaks 1 & 2 .

Resolution is a function of retention times and peak widths, both time units. The PRPs' process of altering the horizontal axis of the chromatograms (akin to redrawing the chromatograms at a different chart recorder speed), i.e., their so-called "resolution enhancement" process, was purely one of convenience to allow more facile visual comparisons. The fact that the USACOE chromatograms compared well with the PRPs' after being compressed in this fashion indicates that the resolution was indeed adequate to start with and was comparable to the PRPs'.

EPA agrees that the analytical method employed here (USEPA Method 8080) will not quantitate certain PCB congeners which are not present in commercial Aroclor mixtures. Even the PRPs concede (DCN # 30A, Appendix II, Page 18) that the method designed to quantitate certain PCB congeners (USEPA Method 680) was not available at the time this study was conducted. Method 8080 was the state-of-the-art technique commonly utilized in the environmental analytical community at that time. EPA agrees that the effect of using Method 8080 as opposed to Method 680 would be a negative bias. If anything, repeating these analyses using Method 680 would result in higher values for total PCBs.

A "visual classification" system was used to select subsamples from certain cores for chemical analysis. This was performed under the personal direction of a Corps of Engineers Waterways Experiment Station representative. However, 18 of the 39 cores tested were sub-sampled on a purely objective basis, using strata limits of 0"-12" and 12"-24". This was consistent with other sampling programs conducted for the site.

One set of field duplicates was analyzed from grid number I-11. Unfortunately, the depth strata subsampled were slightly different, with I-11-1 being subsampled at 0"-13" and 13"-24", while I-11-2 being subsampled at 0"-12" and

12"-24". Thirteen additional grids had duplicate cores sampled, but they were never analyzed.

Some "secondary" calibration data was provided in the Condike June 1986 report, which the PRPs had access to, and which would have allowed an independent assessment of the correctness of the quantification. In addition, results of split samples analyzed by another laboratory support the accuracy of the quantification.

2.2 COMBINING DATA ACROSS STUDIES

DCN #12, Page 9

The approach taken in the Hot Spot Report is based upon a false assumption that the results of multiple studies, years apart, using varying methods for sampling and analysis can be viewed as a single coherent body of data. The Report fails to provide information about the intent, purpose, and (lack of) statistical design of the studies from which the data were drawn. It appears to assume that all of the values used are equally accurate and that inferences can be drawn from the data set as a whole. This is not true, especially because the underlying studies were not conducted in accordance with statistically designed sampling plans.

The approach taken in the Hot Spot Report also incorrectly implies that the measurements made in the various studies can be accurately co-located on a single set of maps.

EPA RESPONSE 2.2

The analytical data for the Hot Spot and the remainder of the Acushnet River Estuary has been acquired over a period of six years. The first sampling programs in the Acushnet River Estuary identified an area in the northern part of the Estuary with significantly higher levels of PCBs than the remainder of the Estuary and Harbor. In 1982, sampling by the U.S. Coast Guard confirmed this fact. The U.S. Army Corps of Engineers (USACE) developed a program to determine the nature and extent of PCB contamination within the Estuary. The USACE developed a grid system for the upper Estuary and performed three sampling events using this grid system. The last sampling program, the USACE Hot Spot sampling program (1988), was confined to the Upper Estuary in the location of the highest PCB concentrations and was conducted to determine the nature and extent of the Hot Spot areas. Thus, each sampling program built upon previous sampling programs in an effort to delineate the boundaries of the Hot Spot.

To facilitate an understanding of the analytical data, the PCB sediment concentrations were mapped. These maps included all of the five data sets to provide sufficient data. EPA believes that the data is of adequate quality to be used for these purposes. Regardless of the difference in sampling and analytical methods, each of these different sampling programs have shown the same magnitude of PCB contamination in the Hot Spot Area. In summary, EPA believes that all of the values are of adequate quality and demonstrate consistent results and can be used collectively to define the extent of contamination and areas for remediation. During the design phase, EPA will determine the necessity of any additional sampling to further delineate the actual limit of removal for plan and specification development.

2.3 CONTOURING METHOD

DCN #12, Pages 9 and 10

The method used for contouring PCB analytical data from sediment samples (as outlined in the May, 1989 Feasibility Study) is a simplistic approach based on arbitrarily-chosen (from a statistical standpoint) contour intervals.... This approach, while valid as a first pass to determine orders of magnitude is entirely inadequate for more detailed evaluation of analytical data.

The applied contour method is not statistically rigorous and does not adequately "weight the data for accurate assessment of directional inhomogeneity (e.g., non-random distribution on contamination). This simplistic approach has purposely not accounted for the factors which provide "fabric" or linearity to these data, such as tidal currents, ongoing sedimentation, and channeling thereby simply cutting across these natural bounding conditions.

The use of only three contour levels with an arbitrary upper threshold of 4,000 ppm PCB has masked many crucial details which may provide insight into the ongoing dynamic movement of PCBs within the sediment and water column. A more appropriate contour interval might be half-step log intervals (i.e., 0-50, 50-100, 100-500, 500-1,000, 1,000-5,000,5,000-10,000 ppm, etc.)

The Feasibility Study contouring approach does not incorporate a linear regression analysis to correlate PCB concentration with distance down the primary transport pathway. This information is useful in assessing the directional inhomogeneity of the data. A linear regression analysis might also help to identify any non-"hot spot" sources of PCBs into the estuary.

Accurate assessment of sediment volume falling above a given lower contaminant threshold is impossible utilizing the Feasibility Study approach. Given the projected costs of remediation for the "hot spot" ($10-15 million), an error of 15-20% in contouring accuracy could result in errors in projected expenditures of several million dollars.

The simplistic contouring approach provides no measure of uncertainty in the contoured data and it provides no means for determination of the adequacy of sampling density.

A statistical approach known as kriging could adequately address these issues by assigning preferred fabric or linearity to data, thereby accounting for directions if inhomogeneity.

Kriging could provide a minimum variance, unbiased linear estimator of the distribution of PCB contamination between any two points of known value in any given geometry. In addition, it can provide an explicit measure of uncertainty in the contoured data by incorporating error bands on all contours and if more data are needed, kriging will provide guidance for optimum placement of additional sampling stations.

EPA RESPONSE 2.3

The contour method used in the FS is an adequate method for a first pass at data interpretation. This method is also acceptable for volume determinations where sufficient data exists. This contouring procedure was used in 1986 and 1987 to plot the original data sets to conceptualize the nature and extent of the PCB distribution. Where natural boundary conditions were known to occur, the contour placement was adjusted in these areas to prevent crossing of these boundaries. Subsequent sampling by the USACE in 1988 confirmed that these contour maps did, in fact, present an accurate interpretation of the distribution of PCBs in the Upper Estuary.

The density of the data points in the Hot Spot Area is a critical factor in determining whether the method of contouring used is an acceptable method for volume calculations. More than 75 samples have been taken in and around the Hot Spot to determine the PCB concentrations and delineate the boundaries of contamination. As illustrated in Figure A-1A of the Hot Spot Feasibility Study (HSFS), the majority of the sample locations lie within 200 feet of each other. Many of the sample points are closer, within 100 feet. Even if a few of the data points are plotted incorrectly, interpolating data at this density is sufficient to calculate sediment volumes. In addition, factors such as tidal currents and channeling become less important as the points are closer and limited cutting occurs across these natural boundaries.

Several contour maps were developed with different contour intervals. The map selected for the HSFS presented four contour intervals: 0-50 ppm; 50-500 ppm; 500-4,000 ppm; and over 4,000 ppm. This map was selected primarily because additional contour intervals did not aid in illustrating the relationship of the Hot Spot to the remainder of the Estuary.

EPA believes that the estimated Hot Spot volume using this contour method is accurate for its intended use given the amount of sampling points used to define the Hot Spot Area. EPA recognizes that uncertainties associated with this volume estimate may impact the cost estimate of the remedial alternatives. However, the magnitude of this uncertainty is expected to fall within the +50% to -30% range for feasibility study cost estimates (Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, October, 1988).

Kriging is another method for calculating PCB contours that is used where there is less data and interpolation is occurring between data points separated by significant distances. With respect to the Hot Spot, EPA believes that sufficient sampling has occurred such that the use of either method (i.e., contouring or kriging) would generate similar volume estimates.

The PRPs' generated a contour map using EPA's data and it is presented in Figure 2.1 at the end of the Section. According to the PRPs, the kriging method produced results that, "represent reliable estimates of constituent masses and deposition in New Bedford Harbor upper Estuary sediment" (Balsam, 1989a). The PRP map (Figure 2.1) shows a similar extent of PCB contamination when compared to EPA's contour map (Figure 2.2). Both of these maps are validated by the PCB sediment sampling and analytical results from the thin layer sampling program conducted by the PRPs (Balsam, 1989b).

2.4 DATA NOT INCLUDED IN HOT SPOT FS

2.4.1 BASELINE ENVIRONMENTAL RISK ASSESSMENT

DCN #31, Page 4-1

> The HSFS specifically references a baseline risk assessment. Although the HSFS states that the environmental risk assessment "is scheduled for completion in the summer of 1989," the document has not yet been released.... Without this document, defendants are unable to examine a critical piece in EPA's purported justification for dredging the hot spot.

EPA RESPONSE 2.4.1

EPA did examine the baseline environmental risks associated with the Hot Spot area sediment as part of Hot Spot Feasibility Study (HSFS). EPA is currently examining the baseline environmental risks for the entire site as part of the second operable unit. Results of this study are scheduled to be available in April 1990.

The following is a brief summary of the HSFS environmental risk assessment presented in the HSFS. The risk assessment evaluated the potential risk to biota from both exposure to the water column and direct contact with the sediment. To evaluate the water column route of exposure, PCB water column data was compared against the Ambient Water Quality Criteria (AWQC) value of 30 parts per trillion. This AWQC value is a residue-based criterion that was developed to provide protection to aquatic biota under chronic exposure conditions. In the vicinity of the Hot Spot, water column PCB concentrations in excess of 100 times the AWQC value have been measured in studies conducted for EPA (Battelle, 1989) and by the PRPs (ASA, 1989).

The environmental evaluation of the Hot Spot sediment consisted of a comparison of estimated pore water PCB concentration against the AWQC using the Interim Sediment Quality Criteria (SQC) method and comparison of site-specific toxicological data (Hansen, 1986). The probability of the Hot Spot pore water PCB concentration exceeding the AWQC was approximately 100 percent. This result was consistent with the site-specific toxicological data that demonstrated the upper estuary sediment region to be toxic both for benthic invertebrates and fish.

2.4.2 SEDIMENT QUALITY DATA - 1987 HOT SPOT SURVEY

DCN #31, Page 4-2

> Over several months, defendants have attempted to procure the full laboratory database utilized to define the "hot spot".

EPA RESPONSE 2.4.2

Over the period of several months, EPA provided the PRPs with 3 copies of the Hot Spot sampling report prepared by the Corps of Engineers New England Division (NED). The report contains information describing the sampling and the analytical programs conducted in 1987 by NED to develop a more definitive picture of PCB contamination within the upper portion of the Estuary. Sampling information included the location (latitude and longitude) and the specific depth of each sample. The analytical program was conducted to provide a physical and geochemical description of the sediments. Physical measurements included moisture content, grain size distribution, specific gravity, and Atterberg limits. The geochemical characterization included PCB and total organic carbon (TOC) analyses.

The actual (PCB) chromatograms and associated laboratory backup QA/QC information are not routinely considered a part of EPA's Administrative Record for a site. However, in the interest of continued information exchange with the PRPs, EPA, with the assistance of NED, produced a majority of this raw laboratory material on October 23, 1989. The Corps is continuing to search for the remaining chromatograms, to determine if they are still in existence.

2.4.3 AIR QUALITY DATA

DCN # 31, Page 4-3

> Only very limited air quality data collected during the pilot dredging program have been made available.

EPA RESPONSE 2.4.3

EPA's contractor has made the PCB chromatograms and associated QA/QC information from the Pilot Study Air Monitoring program available to the PRPs (see DCN #40).

Presently, this data is undergoing data validation. Once validated, the data will be incorporated into the Pilot Study Air Monitoring report. This report will be used in EPA's predesign studies to evaluate the air monitoring and emission control requirements for the dredging and dewatering activities prior to the preparation of plans and specifications. The current schedule calls for this report to be completed by April 30, 1990.

For additional information on volatile PCB emissions, refer to EPA Response 4.3 in Section 4 of this Responsiveness Summary.

2.4.4 TOXICITY DATA

DCN #31, Page 4-4

> Toxicity Data. EPA conducted toxicity data evaluation on biota during the course of the pilot dredging program. Defendants were not provided with the results...

EPA RESPONSE 2.4.4

The results of this portion of the monitoring program are summarized in the Corps of Engineers Pilot Study Interim Report. Several technical papers on this subject are currently being prepared by EPA's Narragansett Laboratory, but are not yet complete. This comment is further addressed in EPA Response 8.8 in Section 8 of this Responsiveness Summary.

2.4.5 CDF STABILITY DATA

DCN #31, Page 4-4

> CDF Stability Data. The Pilot Dredging Program work plan called for the collection of data on the stability of the CDF since its construction. None of the data have been provided...

EPA RESPONSE 2.4.5

An Appendix to the final version of the Pilot Study Report will address CDF dike design and construction in greater detail. This report will contain the data obtained while monitoring the in-water dike portion of the CDF. This comment is further addressed in EPA Response 8.13 in Section 8 of this document.

2.4.6 PILOT DREDGING OPERATIONAL DATA

DCN #31, Page 4-5

> Pilot Dredging Operation Data. Neither the pilot dredging report nor the Administrative Record includes operational data or daily logs compiled during the course of the pilot study. Defendants believe that such information is crucial to the overall evaluation of dredging and a remedial action.

EPA RESPONSE 2.4.6

The pilot study report contains a detailed summary of daily operations which include how the dredges were operated (swing speed, cutterhead rotation, etc.) hours operated per day, downtime per day and dredge location. Very little additional information can be obtained from reviewing contractor daily reports and logs kept by government personnel. However, this information has been added to the Administrative Record as item 4.4.27.

2.4.7 RESULTS MEETING DECISION CRITERIA

DCN #31, Page 4-5

The pilot dredging report indicates that the government ignored its own procedures. At the bottom of page 44, there is discussion of results, despite the fact that some criteria were reportedly violated on several occasions.

DCN #31, Page 5-37

The operations of the Decision Committee and review of data did not follow the plan or the procedures that the public were told would be followed.

EPA RESPONSE 2.4.7

Pre-operational monitoring was used to establish background conditions in the harbor. The decision criteria consisted of a set of numerical criteria that were established to serve as an early warning mechanism that, if exceeded, would require adjustments in the project. The criteria consisted of contaminant levels and biological responses that represented a statistical or biologically significant increase over background conditions.

A decision committee, headed by EPA with representatives from the appropriate state and Federal agencies, evaluated monitoring results. Data was provided to the committee less than 24 hours after sample collection, allowing for timely adjustments to pilot study operations.

The chemical criteria were exceeded on only 2 occasions and biological criteria were not exceeded during the project period. On days when the criteria were exceeded, the EPA project manager contacted committee members to discuss the situation. Extreme weather or obvious operational problems were encountered on days when criteria were exceeded. This resulted in the committee deciding to continue operations and monitoring with appropriate changes to the operations. The instances when the criteria were exceeded were all one day spikes with the following days' contaminant levels returning to the range of background conditions.

###

Section 2 References

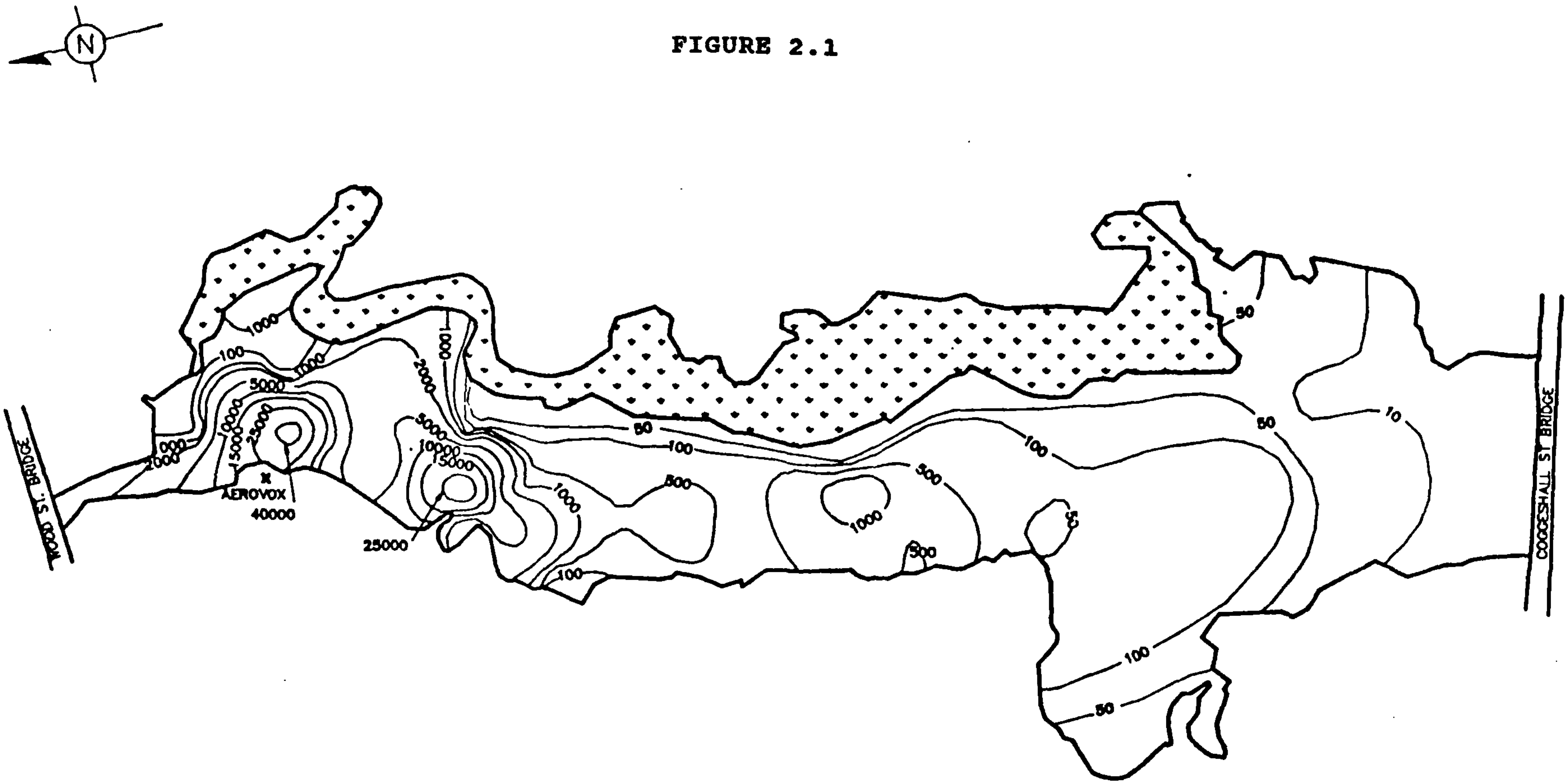
ASA, 1989. "Tidal Cycle Flux Measurement Data," (DCN #21).

Balsam, 1989a. "A Remedial Action Program - New Bedford Harbor Superfund Site, Attachment A, Acushnet River Upper Estuary PCB Mass," (DCN #16).

Balsam, 1989b. "A Remedial Action Program - New Bedford Harbor Superfund Site, Attachment D, New Bedford Harbor Thin Layer Sampling Program," (DCN #19).

Battelle, 1989. New Bedford Harbor Database (hard copy printout), prepared for Ebasco Services, Incorporated.

FIGURE 2.1



LEGEND

100 — = TOTAL PCB CONCENTRATION ISOPLETH (PPM)

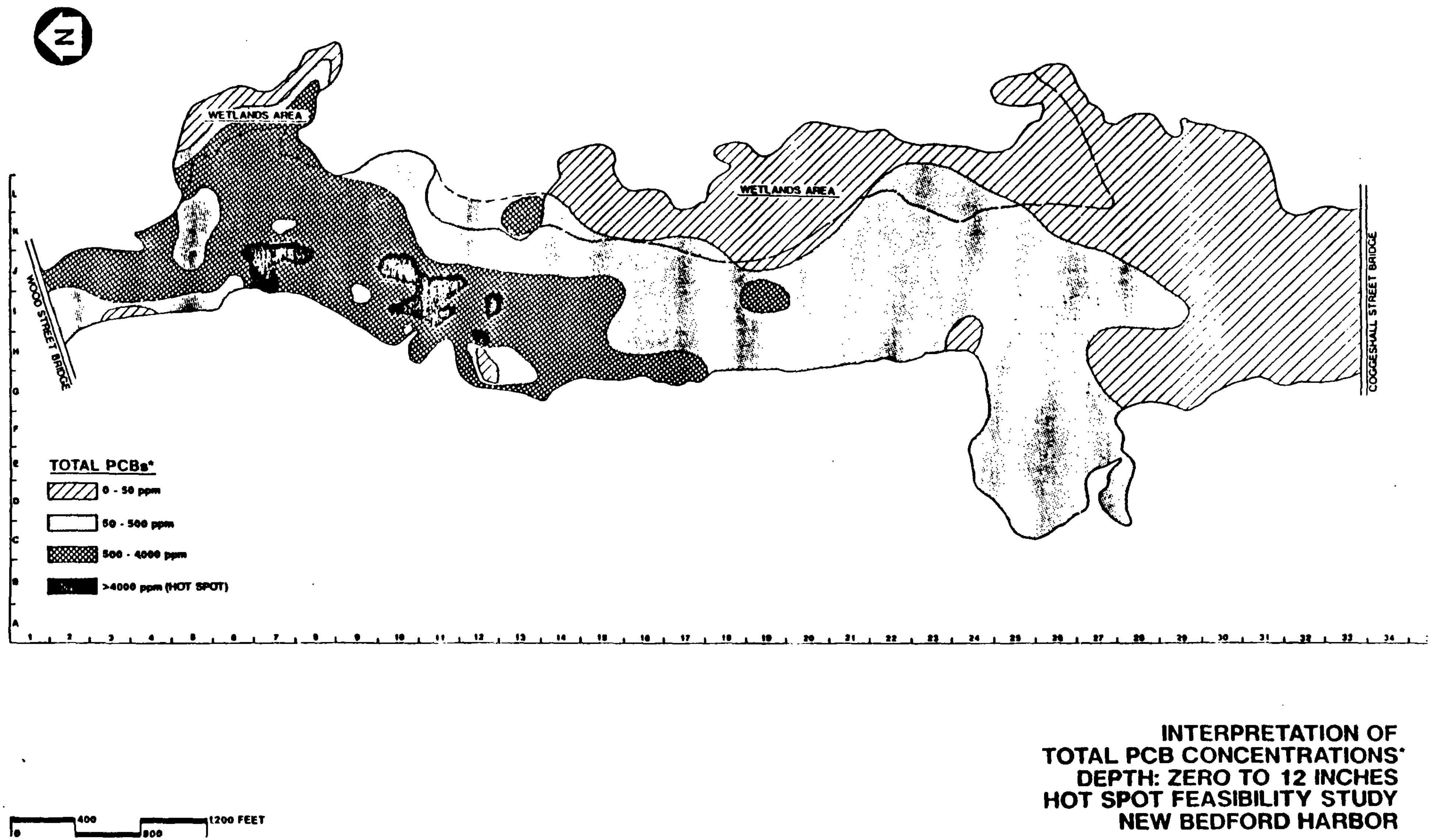
∴ = SALT MARSH

NOTES:

ISOPLETHS DEVELOPED USING INTERPOLATION OF DATA FROM UNITED STATES ARMY CORPS OF ENGINEERS (AUGUST–OCTOBER, 1985 AND AUGUST 1987) AND BATTELLE/NUS (JUNE, 1985)

BALSAM ENVIRONMENTAL CONSULTANTS, INC. 59 STILES RD. SALEM, N.H. 03079			CLIENT: AVX CORPORATION	
			TITLE: ISOPLETHS FOR TOTAL PCB CONCENTRATIONS 0"–12" INTERVAL	
DATE: 10/12/89	DRAWN BY: D.J.H.	CHECKED: G.M.G.	PROJECT: NEW BEDFORD HARBOR	
SCALE: 1"=900'	FILE NO. 1.8" 629216a	APPROVED: L.C.S.	FIGURE NO. 1.5	PROJECT NO. 6292.05

FIGURE 2.2



INTERPRETATION OF
TOTAL PCB CONCENTRATIONS*
DEPTH: ZERO TO 12 INCHES
HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR

* SUM OF AVAILABLE AROCHLOR DATA

Section 3

SECTION 3.0 - RISK ASSESSMENT

3.1 ADDITIONAL CONTAMINANTS OF CONCERN

DCN #5, Page 5

On pages 2-10 and 2-11, it is asserted that risks from metals and PAHs have been analyzed and reported on in the Baseline Risk Assessment. This assertion is incorrect. No analysis from risks of either has been done, and, indeed, contrary to the statement at page 3-1, that a Baseline Environmental Risk Assessment is scheduled for completion in the summer of 1989, no such document has been issued.

DCN #6, Page 4

For the New Bedford Harbor risk characterization, and as noted above, only PCB exposures estimated in the RA are being considered in this critique, although other toxicants are found in the harbor. These include a variety of Oil and Hazardous Materials (OHMs) as well as metals (e.g. other hazardous materials) such as copper, lead and cadmium.

DCN #31, Page 3-3

On page 2-14, Ebasco states that "Exposure to PCBs was evaluated for all routes of exposure. When or if the exposure levels for PCBs were considered insignificant, exposure to cadmium, copper, and lead was then evaluated." Such a selective approach, especially in combination with EPA's decision to ignore the polycyclic aromatic hydrocarbons in the harbor that will still be there after dredging, clearly demonstrates that EPA's goal is not accurately to assess risk, but simply to go forward with dredging.

EPA RESPONSE 3.1

PCBs are the primary contaminant of concern in the Hot Spot area and Estuary. However, even if the Acushnet River Estuary were not contaminated with PCBs, it would by no means be a pristine estuarine environment. It has historically been polluted with industrial and sanitary waste discharges. Due to these discharges, there are elevated levels of polycyclic aromatic hydrocarbons (PAHs) and heavy metals (i.e., copper, chromium, lead, and cadmium) in the estuary sediment.

The potential risk associated with exposure to other contaminants present in the harbor was evaluated and discussed in the Baseline Public Health Risk Assessment (see page 1-2) which was released in August 1989. The Baseline Environmental Risk Assessment for the overall site is scheduled for release in April 1990.

The highest metal-contaminated sediment is not co-located with the PCB Hot Spot Area. Rather, its location correlates with the location of industrial discharges and/or combined sewer overflow discharge pipes. Contamination, such as heavy metal contamination outside of the Hot Spot will be addressed in the second operable unit.

EPA has found PAH compounds to be generally co-located with PCBs. However, the range of PAH concentrations in sediment was significantly less than the range of PCB concentrations. Total PAH concentrations range from below detection limit to 930 ppm, with an average PAH sediment concentration of approximately 70 ppm. (The highest PAH concentration of 930 ppm was detected in the Hot Spot area of the upper estuary.) No discrete areas of elevated levels of PAH compounds were observed, suggesting that PAH contamination results from non-point sources such as urban runoff. PAH concentrations detected in New Bedford Harbor sediment are similar to PAH concentrations detected in other urban and industrialized area (EPA, 1982).

The relative toxicity of PAH compounds with respect to PCBs indicates that the majority of risk from exposure to sediment can be attributed to PCBs. Since PAH compounds can be effectively treated by the technologies used to treat PCB contamination, methods taken to reduce PCB contamination will effectively reduce PAH contamination (E.C. Jordan/Ebasco, 1989). However, unlike PCBs, the occurrence of PAH compounds is expected to continue after remediation due to non-point sources. Therefore, the remedial actions planned in this operable unit may not permanently reduce levels of PAH contaminants.

3.2 EXPOSURE ASSUMPTIONS

3.2.1 Methodology

DCN #6, Page 2

> As a whole, the RA seeks to apply unreasonable and overly large estimates of exposure....

DCN #6, Page 1

> I do not believe that these estimates are realistic or even correct. As to their correctness, they appear to be

mathematically consistent but I conclude they are substantial overestimates of exposure opportunity, exposure dose and as a consequence, they misstate the true risk.

DCN #8, Page 1

The major flaws identified in this report can be roughly categorized into three groups as follows:

1. The findings from the main report are not properly abstracted into the executive summary.
2. The assumptions regarding frequency of exposure are absurd.
3. Other assumptions used in the calculations are not supported by the literature.

DCN #31, Page 3-10

EPA's Guidelines for Exposure Assessment encourage the use of realistic assessments based on the best data available. Worst-case estimates are not encouraged (EPA 1986b). Nonetheless, EPA ignored its own guidelines in performing the exposure assessment and instead manufactured potential risks by linking together a series of implausible worst-case exposure assumptions. As set forth below, the New Bedford Harbor risk assessment has failed to demonstrate the reasonableness of key assumptions and evaluates exposures that are unlikely to occur; potential risks that are estimated for the site are calculated under the terms and conditions of implausible exposure scenarios.

EPA RESPONSE 3.2.1

The Baseline Public Health Risk Assessment (RA) was conducted in accordance to the guidelines presented in the Superfund Public Health Evaluation Manual (SPHEM) and the Superfund Exposure Assessment Manual (SEAM). The exposure parameters used in the RA were obtained from EPA documents and the scientific literature or developed based on professional judgement. Detailed rational and appropriate citations for the methodology and exposure assumptions used were provided in the RA text. Each exposure parameter was reviewed and considered to be consistent with exposure parameters used in other Superfund Risk Assessments. EPA made every attempt to obtain and use realistic exposure assumptions. Comments specific to each route of exposure are discussed in the following sections.

3.2.2 Direct Contact Route of Exposure

DCN #6, Page 3

> Based on personal observation of the area by this reviewer, namely, the low lying mud flats which are adjacent to the harbor and the Aerovox/AVX facility as well as the surrounding property, it is my opinion that few persons of the kind described by the RA as being at particular risk are likely to be attracted to the sediments in this area for any legitimate or recreational purpose.

DCN #6, Page 10

> The most contaminated material in the harbor is said to be the sediment and mud located in the northern part of the harbor. The highest degree of contamination is most frequently underwater and unlikely to be accessible to children, large or small. Access to this area is highly limited and the postulated significant contact with highly contaminated materials is <u>not</u> likely to occur at the levels or with the frequency listed in the RA.

DCN #31, Page 3-7

> When the results of Table 2.1 are compared with sediment concentrations of PCBs used in the risk assessment (risk assessment Table 2-5), it appears that the concentrations of PCBs in sediments at locations at which periodic exposure can be expected have been greatly inflated in the risk assessment.

DCN #31, Page 3-23

> The amount of soil or sediment clinging to skin per day is known as the deposition rate. With only a substantive notation that sediments might adhere to skin more than soils, Ebasco chose an upper range value 3 times higher (1.5 mg/cm) than the EPA's conventionally acceptable default value (0.5 mg/cm), which is supposed to be applied in lieu of more adequate information.

DCN #31, Page 3-14

> Considering the length of time that field work has been performed by EPA at this site, field observations of activity patterns at the actual exposure points should be available. The selection of Marsh and Palmer Islands as potential exposure points is inadequately supported.

DCN #31, Page 3-21

The risk assessment uses the unreasonable assumption that young children will be exposed to sediments at the more limited access areas of the harbor (Marsh, Popes, and Palmer Islands) which do not have public beaches as often as they would be exposed at the public beaches. (Forts Rodman and Phoenix), 20 to 100 times per year (Table 2-6).

EPA RESPONSE 3.2.2

The direct contact exposure scenarios were based on the observations about the land use around the study area and results from the study titled "The damages to Recreational Activities from PCBs in the New Bedford Harbor," prepared by the University of Maryland for NOAA. This study indicates that the local population uses beaches along Areas II and III. However, access to Area I is not totally restricted and a subsection of this area is located next to a playground. Therefore, it is reasonable that exposure could potentially occur in this area. Acknowledging the fact that the frequency of exposure to this area may be less than in the beach area, the RA assumed a lower frequency of exposure.

EPA recognizes that some of the exposure scenarios developed for the direct contact route for the Hot Spot were conservative. However, EPA has examined a less conservative exposure scenario which is mentioned in Section VI.C of the Record of Decision. Based on this assessment, EPA concludes that significant public health risks still exist.

Moreover, the approach used to develop the RA scenarios is consistent with EPA policy as stated in SPHEM:

The Superfund risk assessment process is based on concern for both individual risk and risk to exposed populations. One exposure point that should be evaluated for a pathway is the geographic point of highest individual exposure for a given release source/ transport medium combination (i.e., the geographic location where human inhabitants are exposed to the highest predicted chemical concentrations). Exposure points with lower predicted chemical concentrations and large potentially exposed populations should also be evaluated.

EPA evaluated direct contact and incidental ingestion exposure to sediments since Marsh, Palmer and Popes Island are locations within the study area that are easily accessible and since adults, older children and young children have been observed in these areas. The exposure frequencies assumed for these areas (20 and 100 times per year) correspond to 1 and 5 exposures per week for the six months when outdoor activities are likely to occur. Based on the land use at these locations, these exposure frequencies were considered appropriate.

3.2.3 Incidental Ingestion

DCN #6, Page 11

Controversy exists over the degree to which young and older children ingest sediments, dirt and other materials in their home and play environment. The RA goes to secondary sources to choose an applicable value for "pica" type dirt and sediment exposure. The value used, 0.5 g per exposure, developed by LaGoy in 1987, is still considered by some to be excessively large. Recent EPA guidance indicates that 200 mg per day may be an acceptable estimate. The stated value may be more appropriate for household dust and backyard dirt but is less likely to be true for soils, sediment or mud derived from hydrated soils found in New Bedford Harbor. The true value is likely to be less than 500 mg in any case.

DCN #6, Page 20

Among the spread sheets provided by the EPA and E.C. Jordan, Table C-101 (which does not appear as a separate table in the RA) purports to correctly calculate the risk from daily ingestion of sediment by a child. This table includes a "most probable" and "realistic worst" case scenario. Both of these are wrong and over stated. The area considered is the cove area and the values chosen for the combined estimate, namely sediment ingestion and contact, are likely to overestimate risk by a factor in excess of 25,000.

DCN #31, Page 3-22

A sediment ingestion rate of 500 mg/day was selected for young children (ages 1-6) despite the fact that EPA Guidance (1989) recommends the use of 200 mg/day (page 2-26). Use of a sediment ingestion rate more than double EPA's own recommended rate is counter to EPA's Guidelines for Exposure Assessment's recommendation of realistic, not worst-case estimates.

EPA RESPONSE 3.2.3

As stated in the Risk Assessment text (Page 2-26):

A review of the literature indicated that between 100 to 500 mg of sediment per exposure is a reasonable estimate for sediment ingestion by children less than 5 years old (LaGoy, 1987). Recent EPA guidance suggests an ingestion rate of 200 mg/day be applied to exposures concerning children between the ages of 2-6 years (EPA, 1989). This risk assessment was conducted prior to release of this guidance, and a value of 500 mg/exposure was assumed as the amount of sediment ingested. This is the upper end of the range of estimated values and will provide a conservative estimate of exposure.

However, in response to the comments which it received on incidental ingestion, EPA decided not to include incidental ingestion in the less conservative exposure scenario used in the Record of Decision. Nonetheless, EPA does not consider it appropriate to alter its conclusion that significant public health risks exist.

EPA will evaluate various ingestion rates during the development of target clean-up levels for the second operable unit.

3.2.4 Ingestion of Lobster Hepatopancreas (Tomalley)

DCN #6, Page 12

The magnitude of the derived risk for the ingestion route of exposure is driven by the inclusion of tomalley (lobster hepatopancreas) with its concentration of PCB content (Pruell, et al. 1988). The deletion of this factor or modification of the estimated uptake from this source would result in a reduction in exposure in children and adults by at least a factor of 6.2. If the tomalley is not considered, then lobsters taken from Area III would meet the applicable FDA guideline. Even a lobster taken from Area I would meet the FDA criteria if whole body PCB concentrations are determined (1131.4 ppb or 1.13 ppm in a large lobster taken from Area I, according to Hillman, et al. 1987).

DCN #15, Page 5-8

Analyses of lobster tomalley (liver) reported higher PCB concentrations than in lobster muscle. If lobster tomalley were not considered edible, lobster caught from throughout the New Bedford Harbor area would also contain less PCB than the USFDA permissible level. If lobster tomalley is considered edible only lobster from areas one and two, as shown on Figure 5-1 would exceed USFDA PCB levels (Ebasco, 1989).

EPA RESPONSE 3.2.4

The Greater New Bedford PCB Health Effects Study indicates that 42 percent of people who eat lobster also consume the tomalley. Since PCBs tend to bioaccumulate at higher concentrations within the tomalley, conservative estimates of exposure need to include all edible portions of the lobster. Inclusion of the tomalley is consistent with the FDA guideline for the analysis of the edible tissue portion of lobster.

The FDA's position is based on the fact that once a lobster is placed in commerce, the consumer has no way to identify its source. The FDA regards the exclusion of the tomalley from its standards an impracticable idea which would not adequately protect the consumer.

However, the FDA's limit is not solely health-based. EPA views this fact as significant. The FDA considered, as required by statute, factors such as the economic impact likely to be experienced by affected members of the food industry in establishing tolerance levels. In addition, in defining its standards, the FDA used consumption levels based on national per capita rates. EPA believes consumption levels in New Bedford Harbor are likely to be differ, based in part, on the Greater New Bedford PCB Health Effects Study and New Bedford's proximity to the coast.

The laboratories of the Commonwealth of Massachusetts, under the guidance of FDA's Regional Laboratory, have included the tomalley in all their lobster analyses from 1981 through 1986 (Table 2-8 of the RA). The results of the analyses have consistently detected exceedances of the FDA 2 ppm tolerance limit in portions of Buzzards Bay. These areas include Areas II and III of the DPH fishing closure areas. EPA's analyses of lobsters from these areas collected in 1987 also found exceedances of the 2 ppm limit. Analytical results of the 1984 and 1985 sampling conducted by Battelle showed somewhat lower levels (Hillman, 1987). However, the analyses was not performed using the FDA method, and the tomalley was not included. EPA has calculated the edible portion concentrations using the methodology presented on page 2-31 of the Baseline Risk Assessment for the DPH fishing closure areas. The results for Areas I and II are in excess of the FDA limit, 7.6 ppm and 2.3 ppm PCB respectively, while Area III is below the limit at 1.43 ppm.

A full evaluation of a goal for protection of public health will be completed within the second operable unit feasibility study.

3.2.5 Consumption of Seafood

DCN #6, Page 20

> The issue of exaggerated fish consumption patterns by adults and children, the specific fish availability with its degree of contamination and the calculation from this set of assumptions that there now exists an increased risk of cancer as a result leads the RA to conclude that a substantial cancer risk does exist from this exposure pathway. However, in the opinion of this reviewer, the evidence accumulated to date on this subject is far from conclusive.

DCN #8, Page 9

> Some very absurd assumptions are made about the quantity of local seafood eaten. "These values were decided after a review of the literature failed to provide a site-specific value applicable to recreational consumption of fish and shellfish." Yet a great deal of literature exists which indicate that fish consumption by adults is between 6-14 g/day divided between locally caught and commercial products. However, EBASCO decided to use 227 g on a daily basis as one assumption.

DCN #31, Page 3-25

> No evidence was presented in the risk assessment to support the contention that an individual could or would reasonably catch all of their dietary seafood from the estuary or upper harbor. In the absence of a supporting discussion, the EPA should have used a dietary mixing factor (EPA 1989) to account for a reasonable portion of the seafood diet that would be expected to be acquired in the estuary or upper harbor.... As discussed in the Greater New Bedford Health Effects Study, only about 15% of the local population reported eating seafood two or more times per week. Thus, average consumption could reasonably be estimated to be about one meal per week. Assuming that a single serving of seafood is about 114 g (PTI 1987), average consumption could be about 20 g/day, which is also the default value recommended by MDEQE (1989). EPA (1989) presents average seafood consumption rates of 6.5 to 37 g/day. The risk assessment used a typical consumption rate of one 227 gram meal of fish per week, equivalent to a daily rate of 32 grams/day.

EPA RESPONSE 3.2.5

Since there is no widely accepted value for recreational fish and shellfish consumption, EPA chose to use 8 ounces (i.e., 227 grams) as a standard value for each fish meal, and vary the number of fish meals consumed per year to provide a range of exposure frequencies.

The use of 227 grams/meal corresponds to the following average daily intake values:

227 grams/meal - monthly consumption = 7.5 g fish/day
227 grams/meal - weekly consumption = 32 g fish/day
227 grams/meal - daily consumption = 227 g fish/day

EPA considers this range of consumption values appropriate for this site as this value reflects the range of values cited in the literature. Although EPA recommends the use of the average value of 6.5 g fish/day, the Superfund Public Health Evaluation Manual (SPHEM) also states that "...higher than average fish consumption may be important for some sites where surface water contamination is a problem."

Consumption values cited in the literature range from 6.5 g fish/day used by EPA in its Ambient Water Quality Criteria to 18.7 g fish/day cited by Cordel, et al. (1978). (These values correspond to 10.5 and 30 8-ounce fish meals per year, respectively.) The Environ (1985) report discusses the limitations of these values and recommends using 14 g fish/day (22.5 8-ounce fish meals per year) as a reasonable average daily fish consumption by freshwater recreational fishermen.

The frequency with which children eat lobster in New Bedford Harbor is not available although the Greater New Bedford Health Effects Study does report that individuals consume locally caught seafood. There is no data to indicate that children do not eat lobster. In the absence of scientific data and in accordance with EPA's Guidelines of 1986, EPA has made the conservative assumption that children might eat lobster.

3.2.6 Uncertainty Analysis

DCN #31, Page 3-2

Each of the assumptions used in a risk assessment is more or less uncertain and therefore introduces uncertainty into the final estimates of risk. The New Bedford Harbor risk assessment fails to adequately characterize the orders of magnitude of uncertainty in the estimates of risk presented by the hot spot operable unit. The discussions of risk in the risk assessment and the HSFS imply a severe and present danger to public health and fail to acknowledge that estimated risks are based on the assumed conditions of arbitrary exposure scenarios that apply only to a hypothetical population, not real people who live and work in the City of New Bedford. The exposures were derived from conservative assumptions that greatly overestimate actual exposures of the local population.

DCN #31, Page 3-10

Demographic and land-use data that are presented in Chapter 2 are for the entire Greater New Bedford area, and are inadequate to characterize activities that may occur at a discrete location.

EPA RESPONSE 3.2.6

The RA states that the exposure scenarios evaluated are for the "hypothetical" individual under the specified exposure conditions (Page 2-18):

> These scenarios do not predict the number of people who may be exposed to contaminants in the Greater New Bedford Area, but rather provide an estimate of the magnitude of exposure that could be incurred by an individual receptor under specified exposure conditions.

The uncertainties associated with estimating exposure result from quantifying parameters that are not directly observed (e.g., frequency and duration of exposure). Because some of these parameters are functions of the behavior patterns and personal habits of the exposed populations, no one value can be assumed representative of all possible exposure conditions. To account for some of this variation, exposure scenarios were developed based on a range of exposure frequencies and durations. For some exposure scenarios, the range of exposure parameters spans two orders of magnitude. EPA assumed that the actual exposure encountered by any individual receiving exposure would fall within this range.

There are also uncertainties associated with assigning quantitative values to exposure parameters, such as body weight, ventilation rate, surface areas, and absorption or toxicokinetic factors (TKFs). The parameters used in the RA exposure assessment were based on literature values and professional judgement. Therefore, they may not be representative of each and every individual in the New Bedford Harbor area. However, EPA does not consider the parameters as misleading, and believes the exposure scenarios represent realistic probabilities for the New Bedford population. Moreover, any uncertainties associated with assigning values to these parameters are estimated to be less than one order of magnitude.

3.2.7 Airborne Route of Exposure

DCN #31, Page 3-8

The risk assessment inappropriately characterized ambient air concentrations of PCBs. Only limited air data were available to assess risks associated with inhalation exposure to PCBs. As a result PCB concentrations in air above the mudflats in the estuary were used to characterize ambient air concentrations at other locations in the New Bedford area. The risk assessment acknowledges the inappropriateness of this approach (pp. 2-34 and 4-50), yet posits estimates of potential risks using the mudflat ambient air data nonetheless.

EPA RESPONSE 3.2.7

The Baseline Risk Assessment did evaluate the potential risks associated with exposure to airborne PCBs. The PCB value used in this assessment was 10 ng/m^3. This background value represents observations from several studies in the New Bedford area. The results of assessment indicated a lifetime potential risk of 8×10^{-6}, assuming a 70-year exposure duration. This value is at the low end of EPA's target range.

3.2.8 Dermal Absorption of PCBs

DCN #31, Page 3-30

The risk assessment uses the assumption that PCBs are expected to be dermally absorbed from soil in a manner similar to that of 2,3,7,8-TCDD because no studies of the absorption of PCBs from soil were available (Appendix B). An absorption factor of 5% of the applied dose was used to evaluate dermal absorption of PCBs from sediments. Poiger and Schlatter (1980) measured dermal absorption of 2,3,7,8-TCDD from soil applied to rat skin to be 0.05 to 2.2% of the applied dose (recalculated as 0.07 to 3% by EPA 1984a). Shu, et al. (1988) measured dermal absorption of TCDD in soil applied to the skin of rats that was 1% of the applied dose. Measurements of dermal absorption obtained from rat skin are likely to overestimate human exposure, however. The skin of the rat is highly permeable when compared to human skin (Wester and Maibach 1980, EPA 1984). For example, the dermal absorption of hexachlorophene, a compound structurally similar to PCBs, was reported to be 76% of the applied dose in rats (Chow, et al. 1978) and only 3% in humans (Feldmann and Maibach 1970).

The dermal absorption of PCBs in sediments thus does not appear to be plausibly estimated in the risk assessment. EPA (1988) used a dermal absorption factor of 0.5% of the applied dose for TCDD, an order of magnitude less than the value of 5% used in the risk assessment.

EPA RESPONSE 3.2.8

The EPA Baseline Risk Assessment for New Bedford Harbor derived the toxicokinetic factors using the latest data available on absorption factors for PCBs. For dermal absorption, specifically, a value of 5% is the absorption factor recommended in the EPA document titled "Development of Advisory Levels for PCB Cleanup," dated May 1986. EPA then adjusts the absorption factor to account for the fact that the risk estimates are based on administered dose rather than absorbed dose.

3.2.9 General Comments on Exposure Parameters

DCN #31, Page 3-16

EPA ignored its own guidelines in performing the exposure assessment and instead manufactured potential risks by linking together a series of implausible worst-case exposure assumptions.

EPA RESPONSE 3.2.9

The majority of comments pertaining to the RA deny the validity of the assumptions used to quantify the potential exposure contaminants incurred at this site. EPA generated additional risk estimates based on the exposure parameters recommended by the reviewers. These risk estimates support the conclusions of the RA and establish the need for clean-up at this site. It should be emphasized that EPA does not recommend the use of all these exposure assumptions. These reviewer risk assumptions include:

Direct Contact and Incidental Ingestion of Sediment - Area I

- Exposure by older child
- 40 kg body weight
- 0.5 mg/cm^2 - sediment deposition factor (versus 1.5 mg/cm^2)

- 4,400 cm^2 exposed surface area (total of 2.2 gm contacted vs. 6.6 gm)
- Exposure to 700 ppm and 378 ppm
- 10 exposures per year (versus 20)
- 50 mg sediment ingested/exposure
- 5% and 0.5% dermal TKF (versus 7%)
- Use of 2.6 CPF (versus 7.7)

The risk estimates using the reviewers' risk assumptions are presented in Tables 3-1 and 3-2 at the end of this section.

Exposure to 378 and 700 ppm PCBs results in incremental carcinogenic risks ranging from $6x10^{-6}$ to $8x10^{-5}$. These risk estimates are based on lower values than those recommended by EPA. However, even under these conditions, the risk estimates exceed the Massachusetts DEP total site carcinogenic risk level of $1x10^{-5}$. Since these risk estimates are for a single route of exposure, they do not represent the total site risk.

EPA also calculated risks associated with the ingestion of biota based on revised exposure conditions. These revised exposure conditions include:

- exposure by older child
- 40 kg body weight
- Ingestion of 6.5 grams fish/day
- 1 ppm PCB concentration in edible tissue
- 100% TKF
- CPF of 2.6 and 7.7

These risk estimates are presented in Table 3-3 at the end of this section. Risk estimates based on these exposure conditions range from $6x10^{-5}$ to $2x10^{-4}$. These values exceed the Massachusetts DEP total site carcinogenic risk level of $1x10^{-5}$.

Combined risks from direct contact and ingestion of biota for an older child range from $6.5x10^{-5}$ (exposure to sediment at 378 ppm PCB and ingestion of 6.5 grams fish/day at 1 ppm PCB and a CPF of 2.6) to $2.6x1^{-4}$ [exposure to sediment at 700 ppm PCB and ingestion of 6.5 grams fish/day at 1 ppm PCB and CPF of 7.7 $(mg/kg\text{-}day)^{-1}$]. These risk estimates exceed Massachusetts DEP risk level of $1x10^{-5}$ and fall within and exceed EPA's target range of 10^{-4} to 10^{-7}. These revised risk estimates support the need for remediation at the Site.

Exposure and Risk Assessment is a developing science (SEAM, 1988). New information is being identified to assist in providing more accurate estimates of risk at Superfund sites. EPA intends to continue to revise its exposure and risk assessment methodology whenever scientific advances indicate that doing so is appropriate.

3.3 TOXICITY OF PCBs

3.3.1 PCB Epidemiological Studies

DCN #26, Page 4

ATSDR should change its inconsistent discussion of the clinical studies of capacitor workers. As stated by Smith and others, none of published occupational or epidemiologic studies has demonstrated any adverse health effects in humans exposed to high levels of PCBs except for a reversible skin condition, chloracne.

EPA RESPONSE 3.3.1

This comment is taken out of context from "Metabolic and Health Consequences of Occupational Exposure to PCBs", Smith et al. (1982). In the same paragraph where this sentence appears, the authors discuss possible theories explaining why, in 1982, there appeared to be few studies demonstrating unequivocal and clinically observable adverse health effects in humans exposed to PCBs. The authors state:

This inability to show convincingly an adverse effect on human health from occupational exposure to PCBs may be partially attributable to the often encountered confusion of multiple chemical exposures in the workplace or in the general environment, which either directly or in combination, influence the health of exposed individuals. It is necessary to recognize, however, that clinical and epidemiological methods generally are not available that are sufficiently sensitive and specific to allow a high degree of confidence that, when no significant individual or group effects have been found, an adverse health effect still has not been overlooked.

When viewed within the context of the entire paragraph, the statement is less categorical and precise, and does not support the commenter's position at all. More recent epidemiology studies suggest an increased risk of liver cancer and/or leukemia from exposure to PCBs. Two of these studies are occupational. All of them were published after the Smith, et al. (1982) study. Those studies include: Amano et al (1984), Kuratsume (1989), and Bertazzi, et al., (1987) and are discussed below.

For polychlorinated biphenyls, the epidemiologic evidence is currently viewed by EPA's Office of Health Exposure

Assessment (OHEA) as "inadequate" according to EPA criteria. However, OHEA has supplemented this conclusion with a comment stating that the available date are "suggestive". The International Agency for Research on Cancer (IARC) classified the evidence as "limited" based on the studies by Brown (1987) and Bertazzi, et al. (1987). Yet, a third published study by Amano, et al. (1984), and an unpublished follow-up of that study by Kuratsume (1986) also demonstrated a statistically significant excess risk of liver cancer in males as well as an excess risk of liver cancer in females who accidentally consumed rice oil contaminated with PCBs some seventeen years earlier in Japan. This rice oil was also contaminated with polychlorinated or monochlorinated dibenzofurans (PCDFs or CDFs) in the ratio of approximately 200 molecules of PCB to 1 molecule of PCDF. However, the portion of risk attributable to the furans separately, or to the PCBs separately, or to both in combination cannot be determined.

The conclusions of Bertazzi, et al., are noteworthy. "Interpretation of the results is limited by the small number of deaths; however, the point of interest is the consistency of these results with previous experimental and epidemiologic studies, which indicated the GI tract and lymphatic and hemopoietic tissue as the most probable target sites of the PCB carcinogenic activity."

Brown (1987) concludes "A statistically significant excess in deaths was observed in the disease category that includes cancer of the liver (primary and unspecified), gall bladder, and biliary tract (5 obs. vs. 1.9 exp.; Page 05)....Due to the small number of deaths and the variability of specific cause of death within this category, it remains difficult to interpret these findings in regard to PCB exposure." Brown notes that no deaths occurred prior to 15 years from first employment and that the deceased began working during a time period when levels of exposure were probably the highest and when the higher chlorinated PCB mixtures were being used. Clearly, Brown views the question of how much exposure as an uncertainty. Neither OHEA nor Brown make the case that there is a clear-cut and definite conclusion from this data.

In both the Brown and Bertazzi studies as well as the additional cited references (Zack and Musch, 1979; Gustavsson, et al., 1987), the authors make it clear that because of the small sizes of the cohorts and small number of deaths observed, it was impossible to assess either latent effects or a possible dose-response relationship.

The ultimate conclusion reached by EPA epidemiologists from an evaluation of the available epidemiologic evidence is that there is a suggestion of significantly increased risk of cancer of the liver and biliary tract in persons who are exposed to PCBs contaminated with PCDFs across several human cohort studies. From an exposure point of view, it is not clear which group of isomers or parent compounds might be responsible for the excess risk. Because of these limitations and those alluded to by the authors, OHEA has concluded that the sum total of the evidence does not measure up to the criteria for either "sufficient" or "limited" positive evidence. However, the consistently reported elevated risk of liver cancer in three studies cannot be dismissed.

It should be noted that the OHEA conclusion that PCBs pose a "probable" hazard to humans does not hinge on the interpretation of the human data alone. Rather, it is supported by experimental data as well. This is consistent with the scheme for classifying carcinogens in the published EPA guidelines.

Although not specifically discussed in the PRP comments, the issue of whether PCBs can cause reproductive and/or developmental adverse effects in animals is addressed in this paragraph. The authors of one report summarized epidemiological evidence on health effects other than cancer that may be associated with exposure to PCBs. While EPA agrees that the human data base is limited, the laboratory animal data base supports the conclusion that PCBs are reproductive and developmental toxicants. Exposure in animals at levels of 0.01-1 mg/kg/day has been associated with alterations in reproductive and developmental end points, depending on species of Aroclor, animal species, exposure period and route, and end points examined. Reported effects include: reduced litter size and viability, and altered growth. Slightly higher levels were associated with reduced thyroid function.

3.3.2 DIFFERENCES IN POTENCY AMONG DIFFERENT PCB MIXTURES

DCN #8, Page 1

The carcinogenicity potency factor used by EPA already has many conservative assumptions built in some of which are listed below:

1. Benign and malignant tumors are counted as cancer.
2. High to low dose extrapolation is done using the most conservative model available.
3. Surface area instead of weight is used for species to species conversion.
4. No threshold dose is used although there is ample evidence that PCBs act by an epigenetic mechanism.

5. All PCBs mixtures are treated as though they are Aroclor 1260. Studies have shown that lower chlorinated PCBs are less potent or do not cause cancer at the doses tested.

This review is confined to the PCB section in this toxicological evaluation. The authors have given a very unbalanced view of the literature. In many instances, only the studies reporting a PCB-related finding have been included without presenting other studies that have looked for but not found such effects. Specific criticisms are given in the following paragraphs.

DCN #15, Page 5-5

In summary, the Terra evaluation concludes that there is no evidence of carcinogenicity of 42% chlorine PCB mixtures (Aroclor 1016, Aroclor 1242) in animals or humans. The report further concludes that there is no evidence for the carcinogenicity of 54% chlorine PCB mixtures (Aroclor 1254) is equivocal and of questionable relevance to man. Although the report concludes that there is evidence for the carcinogenicity of 60% chlorine PCB mixtures (Aroclor 1260) in animals, several aspects of the animal bioassay results indicate that these studies also have limited relevance to humans. The Terra report concludes that there is inadequate evidence to show an association between PCB exposure and cancer in humans (Terra, 1989).

DCN #31, Page 3-3

The risk assessment characterized concentrations of PCB mixtures in sediments from New Bedford Harbor as total PCBs and improperly evaluated their risk as though all the PCBs were Aroclor 1260. Characterizing all PCBs as one entity is misleading because the PCB mixtures in the sediments vary in composition (i.e., extent of chlorination) and the toxicity of different commercial PCB mixtures varies widely (see Section 4).

DCN #31, Page 3-31

This model has been re-evaluated at the request of EPA by the person who devised it, and among the conclusions of this two-year study (Allen, et al., 1987) are that the EPA Cancer Potency Factor of 7.7 mg/kg/day should be closer to 0.61 mg/dg/day, and that EPA's use of the former CPF, in combination with other scientifically invalid methodologies, i.e., surface area conversations between species, overstate risk 12 fold. Use of the 0.61 mg/kg/day, and that EPA's use of the former CPF, in combination with other scientifically invalid methodologies, i.e., surface area conversions between species, overstate risk 12 fold.

DCN #31, Page 3-34

EPA (1989) states, "Although it is known that PCB congeners vary greatly as to their potency biological effects, for purposes of ...carcinogenicity assessment Aroclor 1260 is intended to be representative of all PCB mixtures." There is no scientific support for this generalization.

DCN #31, Page 3-44

A cancer potency value for Aroclor 1260 was used to characterize potential risks posed by exposure to sediments. As discussed earlier in Section 2.2, the congener analysis of PCB residues in seafood that was presented to justify the use of the potency factor for Aroclor 1260 is not applicable to sediments. The sediment residues have not been subjected to the same pharmacokinetic influences as the seafood residues. The extensive use of lower chlorinated Aroclors in the New Bedford Manufacturing community makes the presence of less-chlorinated residues even more likely. Use of a cancer potency for Aroclor 1260 to characterize upper bound excess cancer risks posed by sediments is inappropriate, coupled with incorrect and inflated estimates of cancer potency leading to exaggerated estimates of cancer risk (larger probability values than likely to be true).

EPA RESPONSE 3.3.2

The currently available cancer bioassay data on five commercial PCBs, i.e., Aroclor 1260, Kanechlor 500, Aroclor 1254, Clophen A-60 and Clophen A-30, while providing positive carcinogenic evidence in experimental animals do not help to resolve the uncertainty about the mixtures. These five PCB tested mixtures contain variable quantities of various PCB congeners, including both lower and higher chlorinated biphenyls. Most of the positive bioassays are representative of higher chlorination mixtures with the exception of Clophen 30. The chlorination composition of Clophen A-30 (chlorine content of 41.3%) contains a higher percentage of lower chlorinated biphenyl. While one could observe that the higher chlorinated biphenyl mixtures induced carcinogenicity and Clophen A-30 which contains a higher percentage of lower chlorinated congeners also induced a carcinogenic response, any qualitative inference about the potential for human carcinogenic activity based solely on these observations is weak.

OHEA's risk assessment view is that, as a default choice, all PCB mixtures have a slope factor no higher than or equivalent to Aroclor 1260. The upper bound slope factor for Aroclor 1260 is 7.7 and is based on the rat study by Norback and Weltman.

OHEA, and more recently the EPA Risk Assessment Forum, has been actively investigating the technical feasibility of developing a congener-specific approach, perhaps using a toxic equivalency factor (TEF) basis, for assessing cancer and non-cancer risks from exposure to PCBs. As a feasibility study has not yet been released, it is not likely that such an endeavor will provide a completed TEF approach in the near future.

3.3.3 INITIATION VERSUS PROMOTION

DCN #38, Page II-35

Many animal studies report both a cancer promoting ability of PCBs and a cancer inhibiting ability.

EPA RESPONSE 3.3.3

The EPA's current guidance that addresses mechanisms of carcinogenesis is found in the Federal Register, Vol. 51 (33992-34003). "Agents that are positive in long-term animal experiments and also show evidence of promoting or cocarcinogenic activity in specialized tests should be considered as complete carcinogens unless there is evidence to the contrary because it is difficult to determine whether an agent is only a promoting or cocarcinogenic agent. Agents that show positive results in special tests for initiation, promotion, or cocarcinogenicity and no indication of tumor response in well-conducted and well-designed long-term animal studies should be dealt with on an individual basis."

In many laboratory animal experiments, exposure to PCBs have resulted in carcinogenesis. However, in other animal experiments, some tumor inhibition was noted. This tumor inhibition is likely to be related to enzyme inductions. The enzymes induced range from those that are involved in metabolis of PCBs themselves to others that have been implicated as activators and inactivators of other procarcinogens or carcinogens, respectively (cytochrome P-450 and P-448 associated monooxygenase system). The mixed nature of the PCBs would be reflected in mixed enzyme induction, some of which would be capable of exerting the inhibitory effect and some of which would exert the promoting effect. The tumor inhibiting ability of PCBs may be dose and congener related, but it has not consistently been observed, even in relatively similar experimental studies.

3.4 RISK EVALUATION

DCN #31, Page 3-37

The risk assessment calculates a hazard index to estimate the likelihood of adverse noncarcinogenic effects by adding together the relative risks associated with lead, copper, cadmium, and PCBs to derive a total potential site risk. The statement is made on page 4-4 that hazard index values are calculated for exposure to the mixture "because these compounds have been shown to exert similar toxic effects". Similar statements are made on pages 4-7 and 4-26. Review of the bases for the criteria from which each of the toxicity values used to calculate the hazard indices were derived shows that the end points of toxicity of concern are very diverse indeed and in no way justify combination.

DCN #31, Page 3-38

Thus, the risk assessment fails to follow EPA guidance for performing risk assessments of noncancer effects by combining dissimilar end points of toxicity, substantially overestimating noncancer risk.

EPA RESPONSE 3.4

The risk estimates generated in the Baseline RA were derived according to guidance by EPA and Massachusetts Department of Environmental Protection. Chronic Daily Intake/Reference Dose (CDI/RfD) values were calculated separately for each compound in addition to being summed for each exposure scenario to provide a total Hazard Index (HI) value. The risk assessment states the uncertainties associated with developing these HI values and interpreted these results accordingly. The total CDI/RfD value was used to support conclusions regarding the potential adverse effects associated with exposure to a single contaminant. Potential risks were first evaluated using the single-contaminant value. If this value exceeded 1, further evaluation was performed using the total HI.

The quantitative risk estimates were evaluated against the criteria set forth in the SPHEM and DEP's Contingency Plan. The State of Massachusetts has clearly defined values for determining the need for remediation of an uncontrolled hazardous waste site. These are total site incremental risks of 10^{-5} and noncarcinogenic HI of 0.2. These values, in addition to EPA's target incremental carcinogenic range of 10^{-4} to 10^{-7} and noncarcinogenic HI=1, were used to identify contaminants and/or routes of exposure which were associated with public health risks.

3.5 GREATER NEW BEDFORD HEALTH EFFECTS STUDY

DCN #31, Page 3-45

> Other evidence of the risk assessment's excessively overestimated risk comes from the Greater New Bedford Health Effects Study (GNBHES), which was conducted as a result of the concern about PCB contamination in New Bedford Harbor to determine the prevalence of elevated serum PCB levels in the Greater New Bedford population. CDC has estimated that 99% of unexposed persons in the U.S. have serum PCB levels less than 30 ppb; for the GNBHES, levels above 30 ppb were assumed to represent elevated levels. Of the 840 individuals examined, only 11 (1.3%) had levels above 30 ppb. On the basis of these results, a second study was conducted to evaluate the serum PCB levels of residents who were thought to be at high risk of exposure due to their relatively high levels of ingestion of seafood from contaminated areas.

DCN #15, Page 5-3

> Although this epidemiological study concluded that Greater New Bedford area residents do not have significant environmental exposure from PCBs, EPA undertook a baseline risk assessment (Ebasco, 1989) which involved the use of theoretical exposure and toxicological models.

DCN #6, Page 22

> The GNBHES found little evidence of excessive exposure to PCBs (as evidenced by elevated PCB blood levels) and the population appeared no different from other US populations with much less likelihood of PCB exposure.

EPA RESPONSE 3.5

The exposure scenarios developed in the Risk Assessment are not intended to predict the actual number of individuals exposed to PCBs. The scenarios are intended to reflect the possible exposures received by hypothetical individuals in order to assess risks posed by the Site. The Greater New Bedford Health Effects Study (GNBHES) had an entirely different purpose. The primary focus of the GNBHES was to determine the prevalence of serum PCB levels among residents of the Greater New Bedford area. However, the GNBHES does show that individuals who eat locally caught seafood have elevated PCB serum levels. Thus, contrary to the assertions in the comments, the exposure scenarios appear to be valid. The following is a summary of the GNBHES.

The prevalence rates presented in the final report of the GNBHES (i.e., 1.3% had serum PCB levels greater than 30 ppb and 2.7% had serum PCB levels greater than 20 ppb) demonstrate that the general population has not suffered unusual exposure simply as a result of living in close proximity to an area that has suffered serious environmental contamination. These rates do not imply what the health effects of consumption of locally caught contaminated seafood are on the general population (i.e., on serum PCB levels).

Additionally, the Massachusetts Department of Public Health (DPH) conducted an enrichment study (ES) to identify individuals who were likely to be exposed to PCBs via consumption of contaminated seafood or occupational exposure and hence to identify an exposed population necessary for proceeding to Phase II of the Health Effects Study. While eligibility criteria included both routes of exposure, the majority of these individuals were selected on the basis of seafood eating habits. The primary objective of the ES was to identify an exposed population. However, it is possible through further evaluation of the data, the role that contaminated seafood consumption plays with respect to serum PCB level may be delineated.

To accurately assess the contribution of seafood consumption solely, it is necessary to eliminate those individuals reporting occupational exposure to PCBs in both the enrichment and prevalence samples. To address concerns that age is responsible for any difference in serum PCB level between the two samples, it is equally important to eliminate those prevalence participants who do not meet the age criteria for inclusion in the enrichment study.

Listed below are the major observations from this study regarding the relationship between eating locally caught contaminated seafood and serum PCB levels. (The figures and tables referred to in this response are presented at the end of this Section of the Responsiveness Summary.)

1. Those individuals who more likely ate contaminated seafood (enrichment sample) presented higher serum PCB levels than individuals who were less likely to eat contaminated seafood (prevalence sample). These results are shown in Table 3.4.

2. The relationship described above in #1 was consistently observed for each age group represented. These results are shown in Figure 3.1.

3. Additionally, this pattern remained when the individuals with possible occupational exposure to PCBs were removed from the analysis. These results are shown in Figure 3.2.

4. The serum PCB level in those most likely to have eaten contaminated seafood (enrichment sample) did not vary greatly as age increased. Serum PCB levels, however, did vary somewhat as age increased for those who were less likely to have eaten locally caught contaminated seafood (prevalence sample). These results are shown in Figures 3.2 and 3.3.

5. When frequency of seafood consumption was evaluated, the serum PCB level was consistently higher in those who were more likely to have eaten locally caught contaminated seafood (enrichment sample) than those who likely did not eat as much (prevalence sample). This observation may be due to the earlier observation that the enrichment sample subjects usually had higher serum PCB levels than the prevalence sample subjects. Most importantly, though, is that for both the prevalence and enrichment sample subjects as seafood consumption increased, so did serum PCB levels. These (serum PCB) results are shown in Figure 3.4.

6. Analyses of frequency of consumption indicated that the serum PCB levels did not differ significantly with level of seafood consumption for the enrichment sample (the sample size is small for each consumption level). However, statistically significant results were observed in the prevalence sample. This analysis indicates that those who eat seafood once a week or twice a week had significantly higher serum PCB levels than those who ate seafood less than once a week or less than once a month. These results are shown in Table 3.5.

7. Further analyses on frequency of consumption suggest that this observation may be partly due to the effect of age, but not to the effect of occupational exposure. In other words, an individual's serum PCB level may be higher in individuals who ate more seafood but only in certain age groups. Table 3.6 shows that the differences in serum PCB level are no longer statistically significant when age is taken into consideration but that there are statistically significant differences between age groups. However, this explanation does not dismiss the likelihood that a relationship between consumption of locally caught contaminated seafood and serum PCB levels exists. Rather, this observation supports such a relationship,

particularly if the serum PCB level is higher among those who consume seafood at a greater frequency and if the serum PCB level increases as age increases. This result would imply that because of the higher frequency of consumption as age increases, serum PCB level may increase as a result of bioaccumulation. Figure 3.4 illustrates the relationship between serum PCB level and age, and frequency of consumption for the prevalence sample observed in this study. In almost all age groups, the serum PCB level is higher for those with a greater frequency of consumption. Furthermore, the general trend is for serum PCB levels to increase as age increases.

8. Figure 3.5 presents the prevalence sample serum PCB levels for those who consumed locally caught contaminated seafood versus general seafood type according to age. While the numbers are small for each age group, the same trend observed in the enrichment sample can be seen among those who ate locally caught contaminated seafood among the prevalence sample. Serum PCB levels are higher in every age group except the 18-24 group for the local seafood consumers compared to the general seafood consumers. The observations that:

    a. Serum PCB levels increased with age for the consumers of locally caught contaminated seafood (local group) in the prevalence sample,

    b. Serum PCB levels were higher in those with a higher frequency of seafood consumption for almost every age group, and

    c. Serum PCB levels were higher for each age group among those more likely to have consumed locally caught contaminated seafood

3.6 ECOLOGICAL RISK

3.6.1 ENVIRONMENTAL RISK ASSESSMENT

DCN #5, Page 2-3

The first paragraph of this section narrows the risk assessment merely to PCBs, ignoring the documented occurrence in the Hot Spot area of extremely high concentrations of toxic heavy metals (Cadmium, Lead, Zinc, Nickel, Chromium, Copper, and Arsenic), the mobilization of which is certain under the favored remedial alternatives. Moreover, the risk assessment fails to deal with toxic organics such as PAHs, which also reside in the sediments that are scheduled to be disturbed.

DCN #5, Page 4

The first paragraph of this section refers to toxicity experiments conducted by Hansen in which amphipods and sheepshead minnows were exposed to sediment from areas I and II of the harbor. Note that the toxicities reported were the result of all of the materials in the sediments, not specifically to PCBs. The use of this information does not seem appropriate to a risk assessment that is confined (3.2.1) to PCBs. Moreover, the species of amphipod (Ampelisca abdita) used by Hansen in his experiments was not found by the U.S. Army Corps of Engineers in its benthic study of New Bedford Harbor.

DCN #5, Page 10

The statement in paragraph 2, "Due to the extreme contamination present in Hot Spot surface sediment, benthic and demersal organisms are effectively precluded from living in the area", is clearly wrong. As we noted above, the USACE benthic study showed the Hot Spot region (their station 1) to have one of the highest densities of living organisms in the entire harbor. With this objection in place, the following sentence ("This loss of habitat is potentially significant...") in the same paragraph is meaningless. There has been no loss of habitat due to contamination of Hot Spot sediments. The first sentence of the second paragraph ("Ecological risks due to transport of PCBs from the Hot Spot sediment are a function (sic) of the amount of sediment exposed and the extent of contamination in the sediment") is a sweepingly simplistic one. Heavy metals are probably more toxic and present greater threats to the environment than PCBs.

3.6.1 EPA RESPONSE

The Hot Spot area of the Estuary stands out from other site areas because the area is grossly contaminated with PCBs. The level of heavy metal contamination in the Hot Spot is similar to other site areas. EPA recognizes that certain heavy metals can be acutely toxic to aquatic organisms, however, the potential for adverse effects to biota from chronic PCB exposure at this level is high. EPA is currently completing a baseline environmental risk assessment for the site that examines the potential baseline risks to biota from exposure to heavy metals.

The work completed by EPA (Hansen, 1986) demonstrated a correlation between differing PCB levels across the site and toxicity. While the toxicity is attributed to the sediments and not necessarily the PCBs, the correlation existed between differing PCB levels not to changes in other contaminated concentrations.

The results of the benthic survey demonstrated that at sampling station 1 the species diversification was small and the area contained organisms that typically inhabit environmentally stressed sediments.

3.6.2 BENTHIC SURVEY

DCN #5, Page 6

The sampling methodology used in the collection of benthic invertebrates appears to be so seriously flawed that the subsequent analysis and conclusions drawn are probably incorrect. The methods used here surely grossly underestimate the number of organisms found in the sediments above the Coggeshall Street bridge and probably also under estimate the number of infaunal species found there as well.

DCN #5, Page 9

Infaunal communities are responsive to physical and chemical features of their environments such as sediment type and structure and salinities in ways that have not been evaluated here. Indeed salinity was not even measured in this study. There are indications that taxonomic identifications may have been amiss. For example Havelockia scabra (reported here) is a rare, deep water holothuran (10-1200 m) and has never been reported before from Buzzards Bay or adjacent waters. It was probably confused with Sclerodactyla briareus (= Thyone). Odostomia seminuda does not seem to have been recognized as an epizooite living commonly with Crepidula.

EPA RESPONSE 3.6.2

EPA used procedures described in "Standard Methods" (1985) and "Soke and Rohlf" (1981) in conducting the benthic surveys. EPA believes these procedures are sound methodology. While sample size may not have been at optimum levels, the unequal sample size was corrected by using multi-regression analysis techniques.

EPA's studies show the Estuary sediment to be a sandy organic silt that generally increases in silt and organic content in a northerly direction. EPA has characterized the Acushnet River Estuary as a "weak" estuary. This characterization is based on EPA studies that report salinity measurements ranging from approximately 29 to 32 parts per thousand with weak vertical stratification.

EPA believes the Havelockia scabra located during this benthic survey may have been transported to this location by a number of possible mechanisms (e.g., falling off fishing gear, ocean currents, self locomotion, etc.). EPA believes the identification of the Odostomia seminuda to be correct based on the habitat and potential food sources (i.e., several species of bivalves) in the area.

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<u>Section 3 References</u>

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TABLE 3-1

pcb-378

New Bedford Harbor
Direct Contact with and/or Ingestion of Soil or Sediment
Carcinogenic Effects

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\text{Body Dose (mg/kg/day)} = \text{Soil Concentration (ug/g)} \times [(\text{Amount Contacted (g/event)} \times \text{Dermal TK Factor}) + (\text{Amount Ingested (g/event)} \times \text{Ingestion TK Factor})] \times$$

$$\frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{\text{70 years}} \times \frac{\text{1mg}}{\text{1000 ug}} \times \frac{\text{1 yr}}{\text{365 days}} \quad \text{1000 ug}$$

$$\text{Incremental Risk} = \text{Body Dose (mg/kg/day)} \times \text{CAG Potency Factor (mg/kg/day)}^{-1}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
PCBs	378	2.2	0.05	0.005	1.00	40	10	10.0	1.85E-06	4.07E-07	2.60E+00	5.87E-06
PCBs	378	2.2	0.05	0.05	1.00	40	10	10.0	1.85E-06	4.07E-06	2.60E+00	1.54E-05
PCBs	378	2.2	0.05	0.05	1.00	40	10	10.0	1.85E-06	4.07E-06	7.70E+00	4.56E-05
PCBs	378	2.2	0.05	0.005	1.00	40	10	10.0	1.85E-06	4.07E-07	7.70E+00	1.74E-05

TABLE 3-2

pcb-700

New Bedford Harbor
Direct Contact with and/or Ingestion of Soil or Sediment
Carcinogenic Effects

This table calculates estimated body doses and incremental carcinogenic risks.

The equations to calculate body dose level and incremental carcinogenic risks are:

$$\underset{(mg/kg/day)}{\text{Body Dose}} = \underset{(ug/g)}{\overset{\text{Soil}}{\text{Concentration}}} \times [(\underset{(g/event)}{\text{Amount Contacted}} \times \text{Dermal TK Factor}) + (\underset{(g/event)}{\text{Amount Ingested}} \times \text{Ingestion TK Factor})] \times$$

$$\frac{1}{\text{Body Weight (kg)}} \times \frac{\text{No. Events}}{\text{years}} \times \frac{\text{No. of years exposed}}{\text{70 years}} \times \frac{\text{1mg}}{\text{1000 ug}} \times \frac{\text{1 yr}}{\text{365 days}} \quad \text{1000 ug}$$

$$\text{Incremental Risk} = \underset{mg/kg/day}{\text{Body Dose}} \times \underset{(mg/kg/day)^{-1}}{\text{CAG Potency Factor}}$$

Compound	Concentration (ug/g)	Amount of Soil Contacted (g/event)	Amount of Soil Ingested (g/event)	Dermal TK Factor	Ingestion TK Factor	Body Weight (kg)	No. of Events per year	No. of Years Exposed	Ingestion Body Dose (mg/kg/day)	Direct Contact Body Dose (mg/kg/day)	CAG Potency Factor (mg/kg/day)^-1	Incremental Risk
PCBs	700.0000	2.2	0.05	0.005	1.00	40	10	10.0	3.42E-06	7.53E-07	2.60E+00	1.09E-05
PCBs	700.0000	2.2	0.05	0.05	1.00	40	10	10.0	3.42E-06	7.53E-06	2.60E+00	2.85E-05
PCBs	700.0000	2.2	0.05	0.05	1.00	40	10	10.0	3.42E-06	7.53E-06	7.70E+00	8.44E-05
PCBs	700.0000	2.2	0.05	0.005	1.00	40	10	10.0	3.42E-06	7.53E-07	7.70E+00	3.22E-05

TABLE 3-3

Incremental Carcinogenic Risks Associated with Ingestion of Fish

Compound	Concentration (mg/kg)	Amount of Fish Consumed (g/fish meal)	# meals year	# years exposed	Fraction Absorbed (TKF)	Body Weight (kg)	CAG Potency Estimate $(mg/kg/day)^{-1}$	Carcinogenic Risk Estimate
PCBs	1.00	227	12	10	1	40	2.6	6.93E-05
PCBs	1.00	227	12	10	1	40	7.7	2.05E-04
PCBs	1.00	6.5	365	10	1	40	2.6	6.04E-05
PCBs	1.00	6.5	365	10	1	40	7.7	1.79E-04

TABLE 3.4

Mean PCB levels by population sampled

	Prevalence Sample	Enrichment Sample
Mean	5.8	13.3

TABLE 3.5

Serum PCB levels by Frequency of Seafood Consumption
for Prevalence Sample

Frequency of Consumption	Mean PCB Level	Least Squares Means	F-Value	Probability
<1/Month	4.9	0.006		
<1/Week	5.2	0.006		
1/Week	6.4	0.23		
2/Week	7.4	-		
			3.77 (3df)	0.01

TABLE 3.6

PCB Level by Frequency of Seafood Consumption
for Prevalence Sample -
Age and Occupational Exposure Controlled

Frequency of Consumption	Mean PCB Level	Least Squares Means	F-Value	Probability
<1/month	4.9	0.16		
<1/Week	5.2	0.21		
1/Week	6.4	0.96		
2/Week	7.4			
			20.75	0.0001

FIGURE 3.1

Comparison of Prevalance and Enrichment PCB Levels by Age Groups

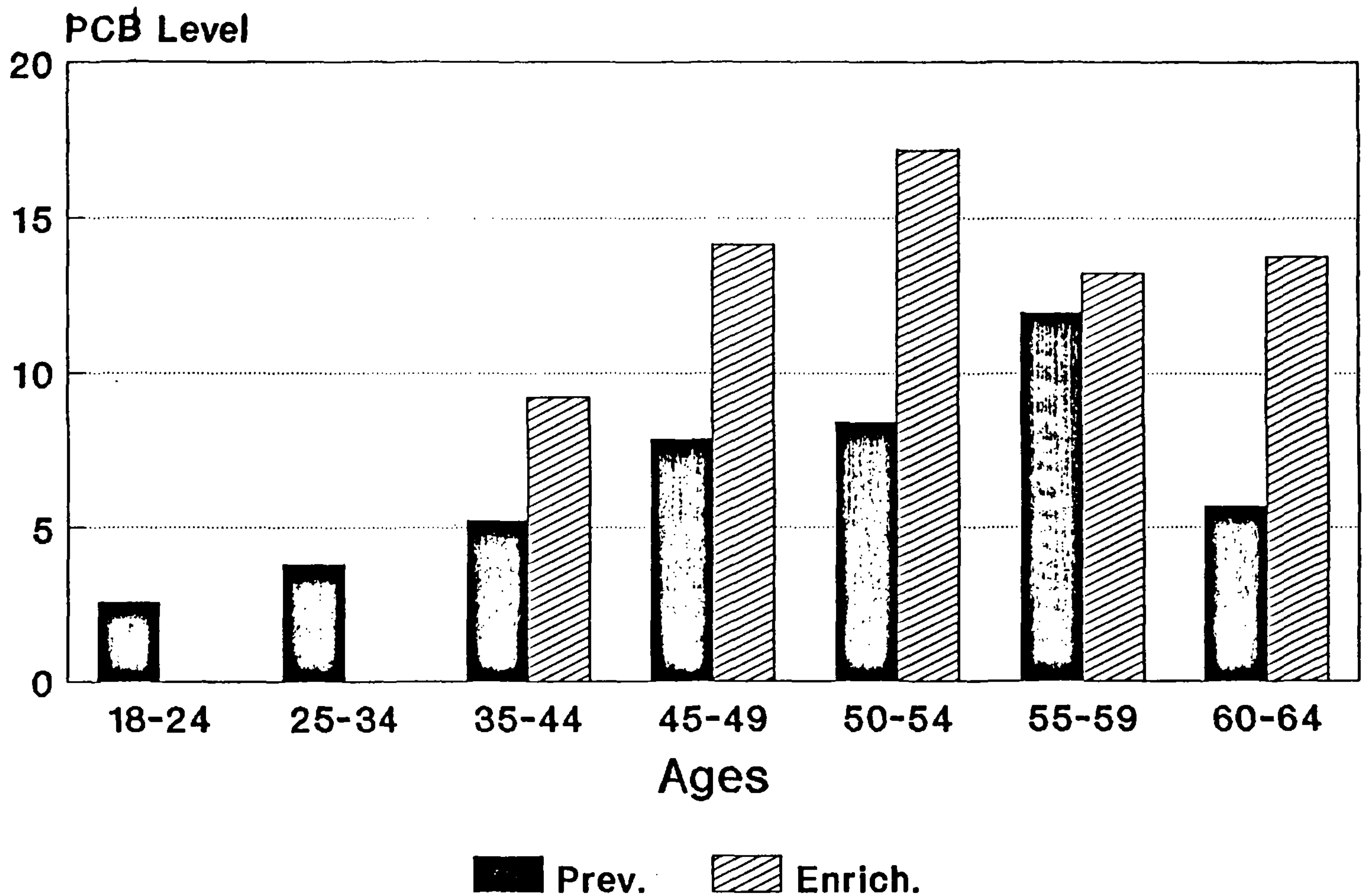


FIGURE 3.2

Comparison of Prevalance and Enrichment PCB Levels with Occupationally Exposed Subjects Removed

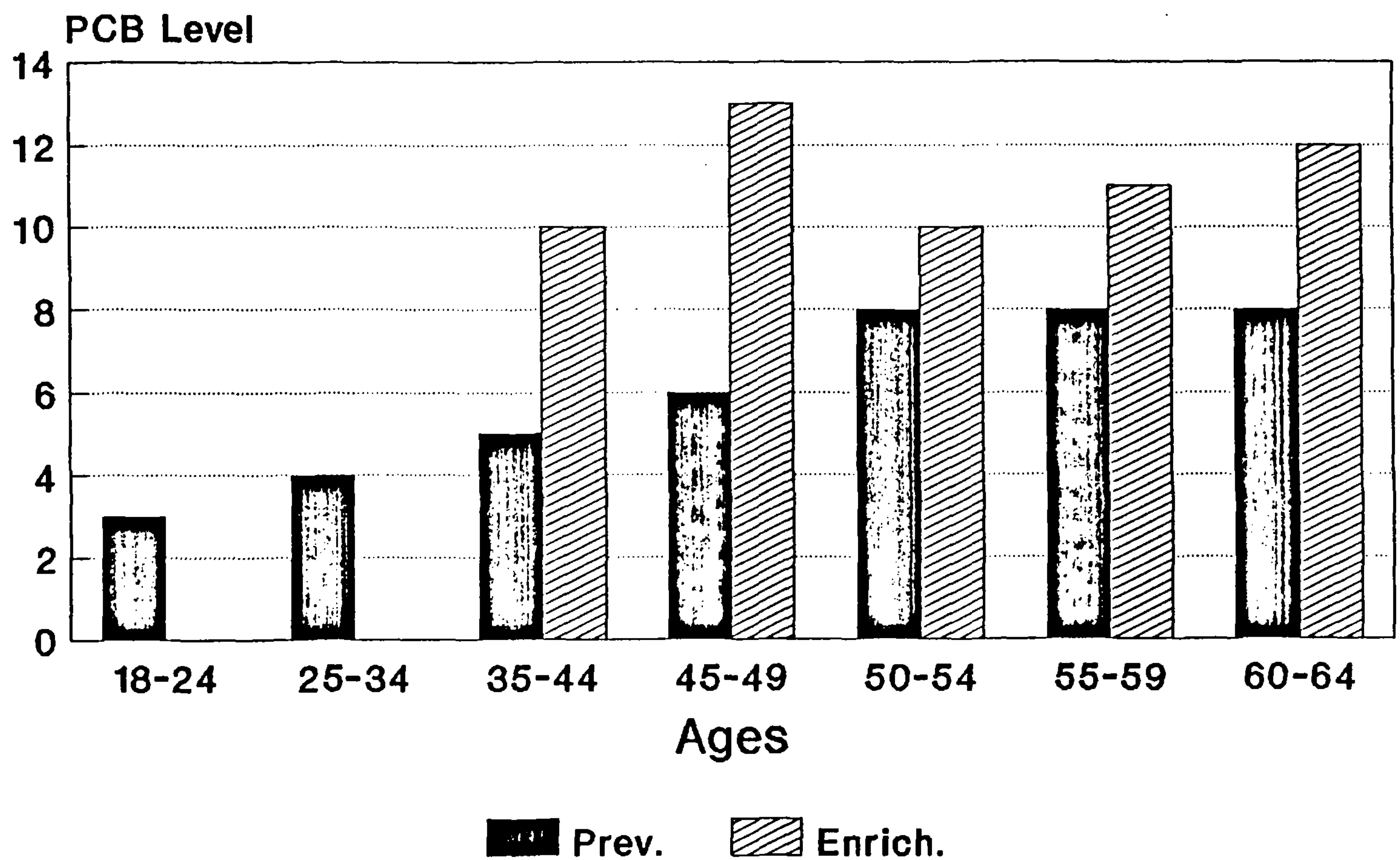
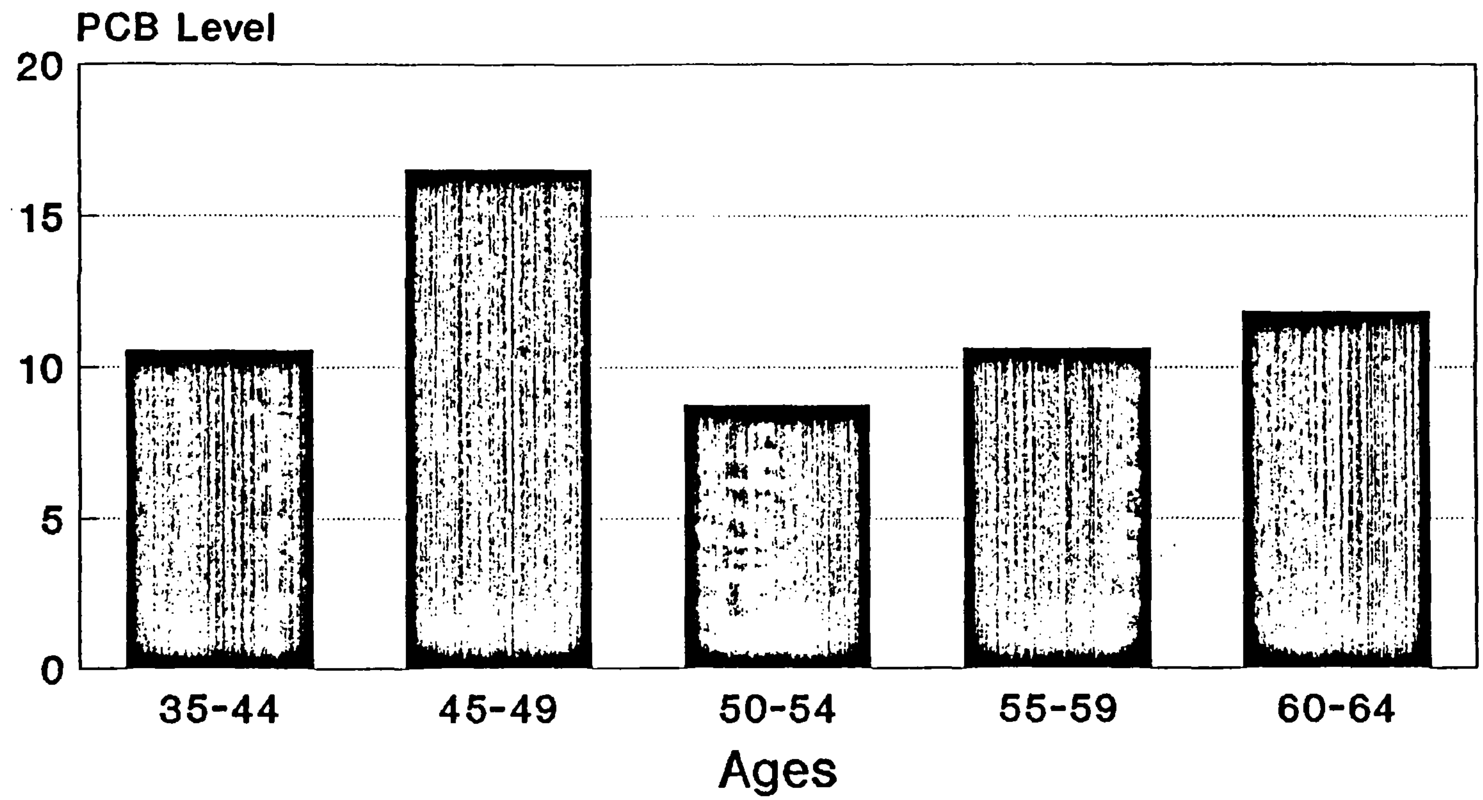


FIGURE 3.3

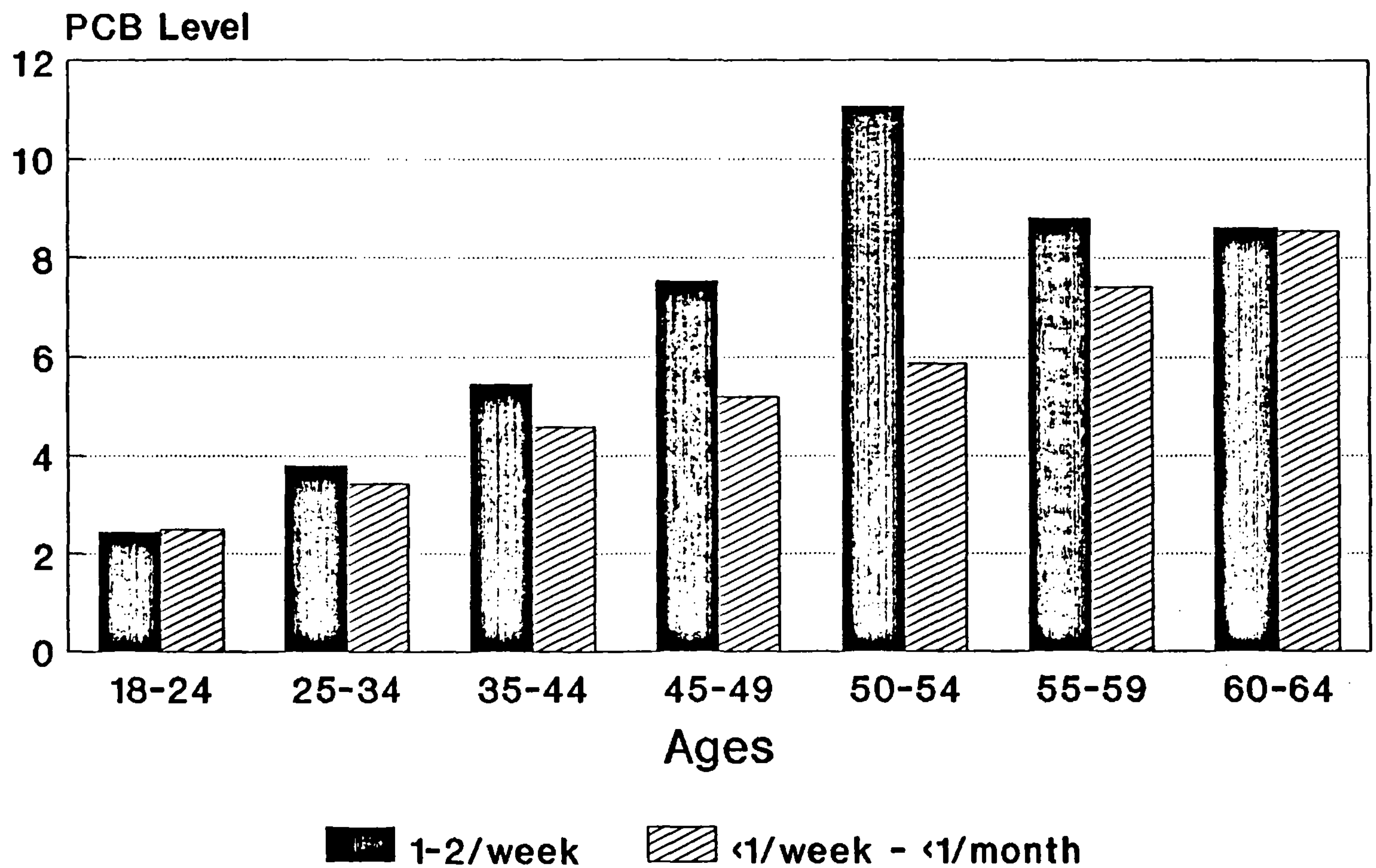
Distribution of Mean PCB Level by Age Groups for Enrichment*



* Local Seafood Consumption with Occupational Exposure Removed

FIGURE 3.4

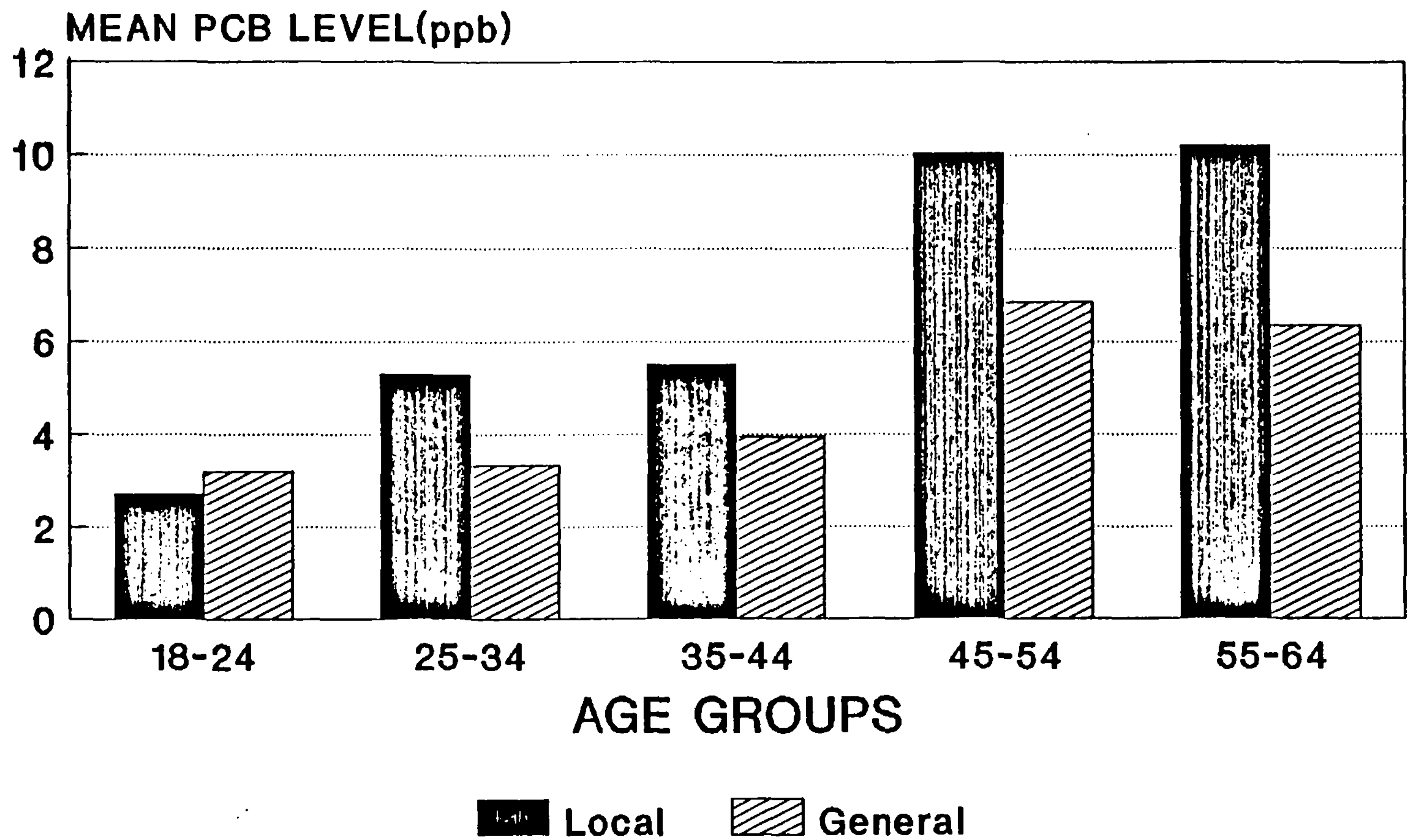
PCB Level by Age and Frequency of Seafood Consumption *



* Prevalance Sample with Occupational Exposure Removed

FIGURE 3.5

COMPARISON OF LOCAL AND GENERAL SEAFOOD CONSUMPTION FOR PREVALENCE SAMPLE



n=130 n=74

1 consumers of locally caught seafood
2 consumers of general but not locally caught seafood

Section 4

SECTION 4.0 - FATE AND TRANSPORT

4.1 MIGRATION OF PCBS FROM HOT SPOT

DCN #1, Page 6, Paragraph 1

> ...The contractor concedes that site specific data are unavailable for the hot spot area, and as a result, it is not possible to determine the relative contribution of transport mechanisms on present or future PCB distribution or that these processes are even occurring. In spite of that admission, the Agency is proceeding as if it knows what is happening to PCBs from the hot spot. There is a total absence of valid scientific research with respect to migration from the hot spot and what, if any, impacts it may have on the balance of the site. No action should be taken with respect to the hot spot until an overall remedial plan has been selected.

DCN #2, Page 7, Comment #4

> Throughout the report there is an assumption that the hot spot is a principal source for contamination for the estuary. This assumption is ultimately used to justify treatment of the hot spot sediments. No proof of any kind, however, is offered to show how the PCBs in the hot spot or in any other sediments in the upper estuary enter the water column.

DCN #2, Page 8, Comment #5

> There is an inherent assumption that reduction in total PCB mass (independent of location) leads to an equivalent reduction in the long term transport of PCBs for the site and hence to reduce risk. From an environmental risk perspective, however, there is an important difference between PCBs which are potentially mobile (in the near surface sediments) and those that have severely limited mobility (deeper in the sediments). From a risk assessment viewpoint removal of mobile, near surface sediments, independent of their total mass, is more important than the total mass of PCBs removed. The use of total PCBs removed as the only measure of acceptability of a remedial action technique is simplistic.

DCN #2, Page 8, Comment #6

> The report is devoid of any real analysis on how the proposed remediation measures will impact the environment. No calculations or analyses are given as to the effects of the removal of the hot spot on the transport of PCBs out of

the upper estuary, impacts to the ecosystem or public health risks. The authors rely solely on reduction in PCB mass as the measure of impact reduction. On the other hand there is extensive analysis of the costs associated with each remedial action measure.

DCN #3, Page 2

"Since the hot spot area contains close to half the total mass of PCBs in the estuary, this area will continue to act as a source of PCB contamination to the remainder to the estuary and the lower harbor and bay." This statement is misleading. It implies, without reference to the literature or to supporting analysis, that reduction of total PCB mass leads to a corresponding reduction in PCBs released into the water column. This basic assumption, which provides the basis for the whole hot spot feasibility study, is erroneous. Isolation and destruction of PCBs that are potentially mobile, (i.e. in the near surface sediments) independent of their total mass, are more important the total mass removed.

<u>EPA RESPONSE 4.1</u>

EPA has conducted extensive studies of the hydrodynamics, sediments, and biota for New Bedford Harbor Site including field, laboratory and model studies. These studies demonstrate that PCBs are moving both within the and away from the Site. EPA did not perform PCB sediment flux modeling for the Hot Spot Area to estimate its contribution of PCBs to the water column. However, EPA believes that this concentrated mass of PCBs continues to release PCBs to the water column. This hypothesis is supported by the direct correlation between the distribution of contaminated sediment and the observed water column concentrations. This correlation is illustrated by the extremely high water column concentrations of PCBs in the vicinity of the Hot Spot.

Further evidence of the important role of the Hot Spot is apparent in the flux modeling conducted by PRPs. This modeling estimates at least 30% of the total PCB flux is derived from the areas of contamination in excess of 4,000 ppm PCBs (i.e., the Hot Spot). Figure 4-1 at the end of this section illustrates this information.

Other information presented by the PRPs during the public comment period for the Hot Spot, also supports EPA's hypothesis that PCB contamination is being spread throughout areas of the Estuary and Lower Harbor/Bay by movement or flux out of the bed sediments. In the PRPs' analysis of their thin layer sampling program (Thibodeaux 1989c), the following observation, referring to a sediment sample ("Site DR") taken in the estuary midway between the Hot Spot and the Coggeshall Street bridge, is made. "Another curious aspect of Site DR is that it appears to still be receiving PCBs into the sediment... This source is very likely those sediment areas in the upper estuary containing higher levels of PCB contamination than the DR site."

EPA has conducted air and water monitoring programs to document whether PCBs are moving away from the Site. The results of the air programs are discussed in Section 4.3 of this Responsiveness Summary. For transport within the water column, several monitoring programs conducted by EPA and the PRPs have documented a net seaward flux of PCBs from the southern end of the estuary at the Coggeshall Street Bridge (EPA, 1983, Teeter, 1988 and ASA, 1989a). The reported flux values range from approximately 2 to 6 pounds of PCBs daily. These PCBs are ultimately transported to portions of the Lower Harbor and Buzzards Bay, where they are redeposited, volatilized into the atmosphere, or taken up into the food chain by aquatic biota. The PRPs fate and transport modeling (ASA, 1989b, and Thibodeaux, 1989c) provides consistent results, supporting the evidence that PCBs are migrating from the Site. The results of these studies indicate that the estimated PCB flux from the estuary sediments ranges from 3 to 36 lbs/day. The PRPs estimate that approximately half of these PCBs volatilize into the atmosphere.

The following paragraph is a summary of the more detailed description of the movement of PCBs from the bed sediment into the overlying water, which is provided in the HSFS.

The movement from the sediment to water column is the result of many mechanisms including physical, chemical, and biological processes. However, the overall mass transfer is primarily a function of the concentration gradient between the bed and the overlying water column and the erosion or deposition of contaminated sediment particles. Since the Estuary and Lower Harbor are depositional in nature, PCB migration through resuspension does not appear to be a major transport mechanism. (The PRPs suggest that the deposition of sediment particles may act to cover contaminated sediments. However, the results of studies conducted for EPA (Battelle, 1989) indicate that suspended sediment becomes contaminated with PCBs from contact with the water column prior to settling.) The processes which move PCBs both out of and back into the bed depend on the local conditions. Finally, of the many mechanisms occurring within the sediment, EPA believes the following contribute significantly to the mobilization of the PCBs:

- desorption of PCBs from the bed sediment and diffusion into the overlying water;
- molecular diffusion of PCBs within the pore water of the sediment; and
- bioturbation, or mixing of the sediment by organisms.

In summary, EPA believes the Hot Spot continues to function as a source of PCBs for the remainder of the Estuary and Lower Harbor/Bay. Studies by the USACE, Battelle, and others cited in the Hot Spot Feasibility Study (HSFS) have documented the fact that PCBs move from the sediment into the water column and are transported via tidal pumping into the Lower Harbor and Bay. PCB concentrations in the Hot Spot sediments and water column above the Hot Spot are orders of magnitude higher than PCB concentrations in other areas of New Bedford Harbor.

4.2 COMBINED SEWER OVERFLOW (CSO) LOCATIONS

DCN #3, Page 2

"PCB contamination at the lower depth (1 to 4 feet) is limited to areas primarily around the storm water overflows and combined sewer outfall discharge pipes. This contamination at depths grater than 1 foot can be attributed to turbulence and subsequent mixing and deposition of contaminants that occurs around discharge areas." This argument, while potentially true, is not supported by any analysis or reference to the literature. The hot spot FS report doesn't show the location of the combined sewer or storm water discharge nor does it document the flow rates or pollutant loads discharging to the area.

The contamination at depths greater than 1 foot in the sediment likely has little to do with turbulence and subsequent mixing. In the vicinity of most shallow outfalls is a region of scour caused by the strong currents generated during peak discharge. As the momentum of the discharge dissipates, particulate material carried in the flow or eroded from the bottom deposits on the sea bed. Once on the sea bed, bioturbation and diffusion transport the particle bound pollutant associated with the discharge deeper into the sediments. Resuspension and transport are also possible in high current areas or regions with substantial wave activity.

DCN #3, Page 4

The current Hot Spot areas correspond to the locations of the storm water and combined sewer outfall". There is no evidence presented to show that the Hot Spot areas correspond to locations of storm or combined sewer outfall discharge.

EPA RESPONSE 4.2

The locations of industrial discharges and combined sewer overflow pipes are presented in an EPA document entitled, "Historical Assessment of the Aerovox-PCB Related Facility New Bedford, Massachusetts" (1982) and the City of New Bedford sewer maps. The Historical Assessment was conducted using historic aerial photographs of the Aerovox facility taken in 1951, 1962 and 1974, U.S.G.S. topographic maps, and Sanborn Map Company fire insurance maps.

EPA compared these discharge locations to the distribution of PCBs. EPA found a direct correlation between areas of significant PCB contamination and the discharge locations adjacent to the Aerovox facility. These locations are shown in Figures 4-2, 4-3 and 4-4 at the end of this Section.

The Historical Assessment also revealed several trenches and a discharge pipe from the Aerovox facility that emptied into the Acushnet River Estuary. Analysis of the April 10, 1962 photograph revealed plumes in the estuary at several of these locations indicating discharge.

EPA acknowledges that erosion and scour may occur at an outfall discharge. However, immediately downstream of these erosive areas there is subsequent deposition. This explains why the highest levels of PCB contamination are not at the terminus of the discharges but slightly offshore.

4.3 ATMOSPHERIC TRANSPORT

DCN #2, Page 14, Comment #11

Throughout the report atmospheric transport of PCBs is given only cursory treatment. Thibodeaux 1989, in his work for the U.S. Army Corps, has shown that evaporative losses may be very significant in the upper estuary.

It seems unusual that the discussion on volatilization from the water column doesn't include reference to Thibodeaux's (1989b) recent work sponsored by the U.S. Army Corps on the problem....Thibodeaux (1989) has shown that the evaporative processes account for approximately 40% of the loss of PCBs from the upper estuary. It seems that this potential route of exposure is much too large to simply ignore.

EPA RESPONSE 4.3

EPA has considered atmospheric transport from the Hot Spot Area, including both PCB emissions from the mudflat areas of the Hot Spot and from the water column area of the Upper Estuary impacted by the Hot Spot.

EPA's evaluation of the mudflat areas has included both air monitoring and air modeling activities. Results of the PCB emission modeling completed by EPA (EPA, 1987a and EPA, 1987b, Thibodeaux, 1989a and Thibodeaux, 1989b) and modeling completed by the PRPs (Thibodeaux, 1989c) indicate that the highest PCB emission potential exists for exposed wet sediment. These findings are significant since a large portion of the Hot Spot is exposed at low tide. Additionally, these studies indicate the next highest emission potential is from the site areas with the highest PCB levels in the water column. These modeling predictions correlate with the observed data from air monitoring studies conducted at the site over the past ten years. The consistent finding of these air studies is the identification of the northern portion of the Estuary as a source area for volatile PCB emissions.

Air monitoring conducted by EPA and Environmental Science and Engineering (ESE) in January 1978 reported results of 490 ng/m^3 to 774 ng/m^3 downwind of the Aerovox facility. The upwind results reported for same period were 5.6 ng/m^3. During September of 1978, the reported downwind values ranged from 268 ng/m^3 to 310 ng/m^3.

In 1982, an area wide air monitoring program was conducted to assess the ambient levels of PCBs, trace metals and other organics within the greater New Bedford area (GCA, 1984). This comprehensive effort included monitoring stations located in New Bedford, Acushnet and Fairhaven. The monitoring locations were selected to provide ambient levels from both known and potential source areas and urban background levels. High PCB levels were reported for several of the known source areas, including the northern end of the Estuary. Two of these sampling stations were located downwind of the Hot Spot area and experienced average PCB concentrations of 69 ng/m^3 and 88 ng/m^3. The study also reported average ambient PCB levels for the background stations ranging from 3.7 ng/m^3 to 16 ng/m^3. One of the recommendations of this 1984 study was a more detailed monitoring program for the northern portion of the estuary to investigate the role of tidal influence on PCB emissions and to evaluate potential temporal changes.

In 1985, an air monitoring program was conducted by EPA (NUS, 1986) to further investigate contaminant emissions from the highly contaminated sediments in the mudflat area adjacent to the Aerovox facility. The objective of this study was to examine the potential role of tidal influence on releases PCBs and trace metals from this area. The program consisted of four sampling locations along the shoreline of the estuary and one background location away from the site. The measured PCB values (Aroclor 1242) ranged from a low of 7ng/m^3 at the background location to a high of 471 ng/m^3 at the sampling site directly east of the Hot Spot area. This sampling location was downwind of the mudflat area for a portion of each sampling period and consistently experienced the highest ambient PCB (Aroclor 1242) levels of all the locations. The results of seven samples taken at this location during periods of high and low tide indicate that PCB (Aroclor 1242) concentrations increased during periods of low tide.

EPA conducted an ambient air monitoring program during the pilot dredging study in 1988 and 1989. The report describing this air monitoring program and its results are scheduled for completion in April 1990. A discussion of this program is provided in EPA Responses 2.4.3 and 8.5 found in Sections 2 and 8 of this Responsiveness Summary, respectively.

As part of the second operable unit, EPA is evaluating volatile PCB emissions from the water column as a fate and transport process. The evaluation will include the use of the New Bedford Harbor fate and transport model. The evaporative coefficient (k_e = 1.12 m/d) value used in the model is similar to the value used by the PRPs (k_e = 1.68 m/d) in their studies (Thibodeaux, 1989c and ASA, 1989).

###

Section 4 References

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ASA, 1989b. "Use of Simple Box Model to Estimate PCB Water Column Concentrations Before and After Capping in the Upper Estuary, Draft," (DCN #29).

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EPA, 1978. Memorandum from Richard J. Siscanaw to Edward L. Taylor through Arthur E. Clark reporting the ambient PCB levels from the New Bedford area.

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EPA, 1987b Memorandum - New Bedford Harbor Site; PCB Emissions from CDF.

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NUS Corporation, 1986. "Ambient Air Monitoring Program for Acushnet River Estuary - New Bedford, Massachusetts," Volume I.

Teeter, Allen M. 1988. New Bedford Harbor Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternatives; Report 2, "Sediment and Contaminant Hydraulic Transport Investigators," Technical Report EL-88-15, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Thibodeaux, 1989a. "Theorical Models for Evaluation of Volatile Emissions to Air During Dredged Material Disposal with Applications to New Bedford Harbor, Massachusetts," Miscellaneous Paper EL-89-3, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Thibodeaux, 1989b. "Theoretical Models for Volatile Emissions from Dredged Material - Comparison of Predicted and Laboratory Measurements for New Bedford Harbor Sediment."

Thibodeaux, 1989c. "Theoretical Evaluation of the Effectiveness of Capping PCB Contaminated New Bedford Harbor Sediment," (DCN #16).

CUMULATIVE PERCENTAGE OF PCBs RELEASED FROM UPPER ESTUARY

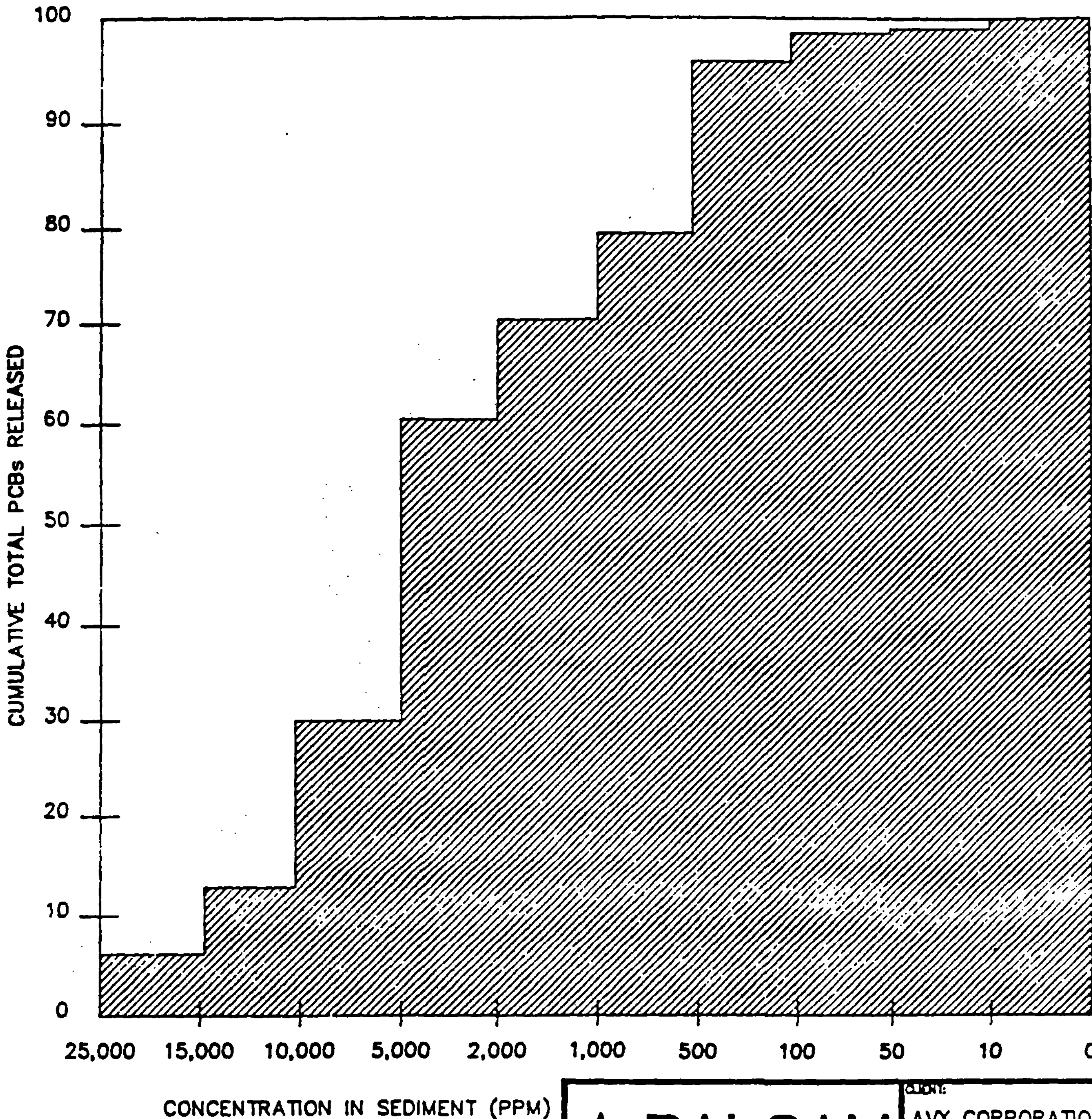
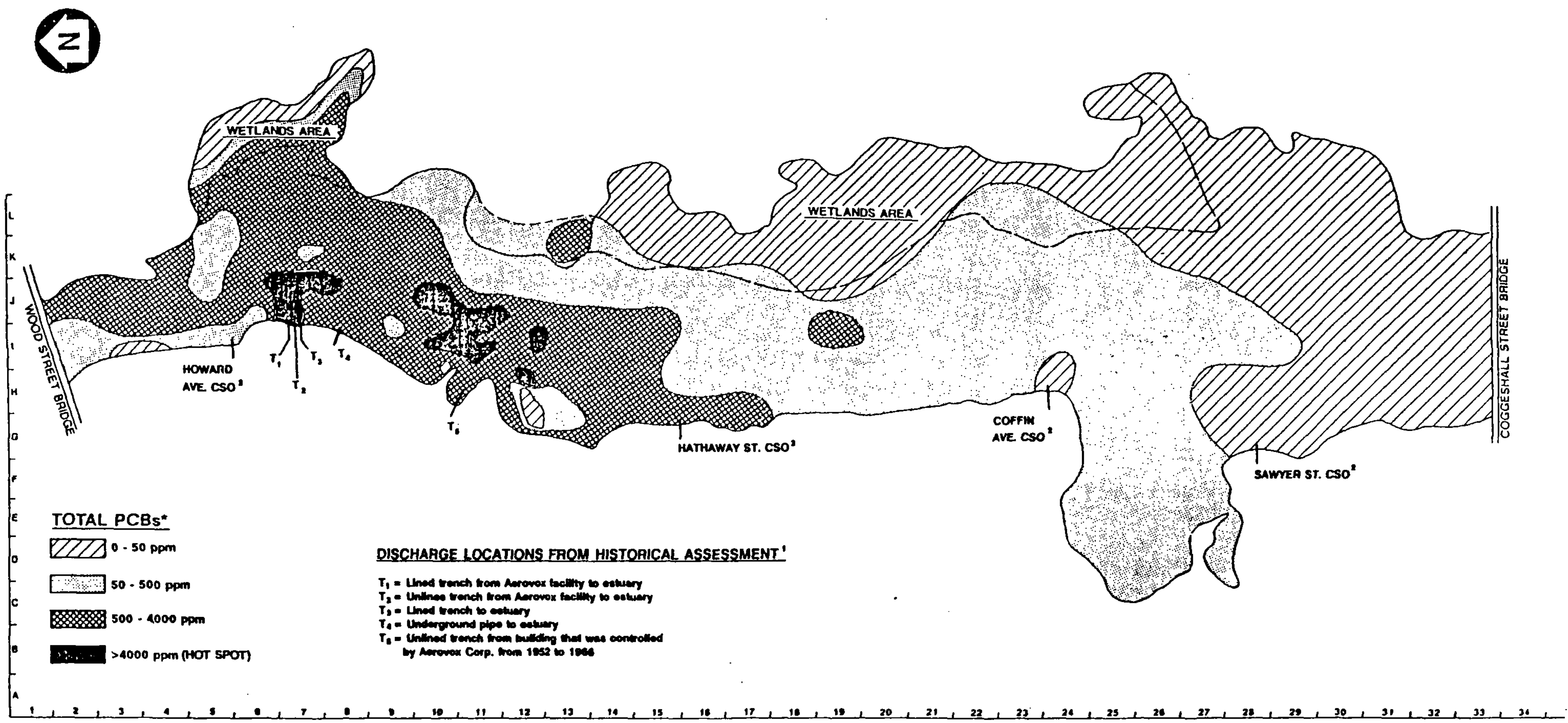


FIGURE 4-1

BALSAM ENVIRONMENTAL CONSULTANTS, INC. 59 STILES RD. SALEM, N.H. 03079			CLIENT: AVX CORPORATION	
			TITLE: CUMMULATIVE PCB FLUX	
DATE: 10/12/89	DRAWN: D.J.H.	CHECKED: G.M.G.	PROJECT: NEW BEDFORD HARBOR	
SCALE: NONE	FILE NO: 629215	APPROVED: L.C.S.	FIGURE NO: 3.6	PROJECT NO: 6292.05



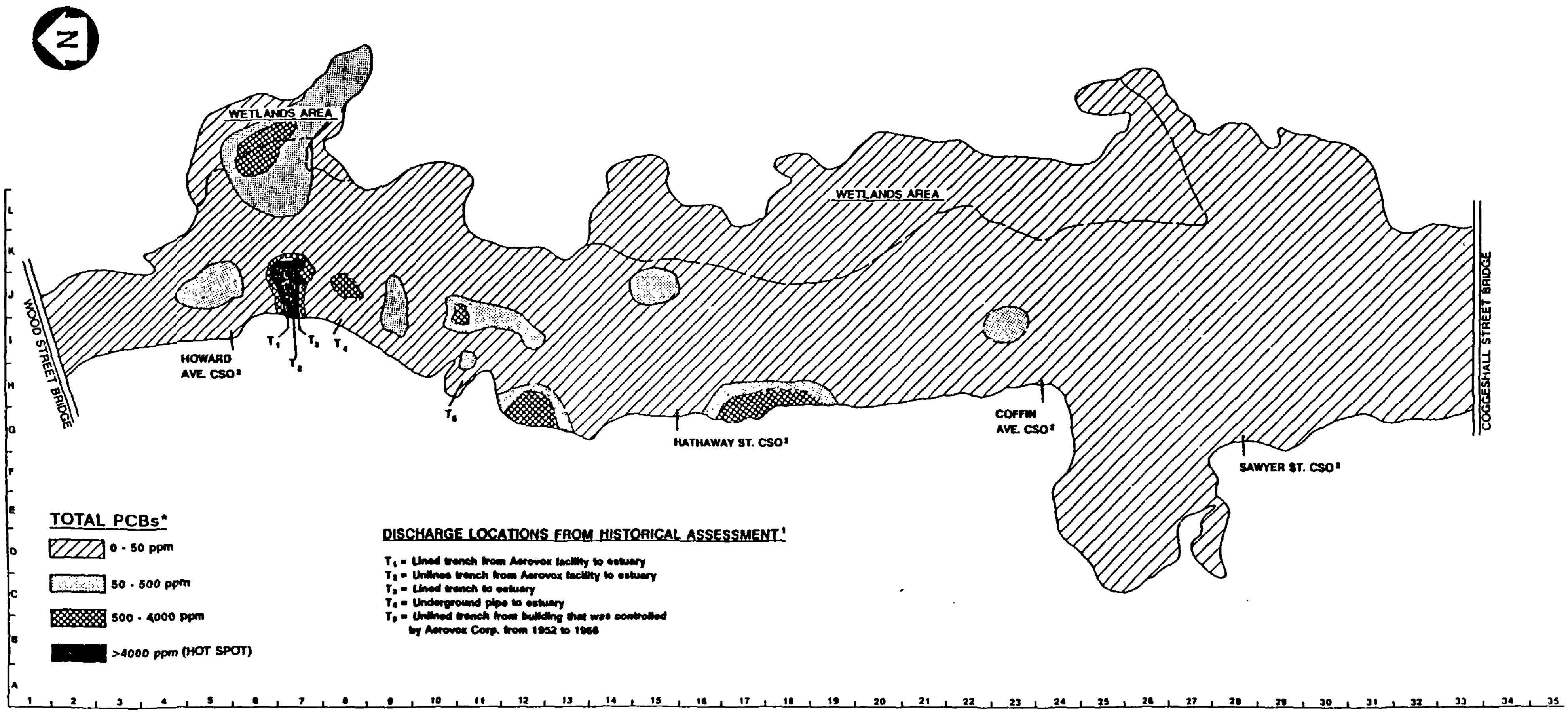
REFERENCES

1. Historical Assessment of Aerovox - PCB Related Facility - New Bedford, Massachusetts.
2. Combined Sewer Overflow (CSO) locations from City of New Bedford sewer system map.

FIGURE 4-2

INTERPRETATION OF
TOTAL PCB CONCENTRATIONS*
DEPTH: ZERO TO 12 INCHES
HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR

* SUM OF AVAILABLE AROCHLOR DATA



0 400 800 1,200 FEET

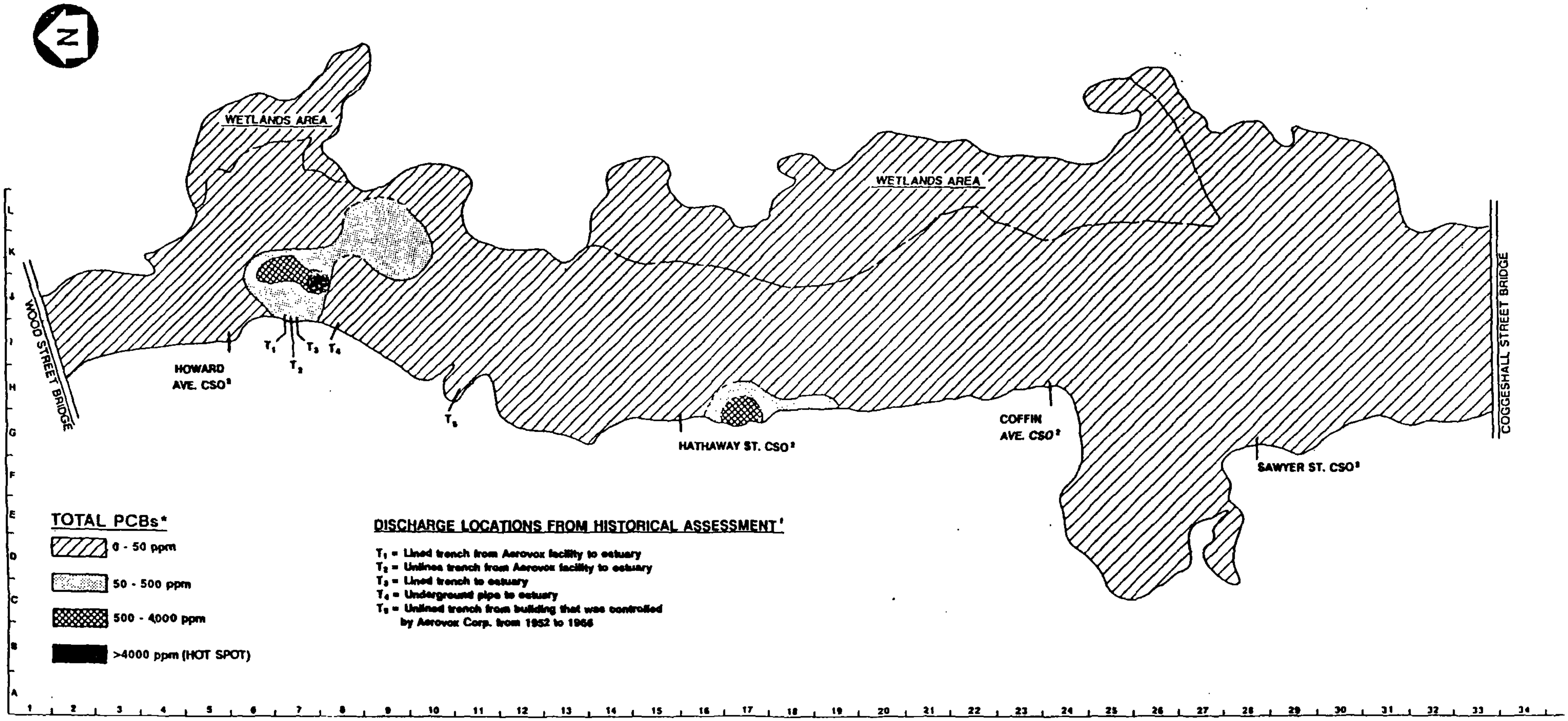
REFERENCES

1. Historical Assessment of Aerovox - PCB Related Facility - New Bedford, Massachusetts.
2. Combined Sewer Overflow (CSO) locations from City of New Bedford sewer system map.

FIGURE 4-3

INTERPRETATION OF TOTAL PCB CONCENTRATIONS*
DEPTH: 12 TO 24 INCHES
HOT SPOT FEASIBILITY STUDY
NEW BEDFORD HARBOR

* SUM OF AVAILABLE AROCHLOR DATA



REFERENCES

1. Historical Assessment of Aerovox - PCB Related Facility - New Bedford, Massachusetts.
2. Combined Sewer Overflow (CSO) locations from City of New Bedford sewer system map.

FIGURE 4-4

INTERPRETATION OF TOTAL PCB CONCENTRATIONS DEPTH: 24 TO 36 INCHES HOT SPOT FEASIBILITY STUDY NEW BEDFORD HARBOR

Section 5

SECTION 5.0 - BIODEGRADATION OF PCBS

5.1 NATURAL BIODEGRADATION AS AN ALTERNATIVE TO REMEDIAL ACTION

DCN #1, Page 6, Paragraph 3, Comment 1

> ...It is asserted that there is inadequate data to estimate the half lives of PCBs as a result of biodegradation. This assertion is incorrect. Such data have been submitted. Moreover, the Agency could add nutrients to the site to speed up the process. The Agency has chosen to relegate the dechlorination issue to the scrap heap because it is inconsistent with the Agency's pre-determination that dredging must occur.

DCN #31, Section 7.4.9.10

> Despite the recognition is this section of the HSFS anaerobic biodegradation is occurring in New Bedford Harbor, no attempt is made to take advantage of this natural process in the design of the recommended remedial alternatives, despite recommendations by EPA's own experts.

EPA RESPONSE 5.1

EPA has considered the evidence of natural biodegradation of PCBs in New Bedford Harbor submitted by the PRPs (Yoakum, et al., on behalf of AVX, and several versions of a report by Brown and Wagner on behalf of Aerovox). EPA has also funded its own research at the Environmental Research Laboratory in Narragansett, Rhode Island, the results of which are described in a report by Lake, et al. (1989). EPA has not accepted all of the assertions of Yoakum and Brown and Wagner, but EPA has also found that even on their own terms these papers do not establish that natural biodegradation would be acceptable as an alternative to remedial action, particularly in the Hot Spot, which appears from these papers to be at least partly unaffected. The evidence does not demonstrate that natural biodegradation will abate the risks to public health and the environment, particularly the risks of contamination of the food chain, in anything less than decades, or indeed at any time in the foreseeable future.

EPA's concern here is limited to the Hot Spot; EPA continues to consider these issues for the second operable unit for the lower levels of contamination.

Evidence exists that the patterns of PCB congeners in some sediment samples have altered relation to presumable starting mixtures of Aroclors 1242 and/or 1016, and 1254.

Such alterations include losses due to dissolution and evaporation, but also include decreases in the content of specific PCB congeners and buildup of other congeners in some samples (Lake, et al.). EPA has not found evidence which conclusively elucidates the causes of these pattern alterations, but for purposes of this discussion, EPA assumes that these alterations result from dechlorination of molecules, and that the dechlorination process is likely to be microbially mediated.

In general, EPA has found that the evidence of natural biodegradation shows it to be widely variable, unpredictable, and generally a slow process. The research conducted by EPA at its Narragansett laboratory found that the extent of dechlorination, and the apparent rates at which it has progressed, vary widely from one location to another, between the surface and various depths within a single core sample, and from one PCB congener to another (Lake, et al.). PRP's reports (Yoakum and Brown and Wagner) show that in some of the most highly contaminated locations, little or no dechlorination has taken place. Brown and Wagner calculated that natural biodegradation would take fifty years or more to eliminate PCB congeners which affect the food chain. Using Brown and Wagner's data, EPA calculates that the time required to reduce a sediment PCB concentration of 4,000 ppm to 50 ppm would be approximately 50 to 350 years. PCB concentrations in the 100,000 ppm range, such as found in the Hot Spot, would require approximately 85 to 600 years for reduction to a 50 ppm level. Thus, both the rates and the areal extent of dechlorination are too variable, and the underlying process too poorly understood, to allow any projections as to future trends that would allow EPA to find this process to be an acceptable alternative to remedial action.

The report by Yoakum, et al. identifies two locations within the Hot Spot with PCB levels of 76,000 ppm and 130,000 ppm where no evidence of biodegradation was reported. In a map included in the report, the authors designated the grid closest to the Aerovox facility as an area where no dechlorination is taking place (Yoakum et al., Appendix VI at 26-36). At least one sample analyzed by Brown and Wagner, Sample #18, appears to have revealed little if any dechlorination.

The PRPs identify many other locations where they observe varying degrees of alteration. It is not possible for EPA to fully evaluate all of these findings, which are based on evaluations of their own sampling and analyses and are based on documents which have not been submitted to EPA. Aside from their own analyses, the authors base their conclusions on reviews of analyses by the government, which were not performed for the purpose of evaluating dechlorination patterns. The chromatograms generated with packed column analyses do not have sufficient resolution of individual congener peaks to be fully reliable as a means of assessing the rate and extent of dechlorination.

Similarly, Brown and Wagner base their conclusions in part on packed column chromatograms. Thus, EPA cannot accept as definitely demonstrated the assertions of these reports concerning the areal extent of microbial activity. From EPA's research, it appears that the area of significant dechlorination may be far more limited than asserted by the PRPs.

EPA's report (Lake, et al.) documents extreme variations found at different locations. Decreases in abundance of presumably dechlorinated congeners were most pronounced in the sample taken farthest up the Estuary, and within that sample, were most pronounced at the 6-7 inch depth. For two samples, one located south of the Coggeshall Street Bridge and one near the Hurricane Dike, their report concludes that the patterns "may demonstrate initiation of dechlorination in these samples or may reflect down bay transport and deposition of partially dechlorinated residues." Thus, the outer limits of the area in which dechlorination is taking place cannot be defined with the available evidence, and the possibility of transport and redeposition of dechlorinated residues cannot be ruled out as an alternative mechanism for creating dechlorinated patterns at some locations.

Within the Upper Estuary, EPA's researchers found that calculated half-lives of one congener at different locations varied from 465 years to 13.2 years. At one of the sample locations, two important congeners, (IUPAC Nos. 118 and 153) showed no relative decrease in quantity. (The designations of different PCB congeners by IUPAC numbers and structure codes is described in full in the article by McFarland and Clark in the Administrative Record. Appendix A in the article lists the numbering and structure codes for 209 PCB congeners.) As discussed below, these two congeners play a significant role in the contamination of the food chain. EPA's study found that PCBs in biota samples from the Upper Estuary had not been affected by dechlorination. Even at the most extensively dechlorinated location, the half-life of congener 153 was calculated at 18.8 years; similarly, the rates of dechlorination for 153 calculated by Brown and Wagner would take decades -- fifty years or more -- to effectively remove it from the environment.

The PRP's comments assert that the effects of the dechlorination pattern or patterns which they have identified can be equated with "detoxification." The PRPs derive the notion of "detoxification" from the (supposed) findings of others concerning the relative toxicity of different PCB congeners. EPA regards the evidence as insufficient to warrant the conclusion that the dechlorination found in New Bedford can be equated with "detoxification," even in the locations in which such dechlorination is most pronounced. EPA finds that the toxicity of dechlorinated residues, and the extent to which dechlorination has altered the toxicity from that of the original Aroclors, are unknown. This issue is also discussed in Section 3.0 of this Responsiveness Summary.

Although EPA recognizes that studies have shown that certain PCB congeners may be more potent than others in respect to certain kinds of toxicity, those congeners are not exclusively the only toxic congeners. No specific congeners have been indisputably identified as the cause of the carcinogenicity and other effects which Aroclor mixtures have been shown to have on laboratory animals. Indeed, as the PRP's comments recognize, the role of the supposedly more toxic structures in respect to carcinogenicity is controversial and unresolved (Whysner, Appendix E). Therefore, it is not possible for EPA to identify a non-toxic residue which dechlorination can be expected to create.

The PRPs have not shown that biological dechlorination will eliminate contamination by PCB congeners of known toxicity in anything short of decades. In a report by Brown and Wagner, after asserting that "detoxification" would occur in 13 years (plus or minus 5), the authors conceded that a different dechlorination rate would have to be calculated for those PCB congeners which are most persistent in crustaceans, birds, mammals, and man. Brown and Wagner wrote the following:

> The most persistent PCB congeners in all these groups of species (which share the ability to biodegrade most PCB congeners by microsomal oxidases of the cytochrome P-450 type) are those having a 2,4,5 - or 2,3,4,5 - CB group attached to any other 4- substituted CP, e.g., 4-, 2,4-, 3,4-, 2,3,4-, 2,4,5-, etc. ... [The dechlorination found in New Bedford] does attack all of these congeners, but sometimes only slowly, notably in the case of 245-245 CB, for which the t - 1/2 may be estimated only roughly from the available data (Table 2) as about 35 years. We estimate that to achieve 90% overall reduction in the level of P450 resistant congeners in the sediments will require 2 half-losses of 245-245 CB, which equates to roughly 70 years, starting in 1965, or <u>50 years from the present</u>. (Brown and Wagner, 1987, at 44-45; emphasis added).

The data on which this calculation was based ("Table 2") first became available to EPA in January 1987, as part of the Requests for Admission ("RFAs") submitted to the United States by Aerovox in the New Bedford Harbor litigation. The RFA version of Table 2 has been included in the Administrative Record at 11.12.8. From this Table, it is apparent that research into biodegradation reveals extremely slow degradation periods for the group of PCB congeners referred to in the passage above as the P450 resistant congeners. The numbers in Table 2 appear to be averages based on all sampling sites. As discussed above, it is evident that rates vary considerably from location to location. Even where dechlorination is well advanced, however, the calculated half-lives for congeners such as 2,4,5-2',4',5', describe change in terms of decades. Lake, et al., calculated an 18.8 year half-life at the most dechlorinated location, and no decrease in relative abundance at less contaminated site.

As discussed by Brown and Wagner, chromatograms published by Farrington, et al., identified congeners which are consistently abundant in the PCBs in New Bedford lobsters (Farrington, et al., 1979). The substantial presence of these congeners was subsequently confirmed by Pruell, et al., in the report which is now Appendix E to the draft Public Health Risk Assessment (Ebasco, 1989). These congeners include IUPAC numbers 118, 138 and 153, or 2,4,5,3',4'; 2,3,4,2',4',5'; and 2,4,5,2',4',5'. The half-lives for these molecules provided by Brown and Wagner's table are respectively, 25, 12.5 and 35 years, plus or minus 10 years. Congener 153, or "245 - 245", is the congener discussed in the passage quoted above. It is not clear how Brown and Wagner calculated that 90% of the congeners would degrade in 50 years; in fact, a half-life of 35 years would mean that after 105 years 12.5% of 153 would remain.

These three long-lived congeners are not toxicologically insignificant. Research shows (Safe, et al.) that 2,4,5,3',4' (118) is among a group of "mono-ortho substituted" PCBs whose toxic effects are similar to those of 2,3,7,8-TCDD (dioxin). The same article identifies to 2,3,4,2',4',5' (138) as an active enzyme inducer "which has been shown to be porphyrinogenic in rats after long term feeding studies." They also identify 2,4,5,2',4',5' (153) as an enzyme inducer. (Safe is also one of the authors of one of the documents submitted by the PRPs, DCN #7).

An attempt to classify PCB molecular structures according to known structure activities and environmental significance has been published by Victor A. McFarland and Joan U. Clarke, two researchers at the Army Corps of Engineers'

Waterways Experiment Station (McFarland and Clarke, 1989). Summarizing the toxicity to both humans and aquatic species, and the relative abundance of various congeners, McFarland and Clarke identified four priority groups of PCB congeners. McFarland and Clarke use mixed-function oxidase induction as the benchmark of toxicity for this classification. Although EPA does not regard this as the only measure of PCB toxicity, and McFarland and Clarke's proposal has not been adopted as a regulatory approach, their article provides a useful analysis and summary of the structure-activity research from which Brown and Wagner apparently derive their concept of "detoxification."

All of the congeners which McFarland and Clarke place in the highest priority group were identified in substantial quantities in New Bedford lobsters and fish. (Pruell, et al.). In addition, the three most abundant congeners, 118, 138 and 153, are all identified as toxic or potentially toxic congeners. Both 118 and 138 are included in the proposed highest priority group described as a class of abundant PCBs for which substantial evidence of toxicity exists. 153 is included in Group 2, which consists of environmentally abundant congeners which exhibit "phenobarbital-type induction," so that they are of lesser toxic potential than Group 1, but still should be regarded as substances of potential toxicity.

No data has emerged since which would change the finding that these congeners have extremely slow rates of loss, rates which would require decades to complete their effect. Nevertheless, EPA has continued to review evidence of natural biodegradation of PCBs as it has become available, and funds its own related research. Contrary to the PRP comments, the research by Dr. Lake was not research which the Superfund program has failed to consider. Rather, this work was funded by Superfund, and the results were placed in the Administrative Record as soon as they were available.

In the course of the Feasibility Study, EPA contractors (E.C. Jordan) solicited in-put on the subject of biodegradation from General Electric, and subsequently from the Corps of Engineers and EPA's Narragansett Laboratory. The responses to E.C. Jordan's requests are all in the Administrative Record. EPA also requested proposals for bench tests of biodegradation treatment technologies and subsequently funded a test by Radian Technology. The results of this test are also in the Administrative Record.

The Administrative Record also includes a long history of correspondence with the PRPs to obtain information on biodegradation. This correspondence was initiated when the General Electric Company referred an EPA contractor's inquiry to Dr. Brown, who wrote to EPA (E.C. Jordan) that he had written a report on his research in New Bedford which could only be obtained from Aerovox's attorneys. This same report was cited as support for comments submitted to EPA on the Detailed Analysis of Remedial Technologies. In spite of repeated requests by EPA, the report was not made available until it was sent to the Department of Justice in January of 1989, over two years after it was first requested, and only after the United States' Motion to Compel Production of the report had been granted by the District Court. The copy of the report produced was dated September 1986. Certain portions of the text had been redacted by Aerovox's attorneys.

EPA has subsequently received a new version of the Brown and Wagner report. This new version was submitted with the PRP comments. Another version was apparently used to create Requests for Admission presented to the United States in January 1987. The RFAs contain material which corresponds to the redacted spaces in EPA's copy of the September 1986 report. (EPA has included the attachments to the Requests for Admission submitted to the Justice Department by defendants in litigation in the Administrative Record to the extent that they provide information relevant and necessary to consider in the choice of a remedy. However, EPA has not acceded to the defendants' assertion that all the RFAs should be added to the record, as many of these RFAs are entirely irrelevant to the choice of a remedy, and in any case the RFAs do not in themselves represent demonstrable information to be considered in the choice of a remedy.)

Although each version of the Brown and Wagner report has been edited differently, they present the same data. Only the September 1986 version contains the paragraph quoted previously. However, the half-life data in the table on which the "50 years from the present" calculation was apparently based is presented in all versions.

Brown and Wagner base this conclusion in part on the results of analyses of water samples. They conclude that "at the time of sampling the estuarine waters included some masses containing relatively higher levels of quite heavily altered ... PCBs and some masses containing somewhat lower levels of almost unaltered PCBs, with relatively little mixing between them" (p. 13); leading to the conclusion that "the water-borne PCBs ... must have been derived partly from the sediments of the upper and middle Estuary, and partly from local, outer harbor sediments" (p.24). While EPA is not in a position to fully evaluate this conclusion (documentation of the water sample analyses has never been provided to EPA, in spite of repeated requests and assurances from Aerovox that it would be provided), it is worth noting that it is consistent with EPA's findings that PCBs from the upper Estuary are being transported into the outer harbor, and would continue to be so transported throughout any period of time in which natural biodegradation might be relied upon as a substitute for remedial action.

In conclusion, EPA has made extensive efforts to consider all available information on natural biodegradation, and, along with the Department of Justice and the Massachusetts Attorney General's Office, has expended considerable effort trying to obtain from Aerovox the very information Aerovox was demanding that the government consider. EPA has concluded, upon examination of the evidence, that it could not possibly support a decision to select natural biodegradation as an alternative to a remedy for the Hot Spot. EPA will continue to consider the relevance of natural biodegradation, including any new information which may become available, for the second operable unit.

5.2 BIODEGRADATION AS A TREATMENT TECHNOLOGY

DCN #31, Section 7.7.6

> The "overview of the Bench-Scale Treatment Technology Test Program, New Bedford Harbor Feasibility Study" Ebasco Services Inc., August 1989 states that considerable research and process development is needed to implement enhanced biodegradation and more specific information is needed to compare effectiveness, implementation and cost. These arguments apply with equal force to the recommended alternatives. Handling heavy metals with incineration, in particular, requires additional research and process development prior to design. Indeed, much additional information is needed to compare the effectiveness, implementation and cost of alternatives. This is another example of the arbitrary nature of the alternative evaluation process.

DCN #31, Section 7.7.8

> The discussion of enhanced in-situ biodegradation on p.5-37 discards the consideration of the alternative prior to its development for consideration because the technology has not been successfully demonstrated in a marine environment. Contrary to law, no serious attempt is made to consider engineering methods which might make this technology feasible.

EPA RESPONSE 5.2

Natural (i.e., in situ) biodegradation is a process by which contaminants are degraded by indigenous micro-organisms without removing the contaminated medium from its location. The micro-organisms may operate in either an aerobic (oxygen) or anaerobic (oxygen-free) environment. The rate of biodegradation may be increased by nutrient addition to the contaminated medium in order to enhance the biodegradation capabilities of the indigenous microbes, or by the introduction of specially adapted (through selective cultivation or genetic engineering) micro-organisms.

Natural biodegradation as a remedial treatment process has been successfully applied to groundwater and soil contaminated with constituents other than PCBs, such as volatile and aromatic hydrocarbons. Numerous vendors offer commercial-scale bioremediation services employing natural biodegradation for these types of wastes.

Natural biodegradation of PCBs as a remedial treatment process was evaluated during the initial screening and detailed evaluation of treatment technologies for New Bedford Harbor. This work was conducted during the spring and summer of 1987 and the results were published in two reports (E.C. Jordan/Ebasco 1987 a,b). Based on the available research and state-of-the-art process development at that time, EPA concluded that: (1) there was no conclusive evidence for the occurrence and mechanisms of natural biodegradation of PCBs, and (2) natural PCB biodegradation as a remedial treatment process had not been successfully demonstrated in any environment.

Since the publication of the treatment technology reports in 1987, numerous studies have provided scientific proof that natural biodegradation of PCBs is occurring in the sediments of New Bedford Harbor and elsewhere. However, no attempt has been made to implement a field demonstration of biodegradation as a remedial process in river or harbor sediments. General Electric, the principle PRP in the PCB contamination of the Hudson River, has recently announced plans to demonstrate an in-river enhanced bioremediation system within the next two years. At the present time, however, none of the engineering obstacles for implementing this system have been addressed in the conceptual design (M. Brown, 1989).

A fundamental issue that has not been thoroughly addressed to date is the biochemical decay rates or half-lives of PCBs. Reliable estimates of the PCB half-lives are critical in determining the length of remedial time that would be required for natural processes, such as biodegradation, to remove PCBs from the sediments. Brown and Wagner (1986) have suggested that the half-life of heavily chlorinated PCBs may range from 7 to 50 years. Based on this estimate, the time required for biodegradation to reduce a sediment PCB concentration of 4,000 ppm to 50 ppm (TSCA) would be approximately 50 to 350 years. For PCB sediment concentrations in the 100,000 ppm range (measured in the Hot Spot), it would require approximately 85 to 600 years for biodegradation to reduce these concentration levels to 50 ppm. There are no known rate estimates for enhanced in situ biodegradation of PCBs in river or harbor sediments.

It is not the purpose of a CERCLA FS to promote, direct, and/or finance research and development on innovative treatment processes. While natural biodegradation of PCBs (unenhanced or enhanced) may offer the potential for an effective, low cost treatment alternative, sufficient information and data is not currently available to address key process design issues such as: the rates of biodegradation; the mechanics of nutrient delivery systems and the logistics of monitoring and/or controlling physicochemical parameters affecting microbial growth and degradation capacities in unconfined sediments; and costs. Consequently, the effectiveness, implementation and cost of natural biodegradation as a remedial treatment process could not be assessed during the Hot Spot FS and no comparisons could be made with other treatment technologies (e.g., incineration, solvent extraction) being evaluated and for which this information was available.

The lack of information and data on natural biodegradation stands in stark contrast to the abundance of available information and data on treatment technologies such as incineration, solidification, and even solvent extraction. It is a fundamentally different process to engineer a solution to immobilize metals than to "consider engineering methods with might make this technology [enhanced in situ biodegradation] feasible." The former will require additional testing to find a formulation of solidifying agents (from among the dozens currently available) to immobilize metals in incinerator ash. This is a process optimization problem. The latter will require extensive research, development and testing of prototype systems to achieve a workable solution. This is a process design problem.

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Section 5 References:

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Safe, Stephen et al. "PCBs: Structure-Function Relationships and Mechanisms of Action;" Environmental Laboratory, Department of Physiology and Pharmacology, Texas A&M University.

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Yoakum & Associates, and Balsam Environmental Consultants, 1989. "PCB Biotransformation in Aquatic Sediments: New Bedford Harbor and Other Sites." (DCN #30)

Section 6

SECTION 6.0 - NO-ACTION ALTERNATIVE/NO-ACTION RISK

6.1 NO ACTION ALTERNATIVE

DCN #1, Page 7, Paragraph 2, Comment 1

> ...It is asserted that the overall remedial strategy for New Bedford Harbor may include a no-action alternative for the upper estuary. If that is so, then I submit that dredging the hot spot is patently inconsistent with the ultimate no action remedy, unless the Agency has concluded that everything is consistent with a possible no-action alternative. Obviously, that conclusion is not rational or at least is not reasonable.

EPA RESPONSE 6.1

By choosing to divide a site into operable units, EPA has implicitly rejected the "no action" alternative for an entire site.

When EPA determines that operable units are appropriate for a site, the "no action" alternative is evaluated for each operable unit. This alternative is evaluated in a Feasibility Study to serve as a comparison for other remedial alternatives under consideration. In its study of possible remedies for the remaining portion of the New Bedford Harbor Site, EPA is evaluating a number of alternatives, including a "no action" alternative.

EPA believes that reduction of the total mass of PCBs will be consistent with any remedy likely to be chosen for the entire Harbor.

6.2 NO ACTION RISK

DCN #1, Page 6, Paragraph 4

> In chapters 6 and 7, the EPA contractor refers to the no-action alternative, but does not adequately consider that option. In fact, it is patently evident that, particularly with respect to any interim remedial action for the hot spot, the no-action alternative is the appropriate choice. First, on page 6-6, the statement is made that public health and environmental risks would not be mitigated to acceptable levels by the no-action alternative. That statement assumes that public health and environmental risks now are at unacceptable levels. The evidence is clearly to the contrary. In fact, as the EPA well knows, the PCBs have been the harbor for perhaps 40 years or more, and there is

no evidence that anybody living in and around New Bedford has ever suffered any ill effects as a result, or, for that matter, that any biota have been injured. On the contrary, the Greater New Bedford Health Effects Study demonstrates the opposite, and it also demonstrates -- according to the government -- the success of institutional controls.

EPA RESPONSE 6.2

The risk estimates for the "no action" alternative follow EPA and State guidance. The assumptions made are reasonable estimates of exposures that may occur if no action is taken at the Site. EPA considers the risk estimates based on contact with the Hot Spot sediment to be unacceptable.

Section VI of the Record of Decision Summary and Section 3 of this Responsiveness Summary provide the background and details of the risk assessment and the assumptions made. Section 3.5 discusses the Greater New Bedford Health Effects Study in greater detail.

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Section 7

SECTION 7.0 - EVALUATION OF REMEDIAL ALTERNATIVES FOR HOT SPOT

7.1 SCREENING/EVALUATION OF ALTERNATIVES

DCN #31, Page 1-17

> A far less drastic, and less potentially damaging, approach than dredging would be adequate and appropriate. Yet, such approaches have been arbitrarily eliminated from consideration by EPA without any genuine analysis.

EPA RESPONSE 7.1

Numerous comments received during the public comment period for the Hot Spot FS criticized the EPA for failing to "devote any resources to a meaningful consideration of alternatives to dredging [followed by treatment and/or disposal] as a remedy." The implied focus of these comments is that capping as an alternative [in situ] remedy was not fairly evaluated. Furthermore, comments asserted that the evaluation that was conducted lacked supporting documentation.

The Hot Spot FS was conducted in accordance with the requirements of the Superfund Amendments and Reauthorization Act (SARA) of 1986, and EPA CERCLA RI/FS guidelines. These legislative requirements and programmatic guidelines prescribe the process for conducting feasibility studies of remedial alternatives for a Superfund site. An overview of the FS process conducted for the Hot Spot is presented in Figure 4-1 of the Hot Spot FS report (E.C. Jordan/Ebasco, 1989). This process is discussed in further detail in Section VIII of the Record of Decision Summary.

7.2 EVALUATION OF CAPPING FOR THE HOT SPOT

DCN #2, Page 12, Paragraph 2, Comment 1

> The treatment of the various alternatives, particularly the evaluation portion, is uneven. The capping alternative is singled out for particularly harsh evaluation, again without supporting documentation.

DCN #2, Page 13, Comment 10

> It is unclear how the impact on the adjacent wetlands occurs.. It would seem that capping with 3 feet of sediment would ultimately increase the wetland area in the upper estuary....The idea that this "alternative is expected to cause increases in PCB mobility" is clearly contrary to

field and laboratory experience that the U.S. Army Corps has with capping (e.g., Long Island Sound, Puget Sound).

DCN #14, Page 2

AVX believes that the in place containment alternative is a comprehensive remedy which should be selected by the Agency not just for the hot spot but for the rest of the site.

EPA RESPONSE 7.2

EPA conducted the Hot Spot FS in three phases. Phase I entailed the identification, screening, and evaluation of remedial technologies. EPA then used technologies retained from these steps to develop complete remedial alternatives. Phase II consisted of the initial screening of remedial alternatives. Phase III consisted of the detailed evaluation of remedial alternatives using the nine criteria required by SARA.

In 1986 - 87, EPA conducted the identification and initial screening of remedial technologies for New Bedford Harbor. Details of this work were published in an interim report by E.C. Jordan/Ebasco (1987a). During this work, capping was identified as a potentially applicable containment or non-removal technology for the PCB and metal contaminated sediments in each of the three geographical study areas: the Hot Spot, the Estuary, and the Lower Harbor. Specific types of caps that were identified included: clay, sediment, and sand and gravel caps (natural media); fabric caps (geotextiles); and multimedia caps which combine natural and synthetic media. In addition, two other containment technologies were identified: impermeable synthetic membranes, and chemical sealants. As a result of the subsequent screening step, which considered the feasibility of implementation and the effectiveness in containing PCBs and metals, EPA retained capping for further evaluation.

EPA conducted a detailed evaluation of capping as a remedial technology during 1987. The results of this work were published in an interim report by E.C. Jordan/Ebasco (1987b). This evaluation considered the applicability of capping for each of the three geographical study areas using three major criteria: effectiveness, implementation and cost. EPA assessed the effectiveness of capping on the basis of technical reliability and potential impacts to public health and the environment. As a technology, EPA did not evaluate capping with respect to attainment of federal and state ARARs and protection of public health and the environment. Instead, the assessment of these factors was reserved for consideration of capping as a remedial alternative.

While evaluating the implementation of a capping technology, EPA considered factors relating to the technical, institutional, and administrative feasibility of installing, monitoring, and maintaining a cap.

EPA developed general cost estimates for capping in each of the three geographical study areas from cost data presented by NUS Corporation (1984).

Because capping satisfied the effectiveness, implementation, and cost criteria, EPA retained capping as an applicable technology for the three geographical study areas. Natural materials such as clean sediments, sands, and gravel were recommended for a cap. Clay caps were not recommended due to: (1) low bearing strength of in situ sediments preventing compaction of the clay; (2) high rates of erosion and scouring of unconsolidated clay; and (3) excessive length of time for clay to settle in the deeper subaqueous areas. Caps constructed from geotextiles or impermeable membranes were not considered practicable due to the logistical problems of placement, seaming, and prevention of sediment resuspension during installation operations.

EPA believed that hydraulic controls, such as sheet piles and earthen embankments or dikes, would be necessary during the installation of a cap in the Hot Spot and Estuary. The hydraulic controls would serve to isolate the contaminated sediment from the rest of the harbor system during remediation, thus facilitating construction activities while minimizing migration of contaminants.

During 1987-88, EPA combined remedial technologies retained from the detailed evaluation step into complete remedial alternatives for each of the three study areas. Details of this work and the subsequent screening of alternatives were described in an interim report by E.C. Jordan/Ebasco (1988). In accordance with SARA requirements for consideration of alternatives involving on-site containment, a capping alternative was developed for the Hot Spot. This alternative consisted of: installing an embankment around the Hot Spot; stabilizing the sediment within the embankment with sand; and installing a synthetic cap over the Hot Spot area.

EPA screened all of the remedial alternatives that were developed for the Hot Spot based on the effectiveness, implementation and cost criteria used during the detailed evaluation of remedial technologies. However, additional factors considered under the effectiveness criterion included: the ability of the alternative to meet levels or standards of control equivalent to applicable or relevant and appropriate standards, requirements, criteria, or limitations (ARARs), long-term reliability, and the potential need for replacement due to failure. As a result of the screening step, EPA eliminated the capping alternative from further consideration for the following reasons:

- o EPA anticipated significant mobilization of highly concentrated PCBs in the Hot Spot caused by dredging and other construction activities necessary during installation of a cap which would result in adverse impacts to the environment;
- o A synthetic cap and the embankments would require long-term maintenance and monitoring;
- o A cap would fail to provide for a <u>permanent</u> and <u>significant</u> reduction in the mobility, toxicity and volume of the Hot Spot sediment; and
- o EPA anticipated a moderate to high potential for future remedial action despite installation of a cap.

During the fall of 1988, the USACE conducted a pilot study of dredging and dredged material disposal at New Bedford Harbor. The results of this study indicated that under controlled conditions, contaminated sediment in the harbor could be dredged with minimal resuspension of sediment and no measurable migration of contamination beyond a 100 meter radius of dredging operations. Biota monitoring conducted during this study also showed no adverse impacts to aquatic biota from dredging activities.

As part of the USACE's Engineering Feasibility Study, an analysis of subaqueous capping was conducted. Capping effectiveness tests were conducted to determine the minimum cap thickness necessary to chemically isolate the contaminated material from the overlying water column. The test results indicated a cap thickness of 35 cm was sufficient to provide chemical isolation. It was also determined that an additional cap thickness of 20 cm was necessary to prevent penetration of burrowing organisms into the contaminated layer (Sturgis and Gunnison, 1988). The USACE recommended an initial cap thickness of 4 feet as an operational requirement in order to obtain a final cap thickness of 3 feet after consolidation. The 3-foot cap would provide added protection and allow for localized variations in the applied cap thickness (Averett and Palermo, 1989).

Based on the results of the USACE pilot study, the USACE EFS, information received from the PRPs, and a New Bedford Harbor Project Team review of the 1988 development and screening of remedial alternatives report, EPA re-examined capping as a remedial alternative for the Hot Spot.

EPA revised its development and screening of remedial alternatives for the Hot Spot in 1989 as part of the Hot Spot FS report (E.C. Jordan/Ebasco, 1989). This work is discussed further in Section 6.0 of this Responsiveness Summary. In addition to the capping alternative developed in the 1988 report (described above), EPA developed a second capping alternative. This alternative consisted of covering the contaminated sediment with a 3-foot layer of sand/silt or clean sediment, and armoring areas of the Hot Spot subject to erosion with graded rip-rap.

However, EPA eventually eliminated both capping alternatives from consideration for the Hot Spot following the screening process for the following reasons:

- Capping would require long-term monitoring and maintenance;
- Capping failed to provide for a permanent and significant reduction in the mobility, toxicity and volume of the Hot Spot sediment; and
- Despite capping, EPA anticipated a moderate to high potential for future remedial action.

EPA believes that any capping of the Hot Spot sediments is not appropriate due to the magnitude of the residual risk associated with these highly contaminated sediments. EPA is currently re-evaluating a capping alternative for the Estuary excluding the Hot Spot, and retains capping as a viable alternative for portions of the Lower Harbor. The results of this work will be presented in the Estuary and Lower Harbor/Bay FS.

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Section 7 References:

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Section 8

SECTION 8.0 - PILOT STUDY/DREDGING

8.1 PILOT STUDY OBJECTIVES

DCN #31, Page 5-7

> This statement of objectives indicates that the selection of dredging is a foregone conclusion and that no evaluation of the technology or the environmental impacts of the implementation were being undertaken....The study was conducted as a design study not as a method of evaluating dredging as and applicable remedial action alternative for the site.

DCN #35, Page 5-1

> We find that the Report does not contain adequate information or data to substantiate the claims made for the above aspects of the proposed work.

EPA RESPONSE 8.1

The Pilot Study was one component of the Corps of Engineers effort to evaluate dredging and disposal methods at the New Bedford Harbor Site. It consisted of a field demonstration of different dredges and disposal techniques, the results of which were provided to EPA and used by Ebasco/E.C. Jordan in their comprehensive feasibility study for the Hot Spot. The Pilot Study focused on critical questions concerning dredging in the heavily contaminated New Bedford environment. These questions included the following:

- What is the dredge's ability to remove the layer of contaminated sediment while minimizing the removal of additional sediment?
- What is the sediment resuspension and contaminant release at the point of dredging?

The technical objectives of the pilot study are discussed on page 5-12 of the Hot Spot FS and page 4 of the Pilot Study Interim Report.

The environmental impacts of dredging and disposal operations were evaluated through an extensive monitoring program which monitored conditions both in the immediate vicinity of the operations and throughout New Bedford Harbor. The monitoring consisted of physical, chemical and biological evaluations of harbor water quality and included an air monitoring component at the confined disposal facility.

8.2 SCALE UP OF PILOT STUDY RESULTS TO HOT SPOT

DCN #2, Page 14, Comments #12 and #13

> The report relies extensively on the results of the U.S. Army Corps of Engineers pilot dredging study to justify the selected remediation measures. Unfortunately, references to this work are generally in the form of personal communications. As such they are not subject to independent evaluation and critique....There is no rationale given as to why the pilot dredging program performed in a cove in the lower part of the upper estuary should apply to the hot spot. It would appear at first glance that the areas are substantially different. The hot spot is located in the main channel of the Acushnet River estuary, which is more subject to tidal and river flows than at the pilot study site. The PCB concentrations in the hot spot are significantly greater than those in the cove. The distance to significant wetland is closer for the hot spot than in the cove. The water depths are shallower in the vicinity of the hot spot than the pilot site. These differences raise questions to the applicability of the pilot study results for the hot spot.

DCN #31, Page 1-16

> ...The pilot study was not designed or implemented in a fashion that would generate information about he effects of dredging on resuspension and transport of contaminants from the hot spot. That information is still missing. It is, however, key to the proposed dredging program.

DCN #31, Page 1-29

> Moreover, EPA has not yet analyzed the data from the pilot dredging study to know what the overall impact of dredging will be relative to PCB fate and transport (although it is clear that given the way EPA designed the study, officials would not be able to predict that effect).

DCN #31, Page 5-8

> The location selected for the pilot dredging program raises significant questions relative to the validity of the information collected when compared to the overall objectives of the program and the applicability of the data to evaluating alternatives for remedial action in New Bedford Harbor, particularly in the "hot spot". The site of the pilot program is a totally unrepresentative of the "hot spot" area and other contaminated areas of the harbor.

DCN #31, Page 5-12

> A separate and distinct question raised by the choice of pilot location is whether dredging in the cove, with its low currents would be representative of more dynamic conditions in other portions of the upper estuary. In fact, consideration of the hydrodynamics of the upper estuary seems to be singularly lacking in the study, either as they exist nor or as they might be changed by dredging itself.

DCN #31, Page 5-26

> Regardless of the cause, the data are not sufficient to extrapolate resuspension rates in the "hot spot" area based on the results of pilot test in the cove.

DCN #31, Page 5-33

> The chemical, physical and biological databases collected during the pilot study do not support the development of dredging activities in the "hot spot" area....The government has made no effort to quantify that impact or to present a full evaluation of the potential water quality impacts of the "hot spot" dredging.

DCN #35, Page S-4

> In our view the proposed project is too difficult, too important and too costly to be based upon the limited data presented in the Report... The information presented in the Report is not sufficient to prepare the final design of the proposed hot spot project.

EPA RESPONSE 8.2

Comments relating to the cove where the Pilot Study was carried out, differences between the cove and the Hot Spot, and the applicability of data gathered during the Pilot Study to the evaluation of dredging in the Hot Spot are addressed in this reply.

The Pilot Study was designed to evaluate dredging in the upper Estuary of New Bedford Harbor. EPA understands that the cove and the Hot Spot are different. EPA expressed its recognition of the difference in the following statement, appearing on Page 5-13 of the Hot Spot FS.

> "The pilot study demonstrated USACE's procedure for estimating contaminant release was conservative for the sediment dredged during the pilot study. However,

extrapolating the results to the Hot Spot is a big step and should be performed with caution."

The information obtained during the Pilot Study that is applied directly to the evaluation of dredging in the Hot Spot is associated with the operating parameters of the dredge, estimated production rates, and sediment resuspension at the dredgehead.

The water depths in the Hot Spot and the physical characteristics of the Hot Spot sediment to be dredged are very similar to the pilot study site. A cutterhead dredge operated as during the Pilot Study (see Table 5-2 of the Hot Spot FS and Page 31 of the Pilot Study Interim Report) would be expected to attain a similar production rate with similar sediment resuspension rates in the Hot Spot.

Other characteristics of the Hot Spot and pilot study cove are discussed below.

<u>Hydrodynamic Characteristics</u>: The transport of sediment and contamination away from the point of dredging is dependant on the currents in the area where the work is going on. Under normal conditions, the currents in the Hot Spot are not strong. However, they are stronger than those in the cove and the pattern of sediment resuspension would be expected to be different.

The Engineering Feasibility Study (EFS) conducted by the Corps of Engineers included an extensive effort to evaluate hydraulic conditions in the upper Estuary and sediment migration associated with dredging and disposal operations. This effort consisted of field, laboratory and model studies. Report 2 of the EFS describes this effort, the results of which were used to estimate sediment and contaminant movement away from a dredging operation in the Hot Spot.

<u>Contaminant Levels</u>: PCB levels in the Hot Spot are much higher than in the pilot study cove. Contaminant release associated with dredging operations would be expected to be higher than during the Pilot Study. In making contaminant release estimates for the proposed Hot Spot dredging operation, the Corps of Engineers used the results of an elutriate test performed on sediment from the Hot Spot, the sediment resuspension rate at the dredgehead determined during the pilot study, and the estimated dredge operating period. The information developed in EFS Report #2 was used to estimate the transport of contaminants away from the point of dredging. The only information from the Pilot Study that is directly applied in the Hot Spot estimate is the sediment resuspension rate at the dredgehead and the

operating characteristics of the dredge. The reasons for directly applying this information are discussed below. The contaminant release estimates are in Table 5-2 of the Hot Spot FS.

Monitoring during the Pilot Study showed actual contaminant levels adjacent to the dredgehead were less than those predicted by the elutriate test. The Pilot Study provided site specific data on dredge operation, contaminant release, and sediment resuspension. The information on dredge operation and sediment resuspension were directly applied in contaminant release estimating procedures. Results of the Pilot Study did not suggest that the contaminant release estimating procedure used in the Hot Spot FS was erroneous.

The physical characteristics of sediments in the Hot Spot Area are similar to those in the pilot study cove, as is shown below. Thus, operating a cutterhead dredge as recommended in the Pilot Study Report should result in sediment resuspension rates that are approximately the same as those observed during the pilot study.

	Average Values	
	Hot Spot (1)	Pilot Study Cove(2)
Liquid Limit	113.3	119.8
Plasticity Index	46.7	50.2
Water Content	153.9	147.1
Specific Gravity	2.28	2.48
% Fines	58.2	75.8

(1) Based on 7 samples
(2) Based on 12 samples

Impacts: EPA estimates that contaminant release during Hot Spot dredging will be higher than that during the Pilot Study. However, EPA has weighed the short term increases in contaminant levels (PCBs and metals levels) in the vicinity of the operation during its evaluation of remedial alternatives under the remedy selection criteria. Dredging operations will be closely monitored to ensure that resuspension is kept to minimum in order to minimize significant increases in the release of contaminants to the Lower Harbor. The design process will examine appropriate monitoring and/or physical barriers to minimize and contain any releases.

8.3 POTENTIAL RELEASE OF NON-AQUEOUS PHASE LIQUIDS

DCN #31, Page 5-10

PCBs in sediments containing low levels of oils (including the PCBs themselves), therefore, may behave differently from PCBs in an adsorbed or dissolved stage. An associated release of NAPL from oily sediments upon dredging would not be modeled or represented adequately by consideration of suspended sediment alone and extrapolating from turbidity and suspended solids observations.

DCN #31, Page 5-28

EPA's estimate of the flux during dredging has likely been underestimated because it does not consider the oil phase that has been observed in the area where dredging is proposed.

EPA RESPONSE 8.3

The contaminant release estimates for the Hot Spot are based on elutriate tests performed on Hot Spot sediment. While the elutriate test does not directly address the contaminant level in a floating sheen, it does provide site-specific data on contaminant release. The contaminant release estimates also include a safety factor of 2 to account for variable conditions.

Surface floatable samples were taken in the vicinity of sediment sampling operations in the Hot Spot. This effort is described in EFS Report 2. The results of this sampling indicate that the surface floatable patch or oily sheen which forms when the bottom is disturbed in this area can contain high PCB concentrations. Any such releases at the dredgehead should be taken up the suction line of the dredge. However, other facets of the dredge operation (raising and lowering of spuds, movement of swing cables, workboats, etc) may result in an oily sheen on the surface. Steps can be taken to control this sheen, such as placing an oil boom around the operation. EPA will determine during the design phase the appropriate method of minimizing this particular type of potential release.

8.4 CHANGES IN ESTUARY HYDRAULICS DUE TO DREDGING

DCN # 31, Page 5-12

The pilot study and the HSFS do not take into account changes in tidal hydraulics which would be caused by dredging.

EPA RESPONSE 8.4

Report 2 of Engineering Feasibility Study addressed changes in tidal hydraulics which would result from dredging in the Upper Estuary. This evaluation indicated that removing the surface layer of contaminated sediment (up to 2 feet) would have minimal impact on tidal hydraulics. The majority of the dredging will occur in the top 2 feet of sediment, with a minimal dredging up to a depth of four feet. Refer to Figure 7 in the Record of Decision Summary (page 44) for a depiction of the limited extent of highly contaminated sediment at depths greater than 2 feet.

8.5 VOLATILIZATION OF PCBS DURING DREDGING & DISPOSAL

DCN #31, Page 5-12

Volatilization - The government has arbitrarily ignored this pathway completely in its documentation of the proposed "hot spot" remedial action.

EPA RESPONSE 8.5

EPA has considered volatilization of PCBs during its studies for the Hot Spot.

EPA has performed a number of studies to examine potential volatile emissions from dredging and disposal activities. These studies include: modeling of PCB emissions (EPA, 1987, Thibodeaux, 1989a, and Thibodeaux, 1989b); bench scale evaluations of volatile emissions from New Bedford sediment (Brannon, 1989); and ambient monitoring as part of the pilot dredging study. These documents, with the exception of the ambient monitoring as part of the Pilot Study, are in the Administrative Record. Section 2.4.3 of this document states that the ambient air monitoring report will be completed when data validation is completed. EPA has made the supporting data from this study available to the PRPs (see DCN #40).

EPA will evaluate the results of the above mentioned studies in the course of completing the pre-design studies for the dewatering facility. The Hot Spot FS did indicate that extensive air monitoring or controls may be required as part of a dewatering facility.

8.6 PILOT STUDY TOXICITY TESTING

DCN #31, Pages 5-15 and 16

> Likewise, with the toxicity testing results, it is impossible to evaluate the potential impacts of the recommended alternative without the detailed results.

EPA RESPONSE 8.6

The Pilot Study's monitoring program had the following principal objectives:

1) Gather sufficient data to address the technical questions regarding contaminant release associated with the dredging and disposal operations.

2) Protect the environment and regulate pilot study operations.

The biological monitoring (toxicity testing) was conducted to ensure that the project met the second objective. The biological monitoring was conducted to detect impacts associated with any and all contaminants in the water column.

The biological monitoring tests used during the Pilot Study were developed at EPA's Environmental Research Laboratory in Narragansett, Rhode Island. These tests included the measurement of contaminants in tissue of blue mussels, acute and chronic toxicity tests developed for the Effluent Toxicity Testing Program, and blue mussel scope of growth tests.

Pre-operational monitoring provided data on baseline contaminant concentrations in water, bioaccumulation of contaminants in mussels, and biological effects on a variety of organisms. These baseline data were used to identify contaminant concentrations and biological responses that were "acceptable" compared to existing conditions. Monitoring data collected during each operational phase of the project were compared to the baseline information to detect statistically significant and/or biologically relevant changes. During the Pilot Study, no statistically significant or biologically relevant changes were detected.

The biological monitoring effort is summarized in the Interim Pilot Study Report. Several technical papers on this subject are currently being prepared by the EPA Laboratory.

8.7 SEDIMENT RESUSPENSION DURING PILOT STUDY

DCN #31, Page 5-19

> The sediment plume surrounds the working dredge and is obviously being transported out of the cove where the experiment is being conducted.

DCN #32

> The PRPs submitted an aerial photograph of the pilot study operation taken on 11/25/89.

EPA RESPONSE 8.7

EPA evaluated sediment resuspension and transport during both the Pilot Study and the Engineering Feasibility Study (EFS). During the EFS, EPA evaluated the physical characteristics of the sediment. EPA determined that one sediment fraction was by far the slowest to settle and deposit and was the easiest to resuspend (i.e., the "mobile" fraction). This mobile fraction of the sediment comprised 28 percent of the EFS composite sample, and the percentage of this mobile fraction in the sediment varied from 1 to 60 percent in the Upper Estuary. Coarser sediment fractions comprised 72 percent of the EFS composite sample. Near-field models predicted that only a small fraction of the coarser sediments would move 100 meters from a dredging operation. The model also predicted that a large fraction of the mobile fraction suspended sediment would move beyond 100 meters of the resuspension point (i.e., dredging operation). Based on these modeling estimates, typical concentrations at a radius of 100 meters from the dredgehead would be approximately 12 mg/l above background levels, resulting in a bulk-sediment release rate estimate of 40 g/sec. Report 2 of the EFS contains a detailed discussion of this evaluation.

During the Pilot Study, the dredge operations were varied to determine operating procedures which minimized resuspension at the dredgehead. For the cutterhead dredge, operating adjustments resulted in a sediment resuspension rate of 20 g/sec, as compared the 40 g/sec estimate discussed above. EPA sampled monitoring stations along cross sections of the cove during pilot study dredging operations. EPA did not detect a well-defined plume of resuspended sediment, and conditions returned to background levels within 500 feet of the dredging operation.

The aerial photograph submitted by the PRPs was taken on November 25, 1988 between 12:00 and 12:30 p.m. On this day, dredging operations had ceased at approximately 11:30 a.m. so that the dredge's swing anchors could be moved while sufficient water was available for the work boats to operate. The plume of suspended material evident in the photo is being generated by the work boat moving the dredge and is not representative of a plume caused by the dredging operation. Moving the swing anchors required the workboats to operate at full throttle in the shallow water. The Pilot Study recommends placing swing anchors on shore to eliminate the need for this type of operation.

8.8 TURBIDITY MONITORING DURING PILOT STUDY

DCN #31, Page 5-20 and 5-21

Sediment resuspension in the immediate vicinity of the working dredges was also evaluated using turbidity data collected by Rizzo Associates personnel on two separate occasions.... Turbidity monitoring conducted within approximately 100 to 700 feet of the active dredges was performed on December 22, 1988 and January 13, 1989 from a small boat. The Matchbox and Cutterhead dredges were operating during these two data collection events. Turbidity measurements in December 1988 ranged between 5.2 and 130 NTU, and had a mean response of 34 NTU.

EPA RESPONSE 8.8

The dates the PRPs conducted monitoring (December 22, 1988 and January 13, 1989) were not days on which the dredge was being operated in order to minimize sediment resuspension. On December 22, 1988 the cutterhead dredge was excavating the Confined Aquatic Disposal (CAD) cell and was removing uncontaminated material. Operating parameters during the movement of uncontaminated material were considerably different from those when contaminated material was being removed. The production rate was 75 cy/hr for uncontaminated material as compared to 35 cy/hr for contaminated material. A higher sediment resuspension rate would be expected at the greater production rate. On January 13, 1989 construction of the CAD was underway. During this period, EPA detected higher suspended solid levels in the cove. These higher suspended solid levels were caused by the CAD operation and not by the dredging operation.

The term "turbidity" represents a complex composite of several variables that collectively influence the optical properties of water. Attempts to correlate turbidity with the weight concentration of suspended matter (suspended solids) are often impractical. EPA monitored total suspended solids (TSS) during the pilot study because this measure more accurately reflected contaminant release directly associated with the dredging and disposal operations. The Pilot Study showed that TSS levels in close proximity to the dredge were elevated and diminished further away from the operation in relation to background levels measured outside the cove.

8.9 DREDGE PRODUCTION

DCN #31, Page 5-24

The cutterhead dredge resuspended contaminated sediment at an average rate of 21.6 g/s, at a mean production of 20 cy/hr... The 35 cy/hr production rate represents a 75% increase over that attained during the pilot study.

DCN #31, Page 5-26 - 5-27

A detailed analysis of the relationship between dredge production rate and sediment resuspension rate should be prepared by the ACOE to evaluate the potential sediment resuspension rate during full scale implementation.

DCN #31, Page 5-30

If the government believes that a production rate of 35 cy/hr is attainable in the "hot spot" sediments, then an analysis and explanation supporting the increased production rate over the pilot scale rate is required in order to demonstrate its validity.

DCN #35, Page 8

In general, the data presented in the Report do not substantiate the conclusions reached in the Report, in regard to sediment resuspension at the dredgehead..

DCN #35, Page 14

The average of the values for resuspension rate R in this table is 21.6, not 17.3. A plot of R versus ladder swing speed (S) values in Table A-1 is shown in Figure A-1 in the Appendix. This plot indicates no strong correlation between S and R.

EPA RESPONSE 8.9

Various dredge operating parameters (swing speed, depth of cut, cutterhead rotation, pump operation) influence the level of sediment resuspension at the dredgehead. These operating parameters were constantly adjusted during the early stages of dredge operation to determine a combination which minimized sediment resuspension. For the cutterhead dredge, EPA computed sediment resuspension rates from 4 days of operation which were representative of the recommended operating procedures. (The four days of operation were Nov. 22, 23, 25 and Dec. 17, 1988.) The average resuspension rate for these four days was 12.1 grams per second. EPA also computed sediment resuspension rates for January 8, 1989 when the cutterhead dredgehead was rotated at full RPM, approximately twice the speed of the other days. This increase in rotation resulted in a higher sediment resuspension rate, which brought the overall resuspension average up to 21.6 grams per second. Due to the variability in the factors which influence sediment resuspension at the dredgehead, EPA used a resuspension rate of 20 grams per second for the contaminant release estimates contained in the Hot Spot FS.

Based on the Pilot Study results, EPA determined that two passes of the dredge were necessary to reduce sediment PCB levels to approximately 10 ppm. The cutterhead dredge attempted to remove the top 1.5 - 2 feet of material in the initial pass over an area. During the second pass, the dredge attempted to just skim the surface and remove very little additional material. EPA estimates the production rate for the first pass of the cutterhead dredge to be 35 cubic yards of sediment removed per hour of dredge operation. When the second pass is taken into account, the production rate for a specific area decreases to 20 cubic yards of sediment removed per hour of dredge operation. The sediment resuspension rates determined from the pilot study were based on sampling carried out while the top layer of sediment was being removed, at an approximate production rate of 35 cubic yards per hour, the same production rate recommended in the Hot Spot FS. Several passes over an area would be required in areas where contamination of 4,000 ppm or greater extends below a depth of 2 feet.

8.10 POTENTIAL PROBLEM SITUATIONS DURING DREDGING

DCN #31, Page 5-32

The June 1989 ACOE report did not address the levels of PCBs released during pilot study problem situations and this potential needs to be evaluated for "hot spot" dredging.

EPA RESPONSE 8.10

One significant result of the Pilot Study was that problem areas relating to dredge operation were identified.

Monitoring of 4 harbor stations took place during the first four days of operation for each dredge. Monitoring at an array of stations within the pilot study cove took place during the first three days of operation for each dredge. These monitoring efforts involved hourly sampling at each station during the dredge's operating period and covered periods when operational problems were encountered. The monitoring effort detected elevated contaminant levels on several occasions which were related to operational problems. These problems were associated with the matchbox dredge's depth of cut and the placement of diffusers placement during CAD.

8.11 POTENTIAL ENVIRONMENTAL IMPACTS DURING PILOT STUDY

DCN #31, Page 1-5

Already the EPA's pilot dredging program alone has destroyed acres of wetlands a situation for which a private developer would be castigated and sanctioned by the EPA itself.

DCN #31, Page 1-31

First, EPA claimed that it needed no permits or approvals to conduct its pilot dredging program. That program resulted in dredging and destruction of acres of wetland, banks and submerged lands to create the CDF and the CAD units.... EPA plans to leave the CDF in place forever.

DCN #31, Page 5-33

Chemical, physical and biological monitoring during the dredging pilot study demonstrated measurable and possibly very significant environmental impacts to the study area during pilot dredging.

EPA RESPONSE 8.11

Many state and federal action levels are exceeded and the environment is negatively impacted by the existing conditions in New Bedford Harbor. EPA considered short term releases of contaminants in the vicinity of the dredging and disposal operations and concluded that these releases were unavoidable. However, EPA attempted to minimize any increases in contaminant levels being released to the Lower Harbor. Monitoring during pilot study operations detected only 4 occasions when contaminant levels exceeded the critical levels established prior to the start of operations. These short term spikes in contaminant levels were associated with obvious operational problems or extreme weather events. Monitoring of the entire operational period of the pilot study did not indicate that operations resulted in a significant increase in the release of contaminants to the lower harbor.

As part of the Pilot Study, EPA constructed a Confined Disposal Facility (CDF) along the New Bedford shoreline. EPA also dredged within a small cove in the Acushnet River Estuary. The CDF was partially constructed below the high water line. Approximately 700 feet of disturbed shoreline and 50,000 square feet of subtidal area was lost. The dredging disturbed approximately 100,000 square feet of the estuary bottom. Both of these areas are within the confines of the Superfund Site containing bottom sediments with elevated levels of PCBs. No vegetation or valuable habitat resources were lost. The appropriate state and federal regulatory agencies participated in the planning and approval process which led to the Pilot Study.

The Hot Spot remedial action will make use of the CDF area for support operations. The final disposition of the CDF, as well as that of the treated sediment, will be addressed by the second operable unit for the Site.

8.12 PRP ACCESS TO PILOT STUDY SITE

DCN #31, Page 5-36

> On behalf of the defendants Rizzo Associates formally requested access to the Site during the pilot dredging program to collect samples and to observe actual dredging operations and the decision criteria process. We were denied...

EPA RESPONSE 8.12

Representatives of the PRPs were on site observing operations during most of the Pilot Study, beginning the CDF construction phase and continuing through dredging operations. PRP representatives were also allowed to sample effluent from the CDF. The log of visitors to the Site documents their presence and activities. The only PRP request for Site access that the EPA denied was their request to place an individual on the operating dredges. EPA could not honor this request because it was not feasible due to the limited space available on the dredges, and the varying number of government personnel involved in monitoring the dredge. PRP representatives were allowed, and in fact did, observe dredging operations from an adjacent boat that operated in close proximity to the operating dredge.

8.13 CONFINED DISPOSAL FACILITY (CDF)

DCN #31, Page 1-16

.... There is no data that has been collected by the government and released to the public showing that the CDF is stable. Visual observation suggests that significant subsidence and erosion has occurred, jeopardizing the integrity of the structure.

DCN #31, Page 5-37

The mud wave impact and its resolution should be incorporated into any design/construction discussion for CDFs in water....There is no mention of the significant mud wave problems that developed during the construction of the existing CDF that resulted in significant construction delays, as well as decreased storage capacity in the cell.

DCN #31, Page 5-38

There must be real and sound basis for any conclusion that the dike is stable... Significant re-construction must be completed before it is used as part of a remedial action, and there is a real question about the CDF's integrity based on defendants observations.

DCN #35, Page 7

Possibly the fact that the CDF never attained the desired ponding depth of 2 ft due to the excessive leakage through the sheet pile dividing wall would explain this poorer performance.

DCN #35, Page 7

High polymer performance can only be expected with a carefully designed system that provides for rapid mixing and flocculation filled by settling of the coagulated solids.... The report does not contain sufficient data or analyses to demonstrate that the CDF, as now constituted, can provide adequate effluent quality for future dredging projects.

"Several concrete foundations located within the primary cell also had a positive effect by increasing detention time and minimizing resuspension within the cell." This comment is not explained.... "The size of the secondary cell can likely be reduced in future CDFs." No data is given to support this statement.

EPA RESPONSE 8.13

In-water dike construction associated with the Confined Disposal Facility is addressed on Page 35 of the Interim Pilot Study Report. The USACE recommendation for in-water dike construction is that the pilot study specifications be followed and that modification to the specified construction procedures used during the pilot study be avoided.

Poor foundation conditions necessitated the placement of a high strength geotextile along the in-water dike alignment and the construction of this section of dike in stages. Various monitoring devices were installed to indicate when strength gain in the underlying sediments was sufficient to allow the second stage of dike construction to begin and when to allow the facility to be filled with dredged material. These monitoring devices included strain gages on the geotextile, settlement plates, piezometers and inclinometers. The most critical point, from the standpoint of dike stability, was immediately after the completion of dike construction. The CDF was filled to elevation +10 MLW during late December 1988 and early January 1989, which is the period when the design capacity of the CDF was utilized. Currently the CDF contains dredged material to elevation +6.0 MLW with very little water on the surface.

Since the completion of the pilot study the dike slopes on the interior of the CDF have suffered some erosion due to heavy rainfall events and the uniformly graded material used on the interior dike slopes. However, this erosion has not effected the structural integrity of the dike or resulted in the release of dredged material or leachate to the harbor.

The CDF will have to be upgraded prior to use during Hot Spot remediation, but upgrading the CDF will not involve a major construction effort. Dike slopes will require regrading and the addition of some material to bring them up to the design cross section.

During the pilot study a polymer was added to the flow at the weir between the primary and the secondary cells to promote additional settling of suspended material in the secondary cell prior to the discharge of the water back to the estuary. The Interim Pilot study Report describes the procedure and the results obtained. The polymer was selected as result of testing performed during the EFS. These tests and the design methodology for the system are described in EFS Report 7.

The structures within the CDF had a positive effect on settling. They acted as baffle dikes and prevented short circuiting of the flow within the CDF and they broke up currents created by the wind.

8.14 PCB REMOVAL

DCN #31, Page 5-40

The Report (page 23) states that in Area 1 the cutterhead dredge left the bottom with an average of 84 ppm PCB after one pass with an average cut of 1.5 feet. In Area 2 the same dredge left the bottom with an average 10 ppm PCB after an average cut of 1.1 feet using a second or sweep pass. No data is presented which substantiates this statement or which indicates how representative this data is.

DCN #35, Page S-2

The report (page 23) states that in Area 1 the cutterhead dredge left the bottom with an average of 84 ppm PCB after one pass with an average cut of 1.5 ft. In Area 2 the same dredge left the bottom with an average 10 ppm PCB after an average cut of 1.1 using a second or sweep pass. No data is presented which substantiate this statement....The Report (pages 46 and 47) refers to preliminary sediment sampling and sampling for removal efficiency. It states that this data will then be used in determining the removal efficiency of each dredge. If this data is not in the report, how can the Report state that the dredges are efficient in removal?

DCN #35, Page S-3

Adequate cross sections and mass balances for solids and PCB are a difficult but a critical measurement and control requirement for this project... The report neither describes data collection procedures nor contains data substantiating recovery of PCB-contaminated materials.

DCN #35, Page 13

Use of a second pass over the area is less productive than a cleanup swing as noted above. The depth of the cutter in the cleanup pass as well as the digging pass is important....The three dredges used were able to effectively remove the contaminated sediment while minimizing the amount of sediment removed. The Report gives no data which supports these statements....The Report states that sediment PCB levels at 0.5 ft. intervals for a 3 ft. depth are contained in Appendix 5. Appendix 5 is not in the Report. These data, along with after dredging cores of similar depth, are critical to the measurement of the effectiveness of dredging in removing PCB-contaminated materials. The spacing of the cores is not indicated. Core spacing is, of course, a critical aspect of a sampling program.

DCN #35, Page 21

Grid size is not a given... Sampling of the top 3 inches is not adequate since this would not show any redistribution of contaminated material into deeper portions of the bottom.

EPA RESPONSE 8.14

EPA determined that two passes of the cutterhead dredge are required to reduce contaminant levels in the sediment. This determination is based on sampling conducted immediately upon completion of dredging in areas 1 and 2. Contaminant levels in these two areas prior to dredging were similar, as is shown below:

AVERAGE PCB LEVEL (ppm)

Horizon	Area 1	Area 2
0-6"	226	385
6-12"	12	34
12-18"	8	5
18-24"	4	1

The cutterhead dredge made one pass through area 1 and removed on average 1.5 feet of sediment. The average PCB level in the remaining sediment was 8 ppm. In area 2, the dredge made two passes and removed on average 1.1 feet of sediment. The average PCB level in area 2 in the remaining sediment was less than 10 ppm. EPA determined the quantity of sediment removed and the thickness of the sediment layer by comparing hydrographic surveys taken prior to dredging and immediately after dredging. EPA determined contaminant levels by analyzing sediment cores. In area 1, 32 samples were taken from the (125 foot by 170 foot) area and were composited into 8 samples for analysis. The sediment analyzed was taken from the top 3 inch horizon. In area 2, 16 samples were taken from the (60 foot by 90 foot) area and were composited into 4 samples for analysis. The sediment analyzed was taken from the top 3 inch horizon.

The Interim Pilot Study Report contains a typical cross section of the dredging areas. EPA prepared numerous cross sections to determine the quantity of material removed.

8.15 DREDGING AND OPERATIONS

DCN #35, Page S-2

The report contains no indication that a high precision survey system was used in the study....The report contains no data on cutterhead depth.... Survey procedures used in the Pilot Study are not described, nor are cross section data presented to confirm the estimated quantities.

DCN #35, Page 4

Swing Speed, Rate of advance, Cutterhead RPM, Dredge pump, Depth of cut... The Report does not discus what rates for the factors in the above list comprise Standard Dredging Procedure. We do not believe that the Report presents sufficient data to justify the setting of any values for the factors listed.... General Dredging practice also does not provide the appropriate approach to the work or the degree of precision required.

DCN #35, Page 5

The correct approach cannot be made without specially fitted equipment and adequate procedures to assure cleanup without excess dredging quantities.... It is interesting to observe that no value is given for the depth of cut "when developing plans for the Upper Estuary."

DCN #35, Page 10

Contaminant release rates are related strongly to suspended solids generation. The data contained in the Report do not, however, substantiate that slow speeds result in lower suspended solids generation

DCN #35, Page 13

The report makes no mention of cutter depth while dredging or whether cutter depth was adjusted for tide changes.... A depth of cut of 2 ft. with a 2 ft. advance proved to be the most effective. There are no data in the Report support this statement.

DCN #35, Page 14

> The Report does not indicate how dredge slurry flow rates or slurry solids concentrations were measured..... while minimizing the amount of material removed. The Report presents no data which substantiate this statement.

DCN #35, Page 21

> The data contained in the Report does not demonstrate the capability to dredge to the precision implied in the Report. Accurate, precise surveys are critical to a project of this type.

EPA RESPONSE 8.15

Dredge Position: The Pilot Study dredging areas were located within a cove in close proximity to the shoreline. EPA established visual ranges on shore to define the limits of the dredging areas. EPA used these visual ranges to position the dredge.

Cutterhead Location: Operating the cutterhead dredge with the dredgehead lowered two feet into the sediment was the most effective way to minimize sediment resuspension. This setting was used for the first pass through both areas 1 and 2. For the second pass through area 2, the cutterhead was set at the sediment/water interface to attempt to skim the sediment surface to remove minimal additional material.

Hydrographic Surveys and Sediment Sampling: EPA performed hydrographic surveys of the dredging areas on the following dates:

September 12, 1988	Survey of areas 1 and 2. Dredging began on November 21 in area 1.
December 15, 1988	Survey of area 1 after contaminated sediment had been removed. Dredging was completed on December 13.
January 6, 1989	Survey of area 1 after CAD cell had been excavated. Dredging was completed on January 4.
January 24, 1989	Survey of areas 1 and 2 after contaminated sediment was removed from area 2 and placed in area 1. Dredging was completed on January 20.

June 22, 1989	Survey of areas 1 and 2 after capping and consolidation of CAD cell. Capping completed on February 11.

A Corps of Engineers crew performed the surveys using a vessel with electronic positioning equipment to establish horizontal and vertical control.

EPA sampled dredging areas immediately after dredging on the dates listed below. Samples analyzed were taken from the top 3 inches of sediment after dredging.

November 30, 1988	Sampling of cutterhead work area in area 1. Dredging was completed on November 29.
December 7, 1988	Sampling of Mudcat work area in area 1. Dredging was completed on December 6.
December 14, 1988	Sampling of Matchbox work area in area 1. Dredging was completed on December 13.
January 23, 1989	Sampling of Matchbox work area in area 2. Dredging was completed on January 13.
January 24, 1989	Sampling of cutterhead work area in area 2. Dredging completed on January 20.

Cutterhead dredge operating procedures are discussed generally on pages 21-24 of the Interim Pilot Study Report. Appendix 1, page 1-2 provides a more detailed discussion of dredge operation. The following information is included in this Appendix:

Swing Speed: Swing Speed was kept steady and as slow as possible
Cutterhead Rotation: 50% of maximum (approximately 20 RPM)
Depth of Cut: (i.e., dredgehead location) 2 feet
Width of Cut: 60 feet
Dredge Pump: Operated at maximum RPM

EPA did not correlate swing speed to sediment resuspension. Information from other projects indicated that with all other factors held constant, slower swing speed resulted in lower sediment resuspension at the dredgehead. Visual observation of sediment resuspension during the (early stages) of the pilot study confirmed this information. EPA instructed the dredge operator to minimize the swing speed. Measured swing speeds during the pilot study ranged from

0.34 to 0.58 feet per second, with an average of 0.50 feet per second. The dredge had the capability of attaining a swing speed of 1.3 feet per second. Maintaining a steady and slow swing speed is dependent on the operator's abilities. EPA does not consider the variation in swing speeds during the pilot study to be significant.

EPA measured the flow rate and density of the slurry discharged into the CDF with a flowmeter and density gauge in the pipeline prior to the discharge point.

8.16 OTHER CONTAMINANTS

DCN #31, Page 1-2

Unresolved concerns range from the resuspension of heavy metals from the sediments into the water column...

DCN #31, Page 1-14

Dredging will simply aggravate the problem posed by the real pollutants: disturbance of the harbor sediments through dredging will resuspend metals and PAHs in the water, where they can do the most harm.

DCN #31, Page 1-15

Second, as indicated above, EPA and the Corps of Engineers have failed to properly address the problem of resuspension of a multitude of contaminants during the dredging and handling of sediments.

EPA RESPONSE 8.16

EPA conducted monitoring during the Pilot Study to detect the release of heavy metals. Contaminant levels were elevated in close proximity to the operation, but the levels returned to background levels within approximately 500 feet of the dredge. Monitoring did not detect the release of metals to the Lower Harbor. The estimating procedure for metals released during dredging is the same as that for PCBs. Release estimates for the Hot Spot are in Table 5-2 of the Hot Spot FS. Levels of metals in pilot study cove are similar to those in the Hot Spot.

The physical disturbances due to dredging which result in PCB release will also release other contaminants. Operating the dredge in the manner recommended by the Pilot Study will minimize sediment resuspension and all contaminant release. The dredging operations will be monitored for releases of PCBs and other contaminants.

EPA has not ignored other contaminants. PCB levels in the sediment and water column far exceed those of other contaminants.

8.17 COST ESTIMATES

DCN #35, Page S-3

No estimate is provided for scaling up the pilot study rental rate to a cost for the hot spot or full-scale dredging programs.

DCN #35, Page 6

The daily rental rate quoted is not particularly relevant as a measure of the dredging cost of the proposed hot spot or full scale dredging programs.... The daily rental rate presented in the Report for dredge, operator and attendant plant bears little relationship to the dredging program.... Further we have a substantial concern that a conventional unit price, lump sum or performance orientated contract is appropriate for the proposed work.

EPA RESPONSE 8.17

Cost estimates for conceptual remedial actions including dredging were included in Report 11 of the Engineering Feasibility Study. The Interim Pilot Study Report did not include any detailed cost estimates.

Detailed plans and specifications and cost estimates will be developed during design. The Corps of Engineers design process calls for "Value Engineering," and cost effective options to achieve the goals of the project will be examined. The design process also includes an assessment of the most appropriate type of bidding for all portions of the project.

8.18 EQUIPMENT AVAILABILITY

DCN #35, Page 5

The proposed work is so unique and cost projected by the Report so high that a common dredge is the least important factor in a successful job.

DCN #35, Page 12

The report describes the difficulties encountered with positioning anchors, their holding capabilities in the bed materials and the turbidity generated form anchor handling. This issue is an example of the problems resulting from the use of "conventional, readily available equipment"... Placing anchors on the shore as recommended in the report would involve the rehandling of relatively long anchor wires as the dredge progresses and relocates itself. This long wire would be a source of turbidity generation. We believe that an analysis is required to demonstrate the feasibility of this proposal.

EPA RESPONSE 8.18

The Pilot Study evaluated three dredges, one of which was a specialty dredge (Matchbox) designed to remove contaminated sediments. These three dredges were selected after a thorough review of available equipment by a team of experts.

EPA recommended an appropriately sized cutterhead dredge for dredging in New Bedford Harbor based on its documented performance. The cutterhead dredge is a standard piece of equipment that is readily available from numerous contractors.

The Interim Pilot Study Report recommended that swing anchors be placed on shore to address the problems of holding capability and sediment resuspension from anchor handling. Modifications to the cutterhead dredge which eliminate the need for swing anchors would be acceptable, but EPA does not consider this necessary.

8.19 CONFINED AQUATIC DISPOSAL (CAD)

DCN #35, Page S-3

Five months after the placement of the CAD cap the Report does not contain cross sections showing the cap condition.

DCN #35, Page 9

The one set of cross sections relating to the CAD development are presented in Figure 3-3, page 3-4 of the Report. These sections are not fully annotated. These sections do not confirm that a 2 to 3 ft. cap has been placed in the CAD.

DCN #35, Page 21

Page 40, paragraph 4 of the Report states that "contaminated sediment was successfully placed in a CAD cell and capped during the Pilot Study." This statement is inconsistent with the fact that sampling work is to be done during the second phase to determine if a cap has been successfully placed.

EPA RESPONSE 8.19

EPA did not consider Contained Aquatic Disposal (CAD) for the Hot Spot operable unit. The final Pilot Study report will contain a detailed discussion of CAD, which will be evaluated as a potential disposal method in the Feasibility Study for the remainder of the Upper Estuary and Harbor.

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Section 8 References

E.C. Jordan Co./Ebasco, 1989. "Hot Spot Feasibility Study, New Bedford Harbor."

Averett, Daniel E. and Otis, Mark J., 1990. "New Bedford Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternative; Reports 1 - 12, Technical Reports EL-88-15, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Otis, Mark J., 1989. "New Bedford Harbor Superfund Pilot Study: Evaluation of Dredging and Dredged Materials Disposal," Interim Report.

Section 9

SECTION 9.0 - UNIT PROCESSES

9.1 SYSTEM INPUT RATES

9.1.1 SEDIMENT FLOW INTO THE CDF

DCN #31, Page 6-1

The report states that the USACE recommended operating the cutterhead dredge at a flow rate of 2,100 gallons per minute for an operating time of 3 to 4 hours per day. At 2,100 gpm, 4 hours of pumping per day yields 504,000 gallons per day. However, the process flow diagram indicates that incoming flow rate from the dredging operation is 690,000 gallons per day, a 37 percent increase over the maximum USACE recommended value. This flow rate would cause additional resuspension.

EPA RESPONSE 9.1.1

The flow rate shown on the process flow diagram in the Hot Spot FS is incorrect. However, the calculations in the FS are based on a dredge production rate of 35 cy/hr recommended by the USACE (Page 7-13 of the Hot Spot FS).

9.1.2 ESTIMATE OF SOLIDS

DCN #31, Page 6-2

The report does not address the impact and expense of running the system for a longer period as a result of the dredging operation taking longer because of higher bulk volume of dredged sediments with higher in-situ sediment solids content.

EPA RESPONSE 9.1.2

For the purpose of the Hot Spot FS, an estimated sediment moisture content of 50 percent by weight was used as the basis for determining the "dry" tons of solids requiring removal and subsequent treatment. Any variations from the assumed moisture content of 50 percent would have minimal impact, if any, on the length of the dredging operation. Variables such as inclement weather and clogging of the dredgehead due to bottom debris would have a greater impact.

9.1.3 SOLIDS FROM PILOT STUDY

DCN #31, Page 6-3

The report states that approximately 6,500 cy of material from the pilot study is already in the CDF. However, when the "hot spot" sediments that are placed in the CDF are dredged out to be dewatered and incinerated, the existing 6,500 cy, as well as the solids that have eroded from the CDF walls and the existing CDF walls that will come into contact or mix with dredged sediments, will be mixed with the "hot spot" sediments.

EPA RESPONSE 9.1.3

The 6,500 cy of material placed in the CDF during the pilot study has been covered with a layer of clean dredge material. The ultimate disposition of this material, which has an average PCB concentration of 100 ppm, is currently being addressed in the second operable unit FS.

Mixing of the Hot Spot sediment with the underlying material in the CDF is expected to be minimal during discharge to the CDF. The material placed in the CDF during the pilot study has consolidated leaving a hard-packed surface. Discharge of dredged Hot Spot sediment through a diffuser is not expected to erode the structural integrity of this surface.

EPA inspected the walls of the CDF and found that erosion is minimal and can easily be repaired.

Removal of the Hot Spot sediment from the CDF with minimal removal of additional material underlying the Hot Spot sediment and walls of the CDF can be facilitated by a number of operational controls. Topographical surveying of the current bottom elevation of the CDF can provide the means to control the vertical cut of the dredge/excavating equipment during removal of the Hot Spot sediment. Lining the inside of the CDF walls with a synthetic liner would not only minimize erosion of the CDF walls but would also serve as a physical barrier to mixing of the CDF and Hot Spot material.

The design phase will examine the most appropriate use of the CDF, particularly for sediment dewatering. Upgrading of the facility, as well as the potential use of (enclosed) tank structures, will be examined in detail during design.

9.2 SEDIMENT DEWATERING

DCN #31, Page 6-11

The conceptual design leaves several operating features for the sediment dewatering process undefined:

- o Storage of dewatered sediment prior to incineration is not addressed;
- o Required/available storage capacity;
- o Control features for run-on/run-off control;
- o Controls for segregation and avoidance of cross-contamination and air emissions;
- o Odors and air emissions from accumulated sediment.

DCN #31, Page 6-13

The feasibility study does not address how equipment sizing and operating costs for dewatering were adjusted to accommodate dewatering from 20% to 62% solids... Additional water content entering the incinerator has a dramatic impact on operating cost, as that water will be evaporated. Sensitivity of energy consumption in the incinerator to performance of the dewatering unit should be addressed in the feasibility study, particularly as it relates to incinerator performance and the operational costs.

DCN #31, Page 6-15

An extremely brief report on the dewatering pilot test was provided. It did not appear to consider the variations in sediment characteristics over many of the different operating conditions that may be encountered.

<u>EPA RESPONSE 9.2</u>

The need and available capacity for storage of dewatered sediment prior to incineration was not explicitly addressed in the Hot Spot FS. This operational feature will be addressed in detail during the remedial design phase where all problems relating to integration of batch and continuous process flows for a range of operating conditions and contingencies are typically resolved.

Conceptually, solutions to the problem of dewatered sediment storage may include the following steps:

- EPA could store dewatered sediment short-term in the immediate vicinity of the incinerator. Sediment dewatered to 50% solids would have sufficient strength to be handled by a front end loader and piled in a staging area. An area approximately 1,600 square feet located between the dewatering system and the incinerator could accommodate up to 5 days of dewatered sediment;

- EPA could provide multiple dewatering units to serve as backup in case of mechanical failures; and/or

- EPA could remove sediment from the CDF on an intermittent basis, with the frequency determined by the rate-limiting step in the process train (e.g., dewatering or incineration).

Operational controls for run-on/run-off, segregation and avoidance of cross-contamination, and odor emission controls from accumulated sediment are important and will be addressed in detail during the remedial design phase.

Conventional technologies, such as the plate and frame press or the belt filter press, have been used successfully and dependably to dewater a wide range of industrial and municipal wastewater treatment facility sludges for years. Existing performance data indicates that these technologies can achieve a solids cake having greater than 50 percent solids by weight (E.C. Jordan/Ebasco, 1987a). On this basis, a bench and/or pilot scale test of dewatering was not included in the original bench scale treatment technology program conducted by Ebasco/E.C. Jordan. For the purpose of evaluating a feasible remedial alternative, it was assumed that the Hot Spot sediment could be dewatered to a 50 percent solids cake for subsequent treatment.

During the course of the bench scale program, Ebasco/E.C. Jordan was approached by O.H. Materials, a vendor of the recessed chamber plate and frame dewatering technology. O.H. Materials offered to conduct a single bench scale test of their technology to determine the dewaterability of New Bedford Harbor sediment. The scope of services was limited to a simple physical analysis and one test conducted on a sample of New Bedford Harbor sediment. No chemical tests were conducted to determine the mass balance for PCBs. This work scope was not intended to be as rigorous as the test protocols set forth in the bench scale treatment program work plan (E.C. Jordan/Ebasco, 1987b) for the other treatment technologies tested.

The results of the test conducted by O.H. Materials and reported in their three page memorandum confirmed the ability of conventional dewatering technologies to achieve a dewatered solids cake (using New Bedford Harbor sediments) in excess of 50 percent solids.

The unit cost presented in the Hot Spot FS for dewatering New Bedford Harbor sediment was based on a 38 percent solids influent compressed to a 62 percent solids cake. Recent discussion with O.H. Materials indicated that the unit cost to dewater a 25 percent solids influent to a 50 percent solids cake would be less because the final percent of cake solids is less. The filter press on which the cost estimates for New Bedford Harbor were based is capable of handling an influent stream from 1 percent solids on up. The controlling factor is the quantity and percent solids of the cake (C. Bearden, 1989). Based on these comments, the unit price for dewatering used in the Hot Spot FS is conservative.

The estimate for incineration cost is developed on a per ton basis assuming 50 percent solids in the filter cake. Additional fuel costs associated with burning a lower solids content feed (e.g., 45 percent) are minimal. The cost to process an additional 10 percent of feed by volume, due to a lower solids content, is covered by the 20 percent contingency used in the cost estimates. The added fuel requirement for processing one tone of 45 percent solids as opposed to one ton of 50 percent solids is approximately 1.5 gallons of No. 2 fuel. This cost is minimal in comparison to the overall process costs of $374/ton.

The tests performed by O.H. Materials indicated a need for the addition of a small amount of lime (0.05 lb/gal) to condition the sediment for dewatering. Lime added at this rate will increase the amount of material to be incinerated by approximately 1.2 percent. In addition to improving sediment dewatering characteristics, the lime will have several beneficial impacts. Lime will help to neutralize hydrogen chloride (HCL) produced by the incineration of chlorinated organics and will therefore help to reduce the acid gas content of the primary combustion chamber effluent stream. Lime will also raise the pH of the ash, which will decrease the mobility of the residual metals. Overall, addition of lime as a conditioning agent will have minimal cost impact and should improve the incineration and handling characteristics of the sediment.

9.3 INCINERATION

9.3.1 FEASIBILITY

DCN #31, Page 6-24

It is not certain what provisions are made for the incinerator feed cake to avoid PCB volatilization, due to atmospheric contact, to eliminate dust problems, and to avoid rainfall and rehydration.... Proper conveyance of "hot spot" soils feed to the incinerator has not been demonstrated.

DCN #31, Page 6-25

> These gases [HCl, HBr, Br2, HF] are extremely corrosive in the scrubber systems, resulting in frequent prolonged system shutdowns . The low fusion temperatures of alkali metal salts lead to extreme fouling problems on the heat transfer surfaces. It is not apparent that these issues have been considered in the evaluation of the incineration alternative for this site.

DCN #31, Page 6-26

> There has been no bench scale testing of incineration to generate data on sediment combustion characteristics, ash content, or potential air emissions.

EPA RESPONSE 9.3.1

The fundamental concept of incineration is the utilization of extreme heat to volatilize and destroy organic compounds. An afterburner on the incineration unit is used to destroy the volatilized contaminants. The residual ash is tested to ensure that the material no longer meets the definition of a hazardous waste.

Incineration has been used at several hazardous waste sites nationwide. A transportable rotary kiln was used at the Nyanza Site in Ashland, Massachusetts; the Naval Construction Battalion Center in Gulfport, Mississippi; and the Times Beach dioxin Site in Times Beach, Missouri. Other sites that have used incineration include: the Arco Swanson River oil fields in the Kenai Wildlife Refuge, Kenai Peninsula, Alaska; Tillie Lewis Food Cannery Site in Stockton, California; the Cornhusker Army Ammunition Plant in Grand Island, Nebraska; the Louisiana Army Ammunition Plant in Shreveport, Louisiana.

Incineration has been demonstrated for PCB wastes ranging from dilute aqueous streams (<1 ppm PCB) to pure PCB oil waste streams. Incinerators can handle materials ranging from 0 to 100 percent moisture content, 0 to 100 percent ash content, 0 to 60 percent chlorine content, and materials with heating values ranging from 0 to 25,000 BTU/lb. The feasibility of incineration for the New Bedford Harbor sediment is not in question. Specific equipment configuration and operating parameters will be examined during the design phase. For the purposes of the Hot Spot FS, worst case conditions were assumed (i.e., low BTU/lb heating value and high chlorine and moisture content).

The incinerator systems on the market today have extensive provisions for handling PCB contaminated materials or other materials with high organic chlorine content. These units are constructed of corrosion resistant materials throughout and routinely handle materials with higher chlorine content than is present in the Hot Spot sediment. Since there will be no boiler components, fouling of heat transfer surfaces will not be an issue. Additional options include enclosed feed systems (operated under negative pressure to minimize fugitive emissions). Since dewatered sediment will have a cake-like consistency, conveyance should prove relatively straight forward.

The Resource Conservation and Recovery Act (RCRA) incineration standards, which the incinerator will be required to follow, specify three major requirements regarding incinerator performance:

a. The principal organic hazardous constituents (POHCs) must be destroyed and/or removed to an efficiency of 99.99%. POHCs are hazardous organic substances present in the waste which are representative of those constituents most difficult to burn and most abundant in the waste. The incinerator's performance in treating POHCs is considered indicative of overall performance in treating other wastes.

b. The particulate emissions must not exceed 180 milligrams per dry standard cubic meter, corrected to 7% oxygen in the stack gas. Compliance with the performance standard for control of particulate emissions is documented by measuring the particulate load in the stack gas during the trial burn.

c. Gaseous hydrogen chloride (HCL) emissions must be reduced either to 1.8 kilograms per hour or at a removal efficiency of 99%. Compliance with the performance standard for control of gaseous HCL emission is documented during the trial burn by measuring HCL in the stack gas.

There will also be requirements for waste analysis (before and after treatment), operation of the incinerator, monitoring, and inspections. Additionally, the incinerator will be required to comply with any additional provisions under the Toxic Substances Control Act (e.g., 99.9999% destruction removal efficiency).

Two published technical articles on incineration of contaminated soils describe the results of process and emissions sampling and analysis.

a. The first article, "Incineration of a Chemically Contaminated Synthetic Soil Matrix Using a Pilot-Scale Rotary Kiln System," describes the results of two tests conducted on soils containing a range of concentrations of contaminants typical of those found at Superfund sites. A complete series of pilot-scale test burns was conducted and a battery of process and emission samples were collected and analyzed. The results from two tests indicate that the ash (treated soil) produced by incineration met proposed regulatory limits for all organics and metals, whereas the untreated soil exceeded the regulatory limits for organics.

b. The second article, "ENSCO MWP-2000 Transportable Incinerator," describes the results of several tests using three full-scale mobile rotary kiln incinerators. The first trial burns were compliance tests for a State of Florida air permit. The kiln was tested at a feed rate of 9,600 pounds per hour of solids over a wide range of operating conditions. Combustion efficiency was consistently above 99.9%, and particulate emission levels were less than one-half of the regulatory (RCRA) standard. The second set of three trial burns included PCB-contaminated soils and liquid PCBs. Destruction and removal efficiencies (DREs) were consistently higher than the Toxic Substances Control Act (TSCA) requirement of 99.9999%. Particulate loading was approximately one-quarter to one-half of the RCRA standard. The third set of trial burns was conducted at a site in Mississippi with dioxin-contaminated soil. The dioxin surrogates hexachloroethane and trichlorobenzene showed DREs greater than 99.9999%, the RCRA standard for dioxin. The particulate emission levels were less than one-half the RCRA standard.

Incineration of municipal solid waste (MSW) is a different process than high temperature incineration of soils or sediment. Although dioxins are sometimes generated in low levels by MSW incinerators, dioxins have not generally been reported from testing of hazardous waste and PCB incinerators. There are several reasons why dioxins are not usually detected in hazardous waste incinerators, such as the one that has been selected in this remedy for the Hot Spot sediment.

a. <u>Hazardous waste incinerators are designed to optimize mixing of the waste material with combustion air.</u> Oxygen is required to destroy organics. When sufficient oxygen is not available, organics may only be partially destroyed, resulting in emissions of compounds such as dioxins. Hazardous waste incinerators are operated with excess oxygen and are designed to maximize the mixing of oxygen with the waste gases. This design ensures efficient combustion and reduces the likelihood that dioxins will be generated.

b. Hazardous waste incinerators are designed with long gaseous residence times. When compounds are volatilized (evaporated) from the soil, the resulting gas is mixed with oxygen at high temperatures to oxidize the organics. Hazardous waste incinerators are designed to have at least two seconds of mixing time for the gases at extremely high temperatures. This residence time is sufficient to minimize the amount of uncombusted organics released in the incinerator emissions.

c. Hazardous waste incinerators are designed to operate at high temperatures. In addition to the long residence times for the gases, incinerators are also designed to operate at high temperatures in the primary combustion zone. Gases are exposed to temperatures in excess of 2,000 degrees fahrenheit for two seconds in PCB incinerators. These high temperatures, combined with good mixing and sufficient residence time in the primary combustion chamber, destroy any organics in the incinerator emissions. The sophisticated design considerations employed for hazardous waste incinerators minimize the possibility of emissions not meeting all of the regulatory standards.

Test burn results and final plans and specifications developed during the design phase, as well as results of sampling during actual incinerator operation, are public information. EPA will share this information with the public as it becomes available. EPA will provide this information to the local information repository, as well as present the findings to the Community Work Group, which has been the major vehicle for community involvement over the past several years.

EPA is aware of the desirability of minimizing impacts, such as noise, from remedial activities. However, a certain degree of disruption is unavoidable with any construction activities. The design process will attempt to minimize any short term disruptive impacts.

Once the design process is completed, the contract for conducting the sediment dredging and incineration will go out for bid. Once all of the bids are evaluated, the contract will be awarded. The contractor that has been awarded the contract will bring an incinerator on-site to treat the contaminated Hot Spot sediments. The contractor will be required to conduct a "trial burn" on-site to confirm that the equipment is capable of meeting the performance standard of decontaminating the sediments and meeting all air pollution control requirements. Only after the contractor has demonstrated that it is capable of meeting all performance standards and control requirements will the contractor be given approval to proceed with incinerating the (remaining) Hot Spot sediments.

9.3.2 SCRUBBER WATER DISCHARGE

DCN #31, Page 6-10

The fly ash solids will contain heavy metals, metal oxides and hydroxides. There has been no testing of fly ash characteristics, leaching potential for metals, and of effective water treatment for removal of metals prior to discharge.

EPA RESPONSE 9.3.2

During the design phase, EPA will conduct testing on the treated sediment (i.e., fly ash solids) to determine the levels of metals remaining in the ash and their leachability. EPA will conduct the Toxicity Characteristic Leaching Procedure (TCLP) test on the ash generated during the test burn to determine the need for solidification. See Section 9.3.4 below for further discussion of ash solidification.

The scrubber water from the incinerator will be treated using a lime or caustic additive. The addition of a basic (i.e., opposite of acidic) material serves to neutralize the chlorine in solution and also tends to precipitate metals. (Most metals have minimum solubility at a pH of 8.5 to 11.0.) The neutralized scrubber water will be temporarily held in a storage tank to allow settling of precipitated solids and will be reused. Solids removed from the tank could be mixed with the CDF sediments or solidified separately. Since these solids will have a high pH, they will readily solidify. The lime used to neutralize the scrubber water would have beneficial effects on solidification and would reduce the need to condition the sediments prior to dewatering.

9.3.3 AIR POLLUTION CONTROL

DCN #31, Page 6-28

> There has been no testing of fly ash or air emissions to develop test data for selection of the air emission control system. The effect of volatile toxic metal emissions on ambient air quality should be evaluated. Chemicals will be required for scrubbing towers or venturi scrubbers as considered in the FS. Chemical storage is not completely addressed in the report from operational or contingency points of view. Handling of fly ash from dry precipitators or baghouses is not described in any detail.

EPA RESPONSE 9.3.3

Equipment used for air pollution control is designed to achieve a high level of particulate, acid gas, and volatile metals removal. Typical values are less than 0.08 grains/dscf of particulate (required by regulations); greater than 99 percent acid gas removal; and greater than 99 percent volatile metals removal (for lead and arsenic). The specific type of equipment to achieve these levels will be specified in the design phase, examined during the test burn, and verified during the trial burn.

Solids collected in the scrubber and the particulate control devices are referred to as fly ash. Fly ash will be handled with the rest of the solid effluent. It will stored or solidified, if necessary. Handling characteristics are similar to those of the treated sediment.

9.3.4 SOLIDIFICATION OF ASH

DCN #31, Page 6-29

> The disposal of the ash is a critical element of the overall treatment system and the disposition of the final end product should be reconciled prior to the recommendation and design of an overall remedial action system.

EPA RESPONSE 9.3.4

There has been no testing conducted to verify the performance of solidification on incinerator ash from treating the Hot Spot sediments. However, solidification has been demonstrated as an effective treatment for a wide variety of metals in a variety of matrices. The incinerated sediment from New Bedford Harbor is expected to provide a good homogeneous matrix for the subsequent handling and treatment of residual metals. Bench- and/or pilot-scale tests will be conducted on incinerated New Bedford Harbor sediments during the design phase to select and confirm the performance of solidification agents for immobilizing metals in the ash residue.

A major reason for conducting the test burn on the contaminated sediments is to characterize the incinerator ash, as well as to specify the appropriate combination of emissions controls. Since the contaminated sediments contain elevated levels of metals which are not destroyed by the incineration process, extensive sampling will be conducted to determine the levels of contaminants and how they behave both before and after treatment. If the treated material fails the TCLP leaching test (used to determine whether or not a material is considered to be a hazardous waste under RCRA), additional treatment (i.e., solidification) will be required for the treated sediment.

EPA assumes that the treated sediment will be considered a hazardous waste under RCRA, due to the level of metals present. This assumption will be verified by the test burn results, as well as by confirmatory sampling that will be required as the incineration process proceeds. The sediment that is dredged for treatment will be solidified and stored temporarily, and its ultimate disposition will be addressed in the second operable unit for the Site.

9.4 COST ESTIMATES

DCN #31, Page 6-30

The following is a partial list of items for which it is not clear that costs were included in the HSFS estimate or for which the cost analysis was incomplete for the incineration alternative:

- Screening of oversized solids before mechanical dewatering;
- Excess capacity in solids filters to handle upsets and variable performance in the CDF;
- Chemical storage facilities and operating costs for chemical addition; ....
- Operating expense to dewater and process sludge from water treatment system;
- Adequate quantity of activated carbon in the water treatment system for removal of PCBs;

- Equipment and operating expenses for removal of solids from CDF primary and secondary cells;
- Cost estimates for secondary dewatering and handling of dewatered sediments for the 6,500 cubic yards of solids already in the CDF from pilot operations;
- Adequate processing capacity in mechanical dewatering to handle incoming sludge at 15 to 20 percent solids;
- Increased operating expense for longer cycle times to process sludge quantity based on limitation of water flux rate;
- Storage facilities for dewatered sludge including controls for runoff, leachate, odors and fugitive emissions;
- The cost estimates for incineration of dewatered sediments for the 6,500 cubic yards of solids already in the CDF from pilot operations;
- Incineration system sizing to accommodate additional moisture content in dewatered solids and maintain design processing rate for dry solids;
- Fuel delivery and storage facilities;
- Allowance for additional fuel if dewatering does not achieve 50% solids and contingency for market fluctuations in pricing;
- Cost estimates for solidification of incinerator ash for the 6,500 cubic yards of solids already in the CDF from pilot operations;
- The cost of the formulation that would actually be utilized for the solidification of incinerator ash;
- Disposal of fly ash as hazardous waste if solidification cannot meet treatment standards;

- o Greater quantity of solids for processing through the CDF, dewatering, incineration and solidification because of low estimate of in-situ sediment moisture content;

- o Utilities and services....

DCN #31, Page 6-35

> EPA, in developing its cost estimate, used a series of optimistic assumptions relative to the system characteristics and operating parameter values.... A realistic sensitivity analysis and cost analysis of the system has not been prepared. As a result, the estimated cost of implementation is significantly underestimated and the system conceptualization may be faulty.

DCN #31, Page 6-38

> Numerous items have been listed for which the potential costs have not been evaluated in the HSFS. When these potential impacts on the cost are combined and the impacts compounded through the recommended system, it is demonstrated that the potential cost of the system could exceed $30 or $40 million.

EPA RESPONSE 9.4

EPA CERCLA RI/FS guidance prescribes that cost estimates for remedial alternative evaluation consider direct capital costs (e.g., equipment, labor, and materials necessary to implement the alternative), indirect capital costs (e.g., engineering, legal and licensing, contingencies), and annual costs (e.g., post-construction operation and maintenance). Furthermore, these cost estimates are expected to be accurate within +50 percent to -30 percent.

For the purposes of an FS, only the major components of a remedial alternative are identified for cost estimation. Costs associated with specific items such as: screening of oversized solids prior to mechanical dewatering; increase operating expense for longer cycle times to process sludge; and actual solidification formulation [for immobilizing metals]; and utilities and services such as city water storage, employee lunch room/washrooms, will all be addressed in the design phase.

In assessing cost sensitivity, the contribution of each major component to the total cost of a remedial alternative is considered. For example, sediment dewatering and water treatment collectively account for 11.3 percent of the total cost of the incineration alternative. Therefore, wide variations in the specific assumptions used to estimate these costs would not substantially impact the overall remedial cost.

Incineration accounts for 39.8 percent of the overall remedial cost. The unit price of $374/ton is based on information collected from other full scale incinerator applications. In general, costs for these other applications included excavation and disposal of the ash. The cost estimate for incineration used in the Hot Spot FS includes the following specific items: feed system, monitoring systems, health and safety program, laboratory and office facilities, [incinerator] control systems, air pollution control systems, ash handling, fuel storage and handling, feed storage area, electrical subsystems, and scrubber water handling and treatment.

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<u>Section 9 References</u>:

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E.C. Jordan Co./Ebasco, 1987a. "Detailed Analysis of Remedial Technologies for the New Bedford Harbor Feasibility Study;" prepared by E.C. Jordan Co. for EPA.

E.C. Jordan Co./Ebasco, 1987b. "Request for Proposals for Bench Testing of Selected Technologies for PCB Destruction/Detoxification: New Bedford Harbor Feasibility Study;" prepared by E.C. Jordan Co. for EPA.

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Section 10

SECTION 10.0 - EVALUATION OF ALTERNATIVE TREATMENT TECHNOLOGIES

10.1 ALTERNATIVE TECHNOLOGIES

DCN #31, Page 7-11, Section 7.7.4

Numerous technologies considered for implementation and some that were pilot or bench-scale tested, such as alkali metal dechlorination, were eliminated from consideration due to lack of historical implementation or full-scale pilot testing. This is contrary to EPA's own policy of technology innovation and the law, relied on by the Agency to support cleanups at a number of other Massachusetts Superfund sites. A decision to eliminate these alternatives should have been made before the bench and pilot tests since the criteria for their elimination was not related to the results of the tests. New Bedford Harbor should not have been utilized by the government for experimentation with technologies, after the agency excluded them from review, since this was costly and unrelated to New Bedford Harbor cleanup.

DCN #31, Page 7-12, Section 7.7.9

Other in-situ technologies are likewise dismissed out of hand without any serious consideration of their potential merits.

DCN #31, Page 7-23, Section 7.9.26

The overview of the bench-scale technology test program discusses the five technologies that were bench-tested:

- o in-situ vitrification
- o KPEG
- o dewatering
- o biodegradation
- o B.E.S.T. solvent extraction

This report states that test were used to determine the effectiveness and potential material handling problems and to define the costs estimates for each method. In reviewing this document with other EPA documents, it is apparent that in situ vitrification, KPEG, biodegradation and B.E.S.T. were all eliminated for reasons that could have been or were identified prior to the initiation of the bench-scale test. Therefore, these tests did not provide any data that either verified the feasibility and applicability of the technology for New Bedford Harbor or helped to refine the cost estimates.

EPA RESPONSE 10.1

Remedial alternatives consist of combinations of technology types and process options that form a series of response actions necessary to achieve the remedial objectives developed for a site problem. The Superfund Amendments (SARA) direct EPA to select a remedial action that utilizes permanent solutions and alternative treatment technologies or resource technologies to the maximum extent practicable.

EPA identified, screened, and evaluated treatment technologies for New Bedford Harbor in accordance with SARA requirements and CERCLA RI/FS Guidelines. The methodology and results of this work are described in detail in numerous published reports (E.C. Jordan Co./Ebasco, 1987a,b,c; 1989a,b).

EPA identified sixty sediment and water treatment process options in the five major technology types identified for New Bedford Harbor: physical, chemical, thermal, biological, and in situ treatment (Table 5-1, E.C. Jordan/Ebasco, 1989a). EPA screened these technologies with respect to their applicability to treating PCBs and/or metals in sediment and/or water matrices, and whether they were technically implementable. As a result of this screening step, the initial list of sixty treatment technologies was reduced to eleven (Figure 5-2, E.C. Jordan Co./Ebasco, 1989a).

EPA conducted an evaluation of the remaining eleven treatment technologies to assess the effectiveness, the level of development (i.e., the readiness of the technology for full-scale implementation at the anticipated time of completion for the New Bedford Harbor FS), and to obtain refined cost estimates of these treatment technologies for the site and waste specific conditions present at New Bedford Harbor. EPA uses available data and information coupled with best engineering judgement to determine the effectiveness, implementation, and cost in its detailed evaluation of technologies for a CERCLA FS. Available information and performance data for many of these technologies looked promising for New Bedford given the site and/or waste specific characteristics found there. However, much of this information and data was generated from earlier stages of technology development and did not necessarily reflect advances in process development which had occurred at the time these technologies were being evaluated for New Bedford.

Therefore, EPA conducted the bench-scale treatment program to ensure that any remedial alternatives incorporating treatment technologies reflected state-of-the-art information and information date specific to New Bedford Harbor. The results of this test program were used to determine:

- the effectiveness of the treatment technologies on treating PCB and metal contaminated sediment and water from New Bedford Harbor;
- potential material handling problems and process rate limiting features that might develop during scale up of the technology at New Bedford Harbor;
- refined cost estimates for treating New Bedford Harbor sediment.

Four of the eleven treatment technologies were selected for the bench-scale test program: in situ vitrification, the KPEG process (alkali metal dechlorination), advanced (aerobic) biodegradation, and the B.E.S.T. process (solvent extraction). Details on the selection of these technologies are reported in E.C. Jordan/Ebasco, 1989b. A fifth treatment technology, dewatering, was included in the program under a different arrangement described in Section 9 of this Responsiveness Summary.

The results of this bench test program and how they were used in the Hot Spot FS are reported in detail E.C. Jordan/Ebasco, 1989a,b.

10.2 SOLVENT EXTRACTION (B.E.S.T. PROCESS)

10.2.1 TOXICITY OF TEA

DCN #31, Page 7-13, Section 7.7.13

The B.E.S.T. extraction solvent, TEA is toxic by ingestion and inhalation and has caused liver and kidney damage in exposed animals. The solvent could have adverse health effects on workers. These facts were arbitrarily excluded from the HSFS.

EPA RESPONSE 10.2.1

The health exposure effects for TEA (triethylamine) have been extensively investigated. TEA has been characterized as mildly toxic by ingestion and skin contact, and mildly toxic by inhalation (Sax and Lewis, 1984). No carcinogenic properties have ever been found. TEA can be detected by smell at extremely low concentrations, below one part per million. The characteristic that allows TEA to be detected by smell at very low concentrations is similar to most amines and to ammonia. The Occupational Safety and Health Administration's (OSHA) permissible exposure limit and time weighted average (PEL/TWA) is 25 ppm, two orders of magnitude higher than the level at which TEA is detected by smell.

Toxicity studies have been conducted with TEA on laboratory rats by the National Institute for Occupational Safety and Health in Cincinnati, Ohio. No adverse effects were observed in rats exposed to 250 ppm TEA vapor for six hours per day, five days per week, for six months. When TEA levels were raised to 1,000 ppm for six hours per day for ten days, the rats showed damage to mucous membranes in nasal passages, trachea and lungs. Other laboratory experiments testing the effects of TEA inhalation have shown an LCLo (lowest published lethal concentration) of 1000 ppm for four hours for both guinea pigs and rats (Sax and Lewis, 1984).

Comparison of the threshold for smell, the PEL/TWA, and the laboratory experimental data indicates that fugitive TEA emissions would become noticeable to workers long before permissible exposure or health threatening levels had been reached.

Laboratory experiments testing the effects of ingestion of TEA have shown LD50 (lethal dose 50% kill) values of 460 mg/kg (body weight) and 546 mg/kg for the rat and mouse, respectively (Sax and Lewis, 1984). This rate indicates that a significant quantity of pure TEA would have to be ingested by an average 70 kg adult to be life-threatening.

In practical terms, the B.E.S.T. system is designed to operate as a closed system such that no TEA is released into the air as air emissions or becomes available for direct contact with equipment operators. In addition, operators and maintenance personnel would receive extensive training on the safety related aspects of handling TEA and the potential health impacts of TEA exposure. Minimum protective equipment consisting of boots, overalls, hard hats and goggles that would be worn by all personnel when working on the site within the BEST unit perimeter. Personnel actually working on the unit could be required to wear breathing protection as an additional safeguard against possible fugitive releases of TEA.

Finally, EPA did not select the B.E.S.T. technology for this operable unit.

10.2.2 PILOT TESTING OF NEW PROCESS HARDWARE

DCN #31, Page 7-13, Section 7.7.15

> Although the RCC B.E.S.T. process has operated at a demonstration scale at a Savannah, Georgia superfund site, its operation and extraction efficiency using the new washer-drier equipment has not been proven at either the pilot or commercial scale... Similarly, it is not clear that the solids handling problems are minimized using the washer-drier equipment because the time required for settling the fine particles from the harbor sediments could be quite long, necessitating numerous washer-driers to achieve the required capacity.

DCN #31, Page 7-14, Section 7.7.16

> Many of the problems noted in the CF Systems tests using liquid propane should be anticipated with the RCC B.E.S.T. process. This is particularly true since the B.E.S.T. evaluation was only done at the bench scale and problems specific to the harbor sediment such as solids handling, solids carryover and PCB accumulation would not have been observed except in the pilot plant or commercial scale operation.

EPA RESPONSE 10.2.2

Resources Conservation Company's (RCC) B.E.S.T. extraction process using triethylamine (TEA) solvent has been successfully demonstrated on a pilot-scale at a Savannah, Georgia superfund site. This demonstration utilized RCC's prototype 100-ton-per-day multistage treatment unit. RCC's bench test protocols, which were used to evaluate the treatability of New Bedford Harbor sediment, were developed to simulate the process dynamics of their prototype unit.

Currently, RCC is pilot-testing a different process hardware system using Littleford rotary washer-dryer units. These units are readily available and are used extensively in the chemical processing industry. One major advantage of this processing system is that sediment-solvent mixing is more uniform, thereby increasing the extraction efficiency per stage (or wash cycle). In addition, the sediment is not moved from one reaction stage to the next (as it was in the prototype system) which simplifies material handling.

Within the last month, RCC has completed a pilot-scale demonstration of their new process hardware system at a Superfund site in Greenville, Ohio. A ten gallon Littleford unit was used to treat PCB contaminated soils. This ten gallon unit is the same unit used by Littleford to pilot-test operational and design parameters prior to full scale implementation. The results of RCC's tests at the Greenville site indicated that soils contaminated with 150 ppm PCBs were reduced to less than 5 ppm PCBs using the new process system (Weimer, 1989).

Application of this new process system at New Bedford Harbor would require additional pilot-scale tests to develop operating and design data for configuring a B.E.S.T. treatment unit for treating New Bedford Harbor sediments.

As noted in EPA Response 10.2.1, EPA did not select the B.E.S.T. technology for this operable unit. Doubts as to the (full-scale) reliability for the heavily contaminated Hot Spot sediments contributed to EPA's selection of incineration over solvent extraction.

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Section 10 References:

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Sax, Irving N., and Richard Lewis, Sr. Dangerous Properties of Industrial Materials. Seventh Edition, Volume III. (Van Nostrand Reinhold, New York). 1984.

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ATTACHMENT A

CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES CONDUCTED AT THE NEW BEDFORD HARBOR SUPERFUND SITE

- Fall 1982 - EPA prepared a Community Relations Plan based on interviews with local officials and residents.
- December 8, 1982 - Public meeting held to explain Superfund process. Speakers from EPA, DEQE and MA Department of Public Health.
- February 9, 1983 - EPA distributed copies of the Remedial Action Master Plan (RAMP) report to the New Bedford Site mailing list.
- February 14, 1983 - EPA held a 30-day public comment period on the RAMP concluding on March 14, 1983.
- May 18, 1983 - EPA held a public meeting to update residents about harbor investigation activities.
- December 20, 1983 - EPA distributed an information fact sheet and update to the site mailing list describing studies to be performed.
- February 1984 - EPA began distributing monthly progress reports in English and Portuguese to the site mailing list. These reports were sent every month through October 1984.
- March 8, 1984 - EPA held a public meeting to update the public on site cleanup activities.
- June 18, 1984 - EPA held a public informational meeting on environmental issues in Southeastern Massachusetts.
- June 1984 - EPA distributed pamphlets to public and private schools in New Bedford, Acushnet, and Fairhaven describing PCBs and areas to avoid to prevent exposure to contaminants in the New Bedford harbor area.
- July 18, 1984 - EPA distributed a copy of the Remedial Action Master Plan (RAMP) Responsiveness Summary to the site mailing list.
- July 27, 1984 - EPA issued a press release stating that EPA would post warning signs in the harbor area.
- August 8, 1984 - EPA issued a press release announcing that a public meeting would be held September 7 to discuss contamination and cleanup plans for the estuary.

- August 22, 1984 - EPA held a public meeting to explain Hot Spot cleanup options.

- August 23, 1984 - EPA began a public comment period concluding on January 15, 1985 to provide an opportunity for public comment on Hot Spot cleanup options.

- August 1984 - EPA conducted interviews with leaders of the Portuguese community to determine how better to inform and involve the Portuguese community. Copies of a Portuguese version of the PCB pamphlet distributed.

- September 7, 1984 - EPA held a public meeting to discuss cleanup plans for the estuary. THe meeting was held at the Portuguese community center and translated into Portuguese.

- September 12, 1984 - EPA held an open house to explain cleanup options for the Estuary.

- September 27, 1984 - EPA issued a press release announcing a public hearing on October 25 and a public comment period on Hot Spot cleanup options.

- October 1984 - EPA distributed a mailing in Portuguese explaining cleanup options and opportunities for public comment.

- October 25, 1984 - EPA held a public hearing on cleanup options.

- October 4, 1985 - EPA issued a press release announcing a public meeting on October 17 to explain the Focused Feasibility Study (FFS).

- October 17, 1985 - EPA held a public meeting to explain the FFS.

- October 28, 1985 - EPA issued a press release announcing the authorization of funds to conduct the Pilot Study (FFS) at the New Bedford Harbor Site.

- September 17, 1986 - EPA issued a press release announcing the distribution and availability of a project management plan for remedial activities at the site.

- April 13, 1987 - EPA issued a press release announcing a public meeting on April 30 to discuss studies underway for the estuary and harbor, including the risk assessment.

- October 1987 - New Bedford Community Work Group (CWG) formed to participate in harbor cleanup decisions, monitor the remedial process and site investigations, and represent community concerns to federal and state agencies addressing harbor cleanup. The CWG has been meeting regularly since it was formed. EPA and DEP representatives regularly attend CWG meetings and provide status reports and presentations on harbor studies.

- April 7, 1988 - EPA conducted a public groundbreaking ceremony to announce the beginning of construction of the Confined Disposal Facility (CDF).

- August 26, 1988 - EPA conducted a field trip to the Site to provide an opportunity for members of the public to learn about the Superfund Innovative Technology Evaluation (SITE) demonstration program.

- November 22, 1988 - EPA issued a press release announcing that the CWG was awarded a $50,000 Technical Assistance Grant (TAG) from the EPA.

- November 29, 1988 - EPA issued a press release announcing two (2) open houses on December 2 and 3 to view pilot study dredging and disposal activities.

- July 28, 1989 - EPA issued a press release announcing that an August 3 public meeting would be held to present Hot Spot cleanup options. The release also announced that a public comment period would take place from August 4 through September 1, 1989.

- August 3, 1989 - EPA held a public meeting on the FS and Proposed Plan for the Hot Spot Study Area.

- August 16, 1989 - EPA held a public hearing on the FS and Proposed Plan for the Hot Spot Study Area.

- August 17, 1989 - EPA issued a press release announcing that an additional public hearing would be held on August 22 and the public comment period on Hot Spot cleanup options would be extended through October 2, 1989.

- August 22, 1989 - EPA held an additional public hearing to hear PRP cleanup options to address harbor contamination.

- September 25, 1989 - EPA held an additional public hearing to hear questions from the CWG and general public regarding Hot Spot cleanup options.

- October 2, 1989 - EPA issued a press release announcing the extension of the public comment period through October 16, 1989.