THIRD FIVE-YEAR REVIEW REPORT FOR NEW BEDFORD HARBOR SUPERFUND SITE BRISTOL COUNTY, MASSACHUSETTS

Prepared by

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Region 1
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SEAFOOD TISSUE RISK UPDATE MEMO

LIST OF ACRONYMS

AAL	Allowable Ambient Limit
AAR	After Action Report
AED	EPA's Office of Research & Development, Atlantic Ecology Division Laboratory in Narragansett, Rhode Island
ARAR	Applicable and Relevant and Appropriate Requirement
ARRA	American Recovery and Reinvestment Act
AWQC	Ambient Water Quality Criteria
CAA	Clean Air Act
CAD	Confined Aquatic Disposal
CalEPA	State of California Environmental Protection Agency
CDE	Cornell Dubilier Electronics, Inc.
CDF	Confined Disposal Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CIP	Community Involvement Plan
CSF	Cancer Slope Factor
CSO	Combined Sewer Overflow
CWA	Clean Water Act
cy	cubic yard(s)
DPA	Designated Port Area
EA	Early Action
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Difference (documents changes to a ROD)
FDA	Food and Drug Administration
FFE	Focused Feasibility Evaluation
FS	Feasibility Study
FYR	Five-Year Review
HDC	New Bedford Harbor Development Commission
IA	Inter-Agency Agreement

ICs	Institutional Controls
IRIS	Integrated Risk Information System
IUR	Inhalation Unit Risk
LHCC	Lower Harbor CAD Cell
LTM	Long Term Monitoring
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MassDPH	Massachusetts Department of Public Health
MassDMF	Massachusetts Department of Marine Fisheries
MHW	Mean High Water
MOA	Memorandum of Agreement
NBH	New Bedford Harbor
NCP	National Contingency Plan
NLD	North Lobe Dredging
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List (EPA's list of Superfund sites)
NRD	Natural Resource Damage(s)
NRWQC	National Recommended Water Quality Criteria
NTCRA	Non-Time Critical Removal Action
NWS	North of Wood Street
OL	Organic Layer
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response (EPA)
OU	Operable Unit
PAHs	Polyaromatic Hydrocarbons
PCB	Poly-chlorinated Biphenyl
PETS	Public Exposure Tracking System
ppb	parts per billion
ppm	parts per million

PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RI/FS	Remedial Investigation/Feasibility Study
RfD	Reference Dose
ROD	Record of Decision
RPM	Remedial Project Manager
SER	State Enhanced Remedy
SFO	Oral Cancer Slope Factor
TCL	Target Cleanup Level
TEF	Toxicity Equivalency Factor
TOC	Total Organic Carbon
TSCA	Toxic Substance Control Act
USACE	U.S. Army Corps of Engineers
VOCs	Volatile Organic Carbons
WHG	Woods Hole Group

EXECUTIVE SUMMARY

This is the third Five-Year Review (FYR) for the New Bedford Harbor Superfund Site (the Site) located in New Bedford, Bristol County, Massachusetts covering the years 2010 through 2015. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR was the signing of the previous FYR on 9/30/2010. This Five-Year Review is for the entire Site (Operable Units One, Two and Three). The United States Environmental Protection Agency (EPA), Region I, conducted this review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c), 42 U.S.C. § 9621(c); National Contingency Plan (NCP), 40 C.F.R. § 300.400(f)(4)(ii); and it is consistent with OSWER Directive 9355.7-03B-P (June 2001).

EPA has segmented the 18,000 acre Site into three operable units (OUs). OU1 covers the Upper and Lower Harbors and an interim action in the Outer Harbor, with a Record of Decision (ROD) issued in 1998 (EPA, 1998) (and modified to date by five Explanations of Significant Differences (ESDs) issued in 2001 (ESD1), 2002 (ESD2), 2010 (ESD3), 2011 (ESD4) and 2015 (ESD5)) (EPA, 2001; EPA, 2002; EPA, 2010; EPA, 2011; EPA, 2015c). The OU1 remedy, as modified by the ESDs, includes removal of roughly 900,000 cubic yards (cy) of PCB-contaminated sediment and disposal of this sediment off-site or in a Confined Aquatic Disposal Cell being constructed in the Lower Harbor. In addition, a small volume of contaminated sediment is disposed in the Pilot confined disposal facility (CDF) that was constructed on the shoreline in the Upper Harbor in 1988. OU2 addressed an area characterized as the "Hot Spot" sediment, generally located in a five acre area near the former Aerovox facility in the Upper Harbor defined by sediment containing PCB levels above 4,000 ppm. The Hot Spot ROD was issued in 1990 (modified by two ESDs issued in 1992 and 1995), an Amended ROD was issued in 1999, and the Hot Spot remedy was completed in 2000 (EPA, 1990, 1992, 1995, 1999, 2000). One of the Hot Spot areas, designated as Area B, was not dredged during the Hot Spot dredging operations due to its proximity to submerged high voltage power lines serving the City of New Bedford. This area will be addressed under OU1. All excavated OU2 contaminated sediment was disposed in a licensed off-site disposal facility. OU3 encompasses the entire 17,000 acre Outer Harbor area; a ROD for OU3 has not yet been issued. However, localized areas of PCB-contaminated sediment located just outside the hurricane barrier in OU3 were capped as an interim remedy under OU1.

The most significant activity that occurred during this FYR period is the entry of a Supplemental Consent Decree to the 1992 Consent Decree (through two reopener clauses) with AVX Corp., whose corporate predecessor, Aerovox Corp., owned and operated the former Aerovox facility, the primary source of PCB contamination in the harbor (EPA, 2013c). In September 2013, the U.S. District Court approved a landmark $366.25 million cash-out settlement which will be used to fund the remaining cleanup of the Site. Due to prior limitations in Superfund funding (which had typically been $15 million per year for this Site), the project was expected to take another 40 years. With this settlement, this project will be accelerated to be substantially completed within 5 to 7 years.

To summarize this Five-Year Review, EPA continues to expect the Upper and Lower Harbor OU1 remedy to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks have been, or are being, controlled to the maximum extent practicable. As described further below, the three exposure pathways of concern are: 1) consumption of local PCB-contaminated seafood, 2) dermal contact with, or accidental ingestion of, PCB-contaminated shoreline sediment, and 3) ecological risks due to the highly contaminated sediment and sediment pore water at the Site.

Based on annual seafood monitoring performed by the Massachusetts Department of Environmental Protection (MassDEP) since 2003, EPA determined that, based on CERCLA risk standards, the state fishing ban issued in 1979 was not sufficiently protective regarding the human consumption of certain species of fish and shellfish in particular areas of the harbor. In 2010 and 2015, EPA issued more stringent seafood consumption recommendations to augment the 1979 fishing restrictions, including more stringent guidance for nursing mothers, women of child-bearing age, and children. In 2015, EPA issued the "*New Bedford Harbor Superfund Site Community Involvement Plan and Institutional Control Plan for Seafood Consumption*," which formalizes the specific steps EPA has taken and will continue to take to implement the institutional controls for local seafood consumption and collaborate with others to reduce consumption of local PCB-contaminated seafood. EPA is performing outreach and education, consistent with the Plan, to inform the community of local seafood consumption health risks and our seafood consumption advisory recommendations. Despite these efforts, given the 18,000 acre size of the Site, coupled with the area's cultural diversity and reliance on local fishing, complete control of PCB-contaminated seafood consumption will continue to be problematic until the risk-based site-specific PCB level for seafood is reached. Institutional controls, outreach and education shall continue until protective levels for PCBs in local seafood are consistently achieved throughout the Site.

EPA has taken actions to minimize dermal contact/incidental ingestion risks from PCB-contaminated shoreline areas. Accelerated cleanups were performed in 2001, 2002/2003 and in 2005 to remediate the highest priority residential and public access areas at the Site along the Acushnet River north of the Wood Street bridge. To control remaining dermal contact/incidental ingestion risks until full remediation occurs, EPA will continue to use shoreline fencing and signage, as appropriate. As a result of the recent settlement, EPA has now initiated planning for intertidal remediation efforts to address remaining dermal contact/incidental ingestion risks. By the end of 2015, EPA will have completed a sampling program covering the intertidal areas of both the Upper and Lower Harbor areas for delineation and remediation planning. Priority intertidal remediation efforts are expected to begin later in 2015, and all intertidal remediation efforts to address dermal contact/incidental ingestion risks will be scheduled over the next 5-7 years as the accelerated cleanup progresses.

Ecological risks will continue until after Site remediation is completed as noted in the 1998 ROD. Current water column PCB levels are greater than ten times the National Recommended Water Quality Criteria (NRWQC) of 0.03 ppb which is based on a Final Residue Value protective of the marine food chain for the protection of aquatic receptors.

Along with evaluating the protectiveness of the remedy, this Five-Year Review documents the significant progress that has been made since the last Five-Year Review. This progress includes, among others things, another 5 seasons of hydraulic dredging in the Upper Harbor; issuance of ESD4 selecting the Lower Harbor CAD Cell (LHCC) as an element of the remedy for sediment disposal and the construction of the LHCC; issuance of ESD5 eliminating confined disposal facilities (CDFs) A, B and C in favor of off-site disposal and designating the Pilot CDF located at EPA's Sawyer Street facility as a permanent TSCA disposal facility; significant navigational dredging performed under the State Enhanced Remedy (SER) component of the ROD; and, as noted above, the issuance of the Supplemental Consent Decree which provides funding to accelerate the remedy.

This Five-Year Review did not identify any issues or recommendations that could impact the protectiveness of the remedy. The long term monitoring program implemented at the Site has shown significant improvements in benthic populations and decreases in surficial PCB sediment concentrations in the Lower and Outer Harbor, supporting the conclusion that EPA's Superfund remedial dredging and the navigational dredging performed under the SER process are improving sediment quality in the harbor.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: New Bedford Harbor Superfund Site		
EPA ID: MAD980731335		
Region: 1	**State:** MA	**City/County:** New Bedford/Bristol County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Ginny Lombardo/EPA, Elaine Stanley/EPA, Dave Lederer/EPA, Rick Sugatt/EPA, Joe Coyne/MassDEP and Paul Craffey/MassDEP		
Author affiliation: EPA Region 1 and MassDEP		
Review period: 10/1/2010 - 9/30/2015		
Date of site inspection: Not applicable		
Type of review: Statutory		
Review number: 3		
Triggering action date: 9/30/2010		
Due date *(five years after triggering action date)*: 9/30/2015		

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1, OU2 and OU3

Protectiveness Statement(s)		
Operable Unit: OU1	*Protectiveness Determination:* Will be Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy for OU1 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks have been or are being controlled to the maximum extent practicable.		
Operable Unit: OU2	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy for OU2 currently protects human health and the environment because the sediment with the highest concentrations of PCBs (ranging from 4,000 ppm to over 100,000 ppm) have been dredged from the Upper Harbor and have been safely transported to an off-site TSCA landfill. However, in order for the remedy to be protective in the long term, the remaining contaminated sediment in this geographical area will be addressed under OU1. All future work, including institutional controls, are now within the scope of OU1.		
Operable Unit: OU3	*Protectiveness Determination:* Cannot be made at this time.	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: A remedy has not been selected for OU3, thus a protectiveness statement for it cannot be made at this time. An RI/FS has been initiated to characterize the nature and extent of contamination.		

1.0 INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA 121 states:

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

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

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

EPA Region 1 conducted a FYR on the remedy implemented at the New Bedford Harbor Superfund Site in New Bedford, Bristol County, Massachusetts. EPA Region 1 is the lead agency for developing and implementing the remedy for the Site. Massachusetts Department of Environmental Protection (MassDEP), as the support agency representing the Commonwealth of Massachusetts, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the third FYR for the New Bedford Harbor Superfund Site. The triggering action for this statutory review is the completion date of the second FYR on 9/30/2010. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. The Site consists of three Operable Units, all of which are addressed in this FYR.

2.0 PROGRESS SINCE THE LAST REVIEW

2.1 Protectiveness Determinations/Statements from the 2010 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Will be Protective	The remedy for OU1 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks have been, or are in the process of, being controlled to the maximum extent practicable.
2	Short-term Protective	The remedy for OU2 currently protects human health and the environment because the sediment dredged from the Upper Harbor as part of the OU2 Hot Spot remedy has been safely transported to an off-site TSCA landfill. However, in order for the remedy to be protective in the long term, this geographical area will also be addressed under OU1. All future work, including institutional controls, for this area will be a part of OU1.
3		A remedy has not been selected for OU3, thus a protectiveness statement for it cannot be made at this time.

2.2 Status of Recommendations from the 2010 FYR

#	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
1	Review of recent seafood monitoring data indicates the 1979 fishing ban needs to be augmented to be protective regarding the human consumption of certain species of fish and shellfish in particular areas of the Harbor, including by certain sensitive populations. Although updated consumption guidance has	Distribute new seafood consumption brochure to target audiences (sportfishermen and recreational shellfishermen). Post new seafood guidance on project website and on shoreline bulletin boards, and make available at public meetings. Coordinate execution of medical grand rounds to	EPA, MassDPH, MassDMF, MassDEP	EPA	9/2010	Completed	04/2015

	been completed and is being distributed, follow-up measures to further address the human consumption of contaminated seafood from the Site will require continued assessment.	include advice for sensitive populations. Continue to explore new solutions to keep local seafood consumption to a minimum.					
2	While the highest priority PCB-contaminated shoreline areas have been remediated, or addressed with fencing or warning signs, other contaminated shoreline areas (typically remote saltmarsh or industrial areas) remain unremediated.	Continue the use of institutional controls, fencing and signage to ensure that dermal contact risks from yet-to-be remediated shoreline areas are controlled. Long term institutional controls will also be developed for remediated shoreline areas to protect against development that is inconsistent with cleanup standards for each area. Increased recreational boating in the Upper Harbor will also be addressed through educational materials and coordination with the City of New Bedford.	EPA USACE	EPA	Ongoing	Completed	04/2015

2.2.1 Efforts Performed to Address Issues/Recommendations from the 2010 FYR

Due to the size of the Site and the area's cultural diversity and reliance on local fishing, EPA recognizes that complete control of seafood consumption will continue to be problematic until risk-based levels in fish tissue are achieved. EPA continues to implement institutional controls, including fishing restrictions and advisories, signage, and educational outreach to minimize and, where possible, prevent exposure to contamination that could result in unacceptable risk.

In April 2015, EPA issued the "*New Bedford Harbor Superfund Site Community Involvement Plan and Institutional Control Plan for Seafood Consumption*": http://www2.epa.gov/sites/production/files/2015-05/documents/574395.pdf (EPA, 2015b). EPA prepared this plan based on community interviews and other relevant information. The *2015 CIP and Seafood IC Plan* specifically addresses the recommendations and follow-up actions identified in the 2010 FYR. The *Community Involvement Plan (CIP)* element specifies the community relations activities that EPA has and will continue to take during remedial response at the New Bedford Harbor Superfund Site. Further, the *Institutional Control Plan for Seafood Consumption (Seafood IC Plan)* element specifies the steps EPA has and will continue to take to implement the institutional controls for seafood consumption and collaborate with others to reduce consumption of local PCB-contaminated seafood.

The *2015 CIP and Seafood IC Plan* includes a new seafood consumption advisory brochure that is being used for outreach and education efforts. This brochure is posted on the project website and is available in Spanish, Portuguese, and Vietnamese. In September 2015, EPA updated its advisories to include a seafood consumption recommendation for tautog in closure area 3. The updated EPA advisories are included in Appendix C and are available at http://www2.epa.gov/new-bedford-harbor/fish-consumption-regulations-and-recommendations. EPA's seafood consumption advisory brochure will be revised to reflect the updated information. The *2015 CIP and Seafood IC Plan* includes actions for the distribution of seafood consumption advisory brochures to target audiences, including sportfishermen and recreational shellfishermen. The *2015 CIP and Seafood IC Plan* was presented at EPA's spring 2015 public meeting, and is posted on the project website, and copies of the new brochure were made available at the spring public meeting. The *2015 CIP and Seafood IC Plan* also includes new actions that EPA will implement going forward to minimize seafood consumption, including the creation of new signage, a new video, and targeted outreach using culturally related peers. These new actions are underway. Further, the *2015 CIP and Seafood IC Plan* confirms that EPA will assist in raising awareness of health risks associated with consumption of PCB-contaminated seafood through participation in Grand Rounds at local hospitals when MassDPH schedules such events.

As documented in the *2015 CIP and Seafood IC Plan*, EPA continues to use and maintain fencing and signage, including informational kiosks (i.e., shoreline bulletin boards), to address both seafood consumption and dermal contact/incidental ingestion risks. EPA conducts inspections of fencing and signage at least annually to ensure these institutional controls remain in place and are protective. The results of the 2015 fencing and signage inspection is attached in Appendix B.10.

To control remaining dermal contact/incidental ingestion risks until full remediation occurs, EPA will continue to use shoreline fencing and signage, including informational kiosks, as appropriate. As a result of the recent settlement, EPA has now initiated planning for intertidal remediation efforts to address remaining dermal contact/incidental ingestion risks. By the end of 2015, EPA will have completed a sampling program covering the intertidal areas of both the Upper and Lower Harbor for delineation and remediation planning. Priority intertidal remediation efforts are expected to begin later in 2015 and all intertidal remediation efforts to address dermal contact/incidental ingestion risks will be scheduled over the next 5-7 years as the accelerated cleanup progresses. EPA is also reviewing state laws concerning various types of land use restrictions to determine appropriate institutional controls for properties abutting the intertidal remediation areas once cleanup levels have been achieved.

2.2.2 Status of Issue #1 - Completed

The *2015 CIP and Seafood IC Plan* documents the actions EPA has and will continue to take to satisfy its obligations under the 1998 Record of Decision (ROD) (1998 ROD) to implement institutional controls to minimize ingestion of local PCB-contaminated seafood and addresses the recommendations identified for Issue #1 in the 2010 FYR. As such, EPA considers Issue #1 from the 2010 FYR to be completed. Until such time as PCB levels in seafood reach EPA's risk-based, site-specific threshold of 0.02 ppm (or other level if this criteria is updated), institutional controls will remain in place and EPA will follow the *2015 CIP and Seafood IC Plan* (or an update to that plan should one be issued). Institutional controls are necessary since it could take many years, even after the sediment remediation efforts are completed, before PCB levels in seafood species reach safe levels for consumption. Institutional controls shall continue until protective levels for PCBs in local seafood are consistently achieved throughout the Site.

2.2.3 Status of Issue #2 - Completed

The *2015 CIP and Seafood IC Plan* also documents the actions EPA has and will continue to take to satisfy its obligations under the 1998 ROD to minimize dermal contact/incidental ingestion risks, including outreach to the recreational boating community, fencing and signage, and addresses the recommendations identified for Issue #2 in the 2010 FYR. As such, EPA considers Issue #2 from the 2010 FYR to be completed. These institutional controls will continue to be implemented until such time as PCB levels in shoreline intertidal areas meet applicable dermal contact/incidental ingestion cleanup levels and/or long term institutional controls are developed for remediated shoreline areas to protect against development that is inconsistent with cleanup standards for each area. As noted above, EPA now has funding in place for intertidal remediation efforts to address remaining dermal contact/incidental ingestion risks and delineation of intertidal/shoreline areas are ongoing.

2.3 Remedy Implementation Activities

Below is a brief summary of enforcement and decision documents issued and major remedial implementation activities that have occurred since the previous FYR. Links are provided for enforcement and decision documents. Remedial implementation activities that occurred during this FYR period are discussed in further detail in Section 4.1. Supplemental remedial implementation information and discussion of historical remedial implementation activities is provided in Appendix A.3.2.

- Supplemental Consent Decree and Settlement: In 2013, EPA entered into a Supplemental Consent Decree to the 1992 Consent Decree (through two reopener clauses) with AVX Corp., whose corporate predecessor, Aerovox Corp., owned and operated the former Aerovox facility, the primary source of PCB contamination in the harbor http://www2.epa.gov/sites/production/files/2013-09/documents/547266.pdf (EPA, 2013b). In September 2013, the U.S. District Court approved a landmark $366.25 million cash-out settlement which will be used to fund the remaining cleanup of the Site. Due to prior limitations in Superfund funding (which had typically been $15 million per year for this Site), the project was expected to take another 40 years. With this settlement, this project will be accelerated to be substantially completed within 5 to 7 years. For further information, see http://www2.epa.gov/new-bedford-harbor/harbor-cleanup-plans-and-legaladministrative-records under "Supplemental Consent Decree with AVX Corp."

- Five More Seasons of Hydraulic Dredging in the Upper Harbor: For years 2011 through 2013, with $15 million per year of Site funding, dredging of contaminated subtidal sediment occurred for approximately 40 to 45 days per year. In 2014, with a portion of the settlement funding EPA received in 2013, EPA was able to make significant improvements to the dredging and treatment systems as well as allow for 118 days of dredging and off-site disposal. The total volume of dredged sediment from 2011 through 2014 was 141,883 cy. The total volume of sediment removed from the harbor under the OU1 ROD through 2014 is approximately 354,570 cy. EPA plans on dredging an estimated 80 days in the 2015 dredge season yielding approximately 47,000 cy of contaminated sediment. Dredging for the 2015 season, season twelve, commenced in August and is expected to run through November. Additional information is provided in Section 4.1.

- Fourth Explanation of Significant Difference - Lower Harbor CAD Cell (ESD4): ESD4, issued in March 2011, modified the OU1 remedy to include the construction and use of a Lower Harbor CAD cell (LHCC) for disposal of approximately 300,000 cy of mechanically dredged sediment from the lower portion of the Upper Harbor and from areas in the Lower Harbor. Construction and use of the LHCC will be conducted using best management practices to minimize environmental impacts, including maintaining water quality performance standards, and water and air quality monitoring will be performed to ensure that no exceedances of project performance standards occur and that the placed sediments stay within the LHCC. ESD4, including responses to public comments received on the draft ESD, is available at http://www.epa.gov/region1/superfund/sites/newbedford/479471.pdf (EPA, 2011).

- LHCC Construction: In 2011, EPA signed a Cooperative Agreement with the Harbor Development Commission of the City of New Bedford (HDC) to provide funding for the design and construction of the LHCC in two phases. The first phase of the CAD cell was completed during the spring of 2014. The second phase of the construction of the LHCC is scheduled to be completed in the fall of 2015. Most recently, in 2015, the U.S. Army Corps of Engineers (USACE) was tasked by EPA to design and contract out the dredging and disposal of contaminated sediment into the LHCC. Dredging and disposal of the sediment are scheduled to occur from late-2015-2018. After a period of time to allow the consolidation of material, the CAD will be capped and institutional controls will be implemented to ensure the integrity of the CAD.

- Fifth Explanation of Significant Difference (ESD5): In July 2015, EPA issued ESD5, available at http://www2.epa.gov/sites/production/files/2015-07/documents/577652.pdf (EPA, 2015c). ESD5 eliminated construction of the planned CDFs A, B and modified-C and selected off-site disposal for the sediment slated for disposal in those planned confined disposal facilities. Further, in ESD5, EPA confirmed that a Pilot CDF previously constructed at the Site is protective and made this Pilot CDF a permanent TSCA disposal facility. As part of the cleanup plan, following completion of remedial dredging activities, the Pilot CDF will be covered with a clean cover/cap meeting all applicable federal and state standards and institutional controls will be enacted to protect the cap over time.

- Intertidal/Shoreline Sampling Program: In 2015, EPA initiated an intertidal/shoreline sampling program to support the characterization of intertidal sediments to address remaining dermal contact/incidental ingestion risks.

- State Enhanced Remedy – Final Determination for South Terminal: In November 2012, EPA issued the Final Determination for the Commonwealth of Massachusetts' South Terminal Project for construction of a confined disposal facility for navigational dredged material as part of the State Enhanced Remedy (SER), available at http://www.epa.gov/region1/superfund/sites/newbedford/525556.pdf (EPA, 2012). The Final Determination allowed for the construction of the approximately 28.45 acre marine terminal, consisting of a CDF and upland area, as well as associated dredging including the dredging and filling of a confined aquatic disposal cell (CAD cell). The Final Determination required that the Commonwealth comply with certain conditions to ensure that the work performed would be protective of human health and the environment and meet the substantive requirements of ARARs. The Final Determination was modified to address changes to the conditions and/or proposed work through three modifications, issued February 2013, September 2013 and September 2014 (available at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data, under State Enhanced Remedy) (EPA, 2013a; EPA, 2013b; EPA, 2014c). In February 2015, construction of the South Terminal Project was substantively completed. This project entailed the dredging of over 262,000 cy of PCB-contaminated sediment from the Lower Harbor (Appendix B.13). This sediment had low levels of PCB contamination and was disposed of in the newly created navigational CAD cell 3. Removal and isolation of this significant volume of PCB-contaminated sediment that would not otherwise be addressed by the Superfund cleanup provided an important enhancement to the remedy, consistent with the objective of the SER program. The Commonwealth continues to complete mitigation projects required by the Final Determination and the State's *Final Mitigation Plan for the New Bedford Marine Commerce Terminal* (MassDEP, 2012). Included in the mitigation projects is supplemental capping adjacent to the OU3 Pilot Cap (discussed further below in Section 3.4.6).

- Other SER Projects: During 2014-2015, the Commonwealth of Massachusetts proposed and executed the Federal Interim Channel Dredging project under the SER program. Under the program, the Federal Channel was dredged to a minimum depth of -29 MLLW to allow the approach of large draft vessels to the South Terminal project. Approximately 117,000 cy of PCB-contaminated dredge material was disposed of in navigational CAD Cells 2 and 3 from the project which was substantially completed in June 2015 (Appendix B.13 and B.14).

- SER MOA Update: In January 2015, the Memorandum of Agreement (MOA) between EPA and MassDEP describing the division of responsibilities for the SER was amended and renewed to allow for continued operation of the program for the next ten years, available at http://www2.epa.gov/sites/production/files/2015-01/documents/568191.pdf (MassDEP and EPA, 2015). [See Appendix A.3.1 for an explanation of the SER program.]

- Former Aerovox Facility: The former Aerovox facility is the primary source of PCB contamination in the harbor. In May 2013, EPA issued a certification of completion of work for a non-time-critical removal action (NTCRA) performed by AVX Corporation (AVX), successor of Aerovox Corporation, pursuant to a 2010 Administrative Settlement Agreement and Order on Consent between EPA and AVX to demolish the former Aerovox building and cap the 10 acre former Aerovox property. AVX is performing an investigation and cleanup of the former Aerovox property under the State hazardous cleanup program pursuant to a 2010 Administrative Consent Order and Notice of Responsibility (Release Tracking Number 4-0601). The City of New Bedford, owner of the property, also entered into a 2010 Cooperation Settlement Agreement with AVX which established a framework for long-term monitoring and maintenance of the site as well as potential redevelopment plans. Control of the primary source of PCB contamination in the harbor is important to a successful harbor remediation, and EPA continues to coordinate the harbor cleanup activities and schedule with the ongoing investigation, cleanup efforts, and schedule at the Aerovox property.

2.4 System Operation/Operation and Maintenance Activities

Below is a brief description of major remedial action monitoring activities that have been implemented at the Site to monitor various aspects of the remedy over time. The data from these monitoring activities covering the period since the previous FYR, along with additional detail, is discussed in Sections 3.4 and 4.1.

- Long Term Monitoring Program (LTM) Round VI (2014): EPA has been collecting long term monitoring (LTM) data approximately every five years at the Site since 1993 to assess sediment conditions and quantify the long term environmental effects and effectiveness of remediation efforts in the harbor. The LTM program began in 1993 (Round I), considered the baseline event, with subsequent rounds taking place in 1995 (Round II), 1999 (Round III), 2004 (Round IV), 2009 (Round V) and, most recently, 2014 (Round VI).

- Seafood Monitoring Program: Since 2003, pursuant to the State Superfund Contract, MassDEP has been conducting annual seafood monitoring to evaluate the levels of PCBs in edible seafood species in New Bedford Harbor and surrounding Buzzards Bay – covering the three fish closure areas established by Massachusetts Department of Public Health (MassDPH). As reported in the 2010 FYR, the seafood tissue data collected through the annual seafood monitoring program was used to establish EPA seafood advisories and recommendations.

- Remedial Dredging Water Quality Monitoring: EPA and the USACE utilize a site-specific turbidity-based monitoring program that produces immediate sampling results, as a protective and quantitative approach to monitoring the dredging process in real-time rather than having to wait days to receive laboratory data.

- Ambient Air Monitoring: Airborne PCB samples have been and continue to be collected at various locations as part of every remedial activity involving removal of PCB-contaminated sediment. To account for the long term nature of the harbor cleanup, as well as the chronic nature of PCB toxicity, EPA uses a "public exposure tracking system" (PETS) to ensure that the public's long term exposure to airborne PCBs remains below health-based levels.

- North of Wood Street (NWS) Sediment Monitoring: Subtidal and intertidal areas north of the Wood Street bridge were remediated and restored in 2001, 2002/2003 and 2005. EPA has been monitoring PCB sediment levels here since that time.

- OU3 Pilot Cap Monitoring: Cornell Dubilier Electronics, Inc., which was located just south of the New Bedford Harbor hurricane barrier, was another historical source of PCBs to the harbor. The OU1 ROD included dredging as an interim action to address an area just south of the hurricane barrier in the Outer Harbor, near the Cornell-Dubilier mill, a known area in the Outer Harbor that contained PCB levels above the Lower Harbor's 50 ppm cleanup standard. In 2004 and 2005, an opportunity for an alternative accelerated cleanup approach for this area presented itself at no cost to EPA: rather than dredging the area, clean sand generated by the port of New Bedford's navigational dredging (implemented pursuant to the SER) could be used to create an underwater cap. Construction of the approximately 19-acre cap was completed in 2005. Since that time, the pilot underwater capped area has been monitored for changes in spatial extent, thickness of cap through bathymetric surveys, PCB levels and TOC of the cap. Monitoring of the cap has been performed in 2006, 2007, 2009, 2010, 2011 and 2012.

- Sawyer Street Groundwater Monitoring: Since 1992, EPA has conducted periodic groundwater monitoring of 6 groundwater wells located at EPA's Sawyer Street facility along the perimeter of the Pilot CDF and Cell #1, to ensure PCBs and VOCs are not released from these areas and allowed to migrate in groundwater.

3.0 FIVE-YEAR REVIEW PROCESS

3.1 Administrative Components

The public was notified of the initiation of this Five-Year Review on 1/5/2015. The New Bedford Harbor Superfund Site FYR was led by Ginny Lombardo, EPA Team Leader for the Site, with technical support from Elaine Stanley and Dave Lederer, Site remedial project managers (RPMs), and community involvement support from Kelsey O'Neil, the Community Involvement Coordinator (CIC). Joseph Coyne and Paul Craffey, Project Managers for the MassDEP, assisted in the review as the representative for the support agency.

The FYR process was initiated with a 'kick-off' meeting on 2/23/2015. In attendance at the meeting were the Site team leader, Site RPMs, Site risk assessor, Site attorney and CIC for the Site. The review consisted of the following components:

- Community Involvement;
- Document Review;
- Data Review; and
- FYR Report Development and Review.

3.2 Community Notification and Involvement

A press release was issued on 1/5/2015 notifying the public that a Five-Year Review was initiated and inviting the public to submit any comments to the EPA. A copy of the press release is included in Appendix C. The results of the review and the report will be made available on the project website and at the Site information repository located at EPA Region 1 Records Center, 5 Post Office Square, Boston, Massachusetts and New Bedford Free Public Library, 613 Pleasant Street, New Bedford, Massachusetts.

3.3 Document Review

This Five-Year Review consisted of a review of relevant documents including long term monitoring reports, annual seafood tissue monitoring reports, water and sediment quality data reports, ambient air monitoring data reports, groundwater monitoring report, and dredge season-end reports. Applicable sediment cleanup levels, as listed in the 1998 ROD, were also reviewed.

3.4 Data Review

3.4.1 Long Term Monitoring

EPA has been collecting long term monitoring (LTM) data approximately every five years at the Site since 1993 to assess sediment conditions and quantify the long term environmental effects and effectiveness of remediation efforts in the harbor. The LTM program began in 1993 (Round I), considered the baseline event, with subsequent rounds taking place in 1995 (Round II), 1999 (Round III), 2004 (Round IV), 2009 (Round V) and, most recently, 2014 (Round VI). The 2014 LTM Report is available at http://www2.epa.gov/sites/production/files/2015-09/documents/583617.pdf (Battelle, 2015d).

Sediment grabs are collected for chemical and physical testing as well as benthic community analysis to assess sediment conditions. Surficial sediment (top 2 cm) is analyzed for PCBs (measured as the sum of the 18 NOAA congeners), total organic carbon (TOC) content and grain size distribution. Sediment from the biologically-active zone (top 10 cm) are analyzed for benthic infauna and grain size. The benthic community evaluation assesses the effectiveness of the remedy in terms of marine bottom (benthic) species abundance and richness (Nelson *et al.*, 1996).

The LTM data are evaluated by EPA's Office of Research & Development, Atlantic Ecology Division laboratory in Narragansett, Rhode Island (EPA-AED) in the context of the overall program to assess spatial and temporal data trends and to monitor the effects and effectiveness of the remedial Site activities. EPA-AED's evaluation of the 2014 LTM data is available at http://www2.epa.gov/sites/production/files/2015-09/documents/583616.pdf (Bergen, 2015). Under the LTM program, sediments are analyzed for 18 of the 209 PCB congeners. These are the same 18 congeners that are used in the National Oceanic and Atmospheric Administration's (NOAA) National Status and Trends Program to assess marine environmental quality (Calder, 1986).

There is a distinct spatial gradient in surficial sediment PCB concentration from the Upper Harbor to the Lower Harbor to the Outer Harbor. This spatial pattern is consistently demonstrated in each of the six long-term monitoring collections (1993, 1995, 1999, 2004, 2009, and 2014). In Nelson and Bergen (2012), there was a detailed analysis of the LTM data from the first five long term monitoring collections, which confirmed that the cleanup activities had resulted in significant improvement in surface sediment and benthic quality in 2009 compared to the 1993 baseline data for the Lower and Outer Harbor areas. The 2014 sediment data continue the trends described in that analysis and are shown visually in the interpolated sediment PCB concentration maps included in Appendix B.8 (Bergen, 2015).

In the Upper Harbor, the % surface area (interpolated from the LTM surface sediment stations) below 10 ppm PCBs (measured as the sum of the 18 NOAA congeners) has continued to increase from 11% in 2009 to 19% in 2014. Of course, this data is only for the recently deposited material in the top 2 cm of sediment but does indicate that the last 5 years of Upper Harbor dredging has not spread any appreciable contamination to the sediment surface in the Upper Harbor. In the Lower Harbor, 10% of the surface sediment LTM stations were above 10 ppm PCBs (measured as the sum of the 18 NOAA congeners) in 2009; however, in 2014, that percentage dropped to zero, demonstrating improving surface sediment conditions in the Lower Harbor and showing that CAD cell work and flux from the Upper Harbor have not caused sediment surface PCB levels to increase in the Lower Harbor. In the Outer Harbor, the differences were smaller given the overall lower concentrations but the area greater than 1.0 ppm PCBs (measured as the sum of the 18 NOAA congeners) decreased from 0.7% in 2009 to zero in 2014.

As noted in Nelson and Bergen (2012), all of the harbor sections (as of the 2004 sampling) have shown statistically significant decreases ($p<0.05$) in surface PCB concentrations when compared to the 1993 baseline sampling. In the 2014 collection, the Upper Harbor PCB concentrations at most stations were not different from 2009 but 7 stations exhibited significant decreases while the average concentration for the area remained the same. In the Outer Harbor, 20 of 23 stations showed decreased concentrations and the mean concentration dropped from 0.24 to 0.17 ppm PCBs (measured as the sum of the 18 NOAA congeners) although this decrease is not statistically significant. The Lower Harbor did exhibit a statistically significant decrease ($p<0.05$) in mean PCB concentration (measured as the sum of the 18 NOAA congeners) from 5.1 ppm to 2.8 ppm with 21 of 29 stations exhibiting decreasing PCB concentrations. The totality of the PCB surface sediment data points to a decrease in overall PCB concentrations in all areas of the Site, demonstrating that remedial operations to date have resulted in notable improvements in surface sediment conditions. The sum of the 18 NOAA congeners is multiplied by a conversion factor of 2.6 to estimate total PCBs (FWEC, 2001; FWEC, 2002); as such, the mean PCB concentration measured during the 2014 LTM program for the Lower Harbor is approximately 7 ppm.

There are several benthic indices that can be calculated from the LTM benthic infauna data. One that has been used at this Site is the Environmental Monitoring and Assessment Program's (EMAP) benthic index for the Virginian Biogeographical Province (Paul, *et. al*, 2001). This biodiversity index was developed to assess estuarine benthic condition from Cape Cod, MA to the mouth of Chesapeake Bay, VA. The original index was based on three metrics: salinity-normalized Gleason's D, salinity-normalized tubificid abundance, and abundance of spionids. For the New Bedford Harbor study, only two of these metrics are used: Gleason's D and Spionid abundance. Tubificid abundance is only considered important in low salinity waters (close to zero salinity), and the New Bedford Harbor study area is saline. A value of zero is considered the cut-off for distinguishing "Good" and "Poor" conditions: positive values are good, negative values are poor.

Consistent with the results found for the other LTM variables, there is a similar spatial pattern for the EMAP benthic index; the Upper Harbor exhibits the worst condition, as evidenced by the large negative values observed each collection year (i.e., degraded condition), the Lower Harbor is significantly improved relative to the Upper Harbor, with values near zero, and the Outer Harbor is always significantly highest with positive values, indicative of a good benthic community (see maps in Appendix B.8). Temporally, the percent of stations in each harbor segment exhibiting a positive or "good" benthic index for each year of the LTM program are shown in Appendix B.8. The Outer Harbor stations are almost all positive for every year. A consistent increase in the number of stations with "good" benthic condition can be seen in the Lower Harbor and this matches up well with the documented decreasing PCB surface concentrations. Even in the Upper Harbor, an increase in the percent of stations with "good" benthic readings can be seen when comparing the 2009 and 2014 data.

The overall increase in benthic health, combined with the decreasing PCB concentrations, points to the improvement in the Site condition. It is logical with the advent of increased remediation that these trends should continue and accelerate. Although monitoring data indicates progress towards achieving the 1998 ROD's sediment cleanup goals, the remedy for the Site is still under construction and these goals are not expected to be achieved until construction is complete.

3.4.2 Seafood Monitoring Program

Seafood tissue monitoring performed at the Site includes both the annual seafood monitoring program and the blue mussels monitoring program.

The seafood monitoring program, initiated in 2003, is coordinated by the Commonwealth of Massachusetts, with oversight by EPA Region 1. Edible tissue of a variety of locally caught species from all three fish closure areas in New Bedford Harbor and surrounding Buzzards Bay are sampled annually for PCB levels. Consistent with the requirements of the 1998 ROD, the purpose of the seafood monitoring program has been to support the implementation of seafood advisory institutional controls for the Site. The seafood monitoring reports are available at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data under "Annual Seafood Monitoring". During this FYR period, the seafood monitoring reports for 2009, 2010, 2011, 2012, 2013 and 2014 were issued (MassDEP, 2010; MassDEP, 2011; MassDEP, 2012a; MassDEP, 2014a; MassDEP, 2014b; MassDEP, 2015).

EPA utilized the historical seafood tissue data (2002-2009) to perform risk assessments that led to site-specific seafood consumption advisories and recommendations that were updated in 2010 and discussed in the 2010 FYR. As part of the development of the *2015 CIP and Seafood IC Plan* and this third FYR, EPA performed an updated risk evaluation of the seafood tissue data collected under the seafood monitoring program, including data from 2010-2014, and confirmed that the seafood advisories and recommendations established by EPA in 2010 remain protective. EPA has documented that evaluation for this FYR in a risk assessment update included in Appendix D. That update also evaluated new data for tautog, collected in 2013 and 2014, which supports a new advisory for closure area 3 for that species. In September 2015, EPA updated its advisories to include a seafood consumption recommendation for tautog in closure area 3. The updated EPA advisories are included in Appendix C and available at http://www2.epa.gov/new-bedford-harbor/fish-consumption-regulations-and-recommendations.

PCB concentrations in seafood tissue levels measured since 2003 have remained fairly consistent. A summary of the seafood tissue data over time for several key species is provided in Appendix B.6. Significant seafood tissue reductions are not expected to occur until the remedial action is complete and it could take many years, even after the sediment remediation efforts are completed, before PCB levels in seafood species reach safe levels for consumption. EPA is currently working with MassDEP to optimize the seafood monitoring program towards tracking seafood tissue decreases over time to demonstrate seafood tissue reductions as the cleanup progresses and following completion of remedy construction. EPA will periodically evaluate whether seafood tissue reductions observed support revisions to the site-specific seafood consumption advisories.

The seafood monitoring program is augmented by the deployment of blue mussels (*Mytilus edulis*) as another element of the long-term monitoring program for the Site (Nelson and Bergen, 2012). Mussel deployments have been conducted twice annually since 1993 by EPA-AED at three stations: NBH-2-Coggeshall Street, NBH-4-Hurricane Barrier, and a control site

NBH-5-West Island. In addition, there were monthly deployments during the 1994-1995 Hot Spot remediation for a total of 51 28-day deployments.

The mean total PCBs (as the sum of 18 congeners) in the blue mussel tissue for all three stations for the period 1993 through 2014 are shown in Appendix B.7. As might be expected, there is a significant spatial gradient among stations. There is an approximate five-fold decrease in overall mean concentration between stations NBH-2 (35 ppm) and NBH-4 (8 ppm) and over an order of magnitude decrease between station NBH-4 (8 ppm) and NBH-5 (0.5 ppm). The PCB differences among stations are maintained over time; however, all stations exhibit seasonal variability due to the mussel reproductive cycle where lipid-rich gametes increase during the year (along with lipophilic organic contaminants such as PCBs), then decrease during spawning. This pattern has also been observed in the New Bedford Harbor indigenous ribbed mussel population as well (Bergen et al., 2001). Monthly deployments during the Hot Spot remediation demonstrated that increases in mussel bioaccumulation were more closely linked to storm events than any dredging activity (Bergen et al., 2005).

The data set indicates that in the period between 1993 and 2014, no net change in PCB water column concentration and subsequent mussel bioaccumulation has occurred, primarily because the exposure to PCBs has not been altered dramatically along this gradient over time. While the overall mass of PCBs removed from the harbor has been significant, especially during the Hot Spot removal, the average water column PCB concentrations near the mussel stations have not appreciably decreased. It is reasonable to expect that once full remediation is complete, surface water PCB concentrations will decrease, leading to a concomitant decrease in mussel PCB tissue concentrations.

Both monitoring programs demonstrate that PCB tissue levels in sampled species are above the site-specific goal of 0.02 ppm for PCB concentrations in seafood (Appendix B.6 and B.7).   PCB tissue levels vary by species and closure area, and generally show a decreasing north to south gradient, i.e., samples closer to the Aerovox source area have higher PCB residues than those further south.   These two programs continue to demonstrate the need for the harbor PCB cleanup, in terms of unacceptable risks to both human health and the marine ecosystem. These monitoring programs also demonstrate that the remedy is being implemented in a safe manner that does not exacerbate PCB bioaccumulation within the local marine food chain, as PCB concentrations in biota have remained fairly constant and increases during active remedy implementation have not been observed.

3.4.3 Water Quality Monitoring

EPA developed site-specific turbidity-based monitoring programs that produce immediate sampling results, as a protective and quantitative approach to monitoring the dredging process in real-time rather than having to wait days to receive laboratory data. The objective of the water quality monitoring is to minimize environmental impacts, limit recontamination of previously dredged areas, ensure that the dredging activities are conducted in a manner which does not hinder the seasonal migration of anadromous fish to and from the Acushnet River, and to determine the degree and extent of sediment plumes advecting away from the Site during dredging operations. Trigger level exceedances would result in the collection of water samples for chemical and toxicity analyses as a follow up or discontinuing dredging operations, as necessary to lessen turbidity. In addition, best management practices have reduced turbidity impacts due to sediment scour from workboats, prop-wash and pipeline groundings.

The extensive water quality monitoring data base collected since the last FYR shows that all in-water construction and dredging operations performed to date have complied with the turbidity criterion. Reports for Upper Harbor water quality monitoring are available for review at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data, under "Water Quality Monitoring" (WHG, 2011b, 2012b, 2013d, 2014; Battelle, 2015b). Turbidity plumes that were observed during dredging and dredge-related activities have generally been confined to within 100 feet of active operations. The continuous monitoring systems employed have also documented that high turbidity events can occur naturally when no dredging operations are underway (Battelle, 2015b).

3.4.4 Ambient Air Monitoring

Through an extensive air monitoring program, a comprehensive data base of airborne PCB levels has been developed for the New Bedford Harbor Site. Ambient air PCB samples have been and continue to be collected as part of every remedial activity involving removal of PCB-contaminated sediment. To ensure that the airborne PCB levels reported are truly the total of all detectable PCBs, the analytical method used at the Site since 1999 quantifies all ten of the PCB homolog groups. To account for the long term nature of the harbor cleanup, as well as the chronic nature of PCB toxicity, the Site team established a "public exposure tracking system" (PETS) based on a site-specific risk evaluation to ensure that the public's long term exposure to airborne PCBs remains below health-based levels. To assist public understanding of the program, the PETS process graphs a linear acceptable exposure level over time, and plots the actual monitored exposure levels at various receptors over time: as long as the field monitored values remain below the "budgeted" cumulative exposure line then health risks from airborne PCBs remain insignificant.

During the FYR period, EPA continued its extensive air monitoring efforts. In the Upper Harbor, monitoring continued in conjunction with the hydraulic dredging program under the *Final Plan for the Sampling of Ambient Air PCB Concentrations to Support Decisions to Ensure the Protection of the Public During Remediation Activities, Revision No. 3* (Jacobs, 2006). In the Lower Harbor, monitoring was conducted to monitor PCBs in ambient air during construction of the LHCC starting in 2013 pursuant to the *Final Plan for the Sampling of Ambient Air PCB Concentrations During Lower Harbor CAD Cell Construction* available at http://www2.epa.gov/sites/production/files/2014-10/documents/538677.pdf (Jacobs, 2013c). See Appendix B.5 for a table of ambient air monitoring data for 1999-2015, along with a map of the sampling locations, and for the 2015 PETS curve for the Aerovox and Coffin Ave monitoring locations, offered as examples of the PETS program. Air monitoring data is also posted on the project website at http://www2.epa.gov/sites/production/files/2015-09/documents/581891.pdf (Jacobs, 2015d). Ambient air monitoring data collected during the past five years continue to show that cumulative exposure from PCBs measured in ambient air remains below risk-based exposure budgets that are protective of human health.

In response to community concerns about the potential for air emissions from the LHCC, EPA took several steps. During the planning phase for the LHCC project, EPA conducted modeling to project potential air emissions from the LHCC project. The conclusion of the modeling effort was that emissions would be well below any health-based standards for the project and these results were incorporated into ESD4. Under the 2013 *Final Plan for the Sampling of Ambient Air PCB Concentrations During Lower Harbor CAD Cell Construction*, EPA expanded its historic air monitoring network through the addition of four additional air monitoring stations in the Lower Harbor: two monitoring stations near the LHCC site in Fairhaven, one in New Bedford, and one on board the dredge plant. Pursuant to the 2013 air plan, stations in the Lower Harbor were monitored prior to, during, and after the top of CAD material was removed from both the Phase I and Phase II LHCC projects. Ambient air monitoring efforts performed during construction of both phases showed no levels of PCB emissions approached the level of any health-based standards established for the project.

In order to account for the expedited remediation schedule planned with the settlement funding, which will provide for longer dredge seasons and increased production and concurrent hydraulic and mechanical dredging in the Upper and Lower Harbor, the EPA updated its air monitoring plan in 2015. The *Draft Final Ambient Air Monitoring Plan for Remediation Activities*, issued in July 2015, (*2015 Air Monitoring Plan*), available at http://www2.epa.gov/sites/production/files/2015-08/documents/577154.pdf (Jacobs, 2015c), will be implemented for all remaining remediation activities starting with the 2015 dredge season, which began in August 2015. Under the *2015 Air Monitoring Plan*, EPA updated risk-based ambient air goals and again expanded its air monitoring network in the Lower Harbor in preparation for the dredging of material in conjunction with the LHCC project, and its disposal in the LHCC. Four new Lower Harbor stations were added to provide fuller monitoring coverage of any potential emissions from the project. The new stations will begin operation by late 2015.

3.4.5 North of Wood Street Monitoring

Subtidal and intertidal areas north of the Wood Street bridge (NWS) in the Upper Harbor were remediated and restored in 2001, 2002/2003 and 2005. EPA has been monitoring PCB levels in sediment in this area since 2004. During this FYR period, post-remediation monitoring for the NWS cleanup occurred in 2011 and 2012 (WHG, 2011d; WHG, 2012c).

PCB levels in NWS subtidal sediments have fluctuated up and down over the course of post-remediation monitoring since 2003 with a general increasing trend in concentration. Only one of the ten river (or subtidal) sediment stations sampled in 2012 tested below the 1998 ROD cleanup level of 10 ppm PCBs for subtidal areas of the Upper Harbor. However, six out of ten sampling stations contain lower concentrations of PCB when compared to 2011. The stations containing the thickest layer of OL (organic layer) corresponded to the stations with the highest concentrations of PCBs, as PCBs tend to bind to organics.

For the shoreline/intertidal sediment, concentrations of PCBs have remained consistently low and fluctuate slightly up and down at the sample locations. Sampling results for recreational use areas show PCB concentrations below the 1998 ROD cleanup level of 25 ppm for recreational shoreline land use. For all post-remediation residential shoreline locations, monitoring results show PCB concentrations have fluctuated slightly up and down but are less than 1 ppm PCBs (the 1998 ROD cleanup level for residential shoreline areas), with the exception of three locations. For one station, the PCB concentration was slightly above 1 ppm PCBs in 2011 but fell below 1 ppm PCBs in 2012. For the two other stations, results showed PCB concentrations below 1 ppm PCBs in 2011 and in 2012 slightly exceeded 1 ppm PCBs.

EPA did not monitor the sediment in 2013 and 2014 due to limited funding in 2013 and a decision to address recontamination under the accelerated cleanup strategy. In 2015, EPA began and continues to obtain extensive sediment data to comprehensively design a remediation strategy that will achieve cleanup goals across the Site. As part of EPA's accelerated cleanup plan, any NWS areas that have been re-contaminated above the applicable cleanup levels will be reassessed as the remedial action efforts progress towards completion. See Section 4.1 for additional discussion.

3.4.6 OU3 Pilot Cap Monitoring

As an alternative to the dredging interim remedy in the 1998 ROD, in 2004/2005, EPA constructed an approximately 19-acre pilot cap to permanently isolate sediment contaminated with PCBs above 50 ppm in the Outer Harbor, using clean sand and gravel from a navigational CAD cell constructed as part of the State Enhanced Remedy. Since that time, the pilot underwater cap has been monitored for changes in spatial extent, thickness of cap through bathymetric surveys, PCB levels and TOC (total organic carbon) of the cap. During this FYR period, monitoring events were performed in 2010 (after the second FYR), 2011 and 2012 (WHG, 2011a; Jacobs, 2011a; Jacobs, 2012; WHG, 2013a). OU3 Pilot Cap monitoring reports are available at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data#OuterHarborStudy. As of the 2012 monitoring event, cap surface sediment monitoring data show PCB concentrations were all less than 4 ppm: samples within the pilot cap ranged from 0.04 to 3.11 ppm with an average of 0.56 ppm (excludes three stations located outside the cap area) (WHG, 2013a). Monitoring data continue to support that the pilot capping operation was successful, and that additional capping efforts in this area would be justified. The benthic environment has been robustly re-colonized, indicating that such capping presents only a short-term impact.

In 2011, EPA requested that the U.S. Coast Guard establish the capped area as a "Regulated Navigation Area" and, through the Department of Homeland Security, published a Final Rule in the Federal Register with an effective date of July 20, 2011 which prohibits all vessels and persons from activities that would disturb the seabed within the regulated navigation area, including but not limited to anchoring, dragging, trawling and spudding. Vessels may otherwise transit or navigate within this area without reservation.

Pursuant to the South Terminal Final Determination and the *Final Mitigation Plan* (MassDEP, 2012b) for that SER Project, the State is capping an additional area adjacent to the existing OU3 Pilot Cap (see Section 2.3). When the pilot cap was placed in 2004/2005, the cap material was placed over all sediments above 50 ppm; however, some areas closest to the Hurricane Barrier, with PCB concentrations of less than 50 ppm, that were slated for capping under this project remained uncapped due to technical limitations of the placement method and the shallow depth of the area. The South Terminal mitigation effort will utilize clean sand from construction of the bottom of the EPA CAD Cell to cap an area nearest to the Hurricane Barrier adjacent to the existing OU3 Pilot Cap, an area of approximately 20 acres (extending the existing OU3 Pilot Cap and addressing much of the area slated for capping in 2005 that was not capped during that effort). This mitigation project was initiated in July 2015 and is expected to be completed in October 2015. See Appendix B.11 for a figure of the OU3 Pilot Cap and proposed State's cap expansion area. The final remedy for this area will be included as part of OU3. In the interim, monitoring activities will continue to ensure the cap is functioning as designed.

3.4.7 Sawyer Street Groundwater Monitoring

Since 1992, EPA has conducted periodic groundwater monitoring of 6 groundwater wells located at EPA's Sawyer Street facility along the perimeter of the Pilot CDF and Cell #1, to ensure PCBs and VOCs are not released from these areas and allowed to migrate in groundwater. During this FYR period, annual groundwater monitoring of the Sawyer Street well network was conducted in 2010, 2011, 2012, 2014 (WHG, 2011e; WHG, 2012a; WHG, 2013c; Battelle, 2015a) and is scheduled for Fall 2015. Sawyer Street groundwater monitoring reports are available at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data, under "Sawyer Street Groundwater Monitoring". Groundwater data has consistently shown that PCBs are not migrating from the Pilot CDF or Cell #1 areas of EPA's Sawyer Street facility. In addition, in March 2015, EPA issued the "*Modeling Analysis of Potential Environmental Impact of the Pilot Confined Disposal Facility*," (Jacobs, 2015a) which concluded that discharge of PCBs from the groundwater to the harbor would unlikely be measurable.

3.4.8 Other

In addition to these monitoring programs, the Site team undertakes a variety of sediment PCB monitoring projects as needed to assist in the implementation of the ongoing remedial actions. These include additional characterization sampling and "progress" sampling during remedial operations.

3.5 Site Inspection

A Site inspection specific to the FYR was not performed. Site inspections for the OU1 remedy are conducted routinely throughout each year since USACE is on site full time for construction oversight and EPA is frequently on site for coordination and oversight activities. In addition, inspections occur daily during the dredging season by the USACE, with additional oversight from EPA. An overall evaluation of the operations is prepared and documented yearly in a year-end dredge data report prepared by the USACE contractor. Annual dredge season data reports are posted on the project website at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data#AnnualDredgingReports (Jacobs, 2011b; Jacobs 2013a; Jacobs 2013b; Jacobs 2014; Jacobs 2015b). Applicable data from recent site inspection activities is summarized below:

3.5.1 Signage for Seafood Advisories and Signage and Fencing for Contaminated Shorelines

Signage and fencing at the Site installed as part of the remedial institutional controls are inspected annually, at a minimum. Most recently, in May 2015, USACE's contractor inspected the seafood advisory and contaminated sediment signage, including informational kiosks, along the Upper, Lower and Outer Harbor areas. The report on the 2015 inspection is included in Appendix B.10. All signs that were missing or in poor condition were replaced in June 2015. Signage will continue to be monitored by EPA, USACE and their contractors and missing and/or damaged signs will be replaced as needed. Fencing in areas with contaminated shoreline sediment adjacent to parks and residential areas was also inspected and found to be in good condition. Fencing in these areas will continue to be monitored by EPA, USACE and their contractors and missing and/or damaged fencing will be replaced as needed.

3.5.2 Dredging, Desanding and Dewatering Operations

Dredging operations (including desanding and dewatering activities) are continuously monitored by the USACE during the dredging season. During off-dredging season periods, operations facilities and temporary waste disposal areas are inspected by USACE staff based at the Site, as well as by contracted security personnel.

3.6 Interviews

As noted above, in April 2015, EPA issued the *2015 CIP and Seafood IC Plan*. A large part of the plan was developed using feedback from community interviews on the EPA cleanup and outreach efforts. There were a number of community groups and individuals interviewed from various geographic and socioeconomic spectrums in New Bedford, Fairhaven, Dartmouth and Acushnet. The *2015 CIP and Seafood IC Plan* details the interviews and feedback, as well as plans for action relative to the community's feedback. EPA began implementation of the plan in the summer of 2015. The feedback from the community reflected positively on the EPA's cleanup of the harbor and gave numerous suggestions for increased education and outreach.

EPA coordinates on a daily basis with the USACE implementation team and USACE contractors performing the work. EPA also communicates regularly with other harbor stakeholders and the community. During the FYR process, EPA conducted interviews with MassDEP, the City of New Bedford and the New Bedford Harbor Development Commission (HDC). The purpose of the interviews was to document any perceived problems or successes with the remedy that has been implemented to date. Interview records were issued to the interviewees via email. Completed interview records were submitted on 6/2/2015, 7/17/2015 and 7/31/2015. Interviews are summarized below and completed interview questionnaires are included in Appendix C.

All interviewees are confident that, with the AVX settlement in place, the cleanup will achieve the desired positive effect on the harbor and surrounding communities. There is agreement that EPA has effectively taken advantage of the funding in the cleanup planning and implementation. The EPA establishment of a Team Leader position is considered beneficial to all aspects of the cleanup work. All interviewees agree that the EPA has effectively and efficiently responded to community concerns and complaints. Public meetings, especially in the form of the poster session held in October 2014, are effective. Some recommendations to improve resident's take-aways from public meetings are to develop data and graphics to hand out to the public for them to bring home from meetings, rather than references to the project website.

The interviews focus on the strong collaboration and cooperation of EPA with MassDEP, the City and HDC on all elements of the cleanup. The main focus from the HDC is to continue to make effective use of the SER process and to increase port activity. The HDC leadership would like to work with EPA to develop a mechanism to keep the SER process, or a similar process, in place once the EPA cleanup is complete. The City believes that the great working relationship with the EPA on a number of city plans, including those for future use of the harbor area, have been positively enhanced with the use of settlement funds.

4.0 TECHNICAL ASSESSMENT

The technical assessment was only conducted for OU1, since OU2 is complete and requires no further action (including no O&M) and a ROD has not yet been issued for OU3.

4.1 Question A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy is being implemented in accordance with the requirements of the 1998 ROD; the 2001, 2002, 2010, 2011 and 2015 ESDs; and design specifications. The remedy is expected to be protective when it is completed. With the recent settlement, this project will be accelerated to be substantially completed within 5 to 7 years. Key remedial actions at the Site are discussed below, along with a summary of the remedial activities conducted during the period covered by the FYR, and a discussion on how they are meeting the intent of the decision documents.

4.1.2 Dredging of Harbor Sediment

USACE, through its contractor, continues hydraulic dredging activities in the Upper Harbor. Appendix B.3 shows the major components of the hydraulic dredging process. The depth to which sediment has to be removed in a particular dredge area is based on core sampling data, a z-star (z*) predictive model for dredging depth, and bathymetric survey data. EPA's focus to date has been on removing the most highly contaminated PCB sediment layers to achieve the greatest risk reductions with the limited funding that had been available historically.

For years 2011 through 2013, with $15 million per year of Site funding, dredging of contaminated subtidal sediment occurred for approximately 40 to 45 days per year. Approximately 64,571 cy of contaminated sediment and debris was processed and shipped off-site by rail or truck to licensed disposal facilities during the 2011-2013 period. In 2014, with a portion of the settlement funding EPA received in 2013, EPA was able to make significant improvements to the dredging and treatment systems as well as allow for 118 days of dredging and off-site disposal of approximately 77,312 cy of in-situ sediment. The total volume of dredged sediment from 2011 through 2014 was 141,883 cy. The total volume of sediment removed from the harbor under OU1 through 2014 is approximately 354,570 cy. EPA plans on dredging an estimated 80 days in the 2015 dredge season yielding approximately 47,000 cy of contaminated sediment. The 2015 dredging season commenced in August 2015 and is expected to run through November 2015. Appendix B.4 includes a figure showing the areas where dredging has occurred through 2014 and a figure showing the areas where dredging is ongoing and to be performed in 2015. Appendix A.3.2, Table 2, lists all Site sediment remediation efforts and volumes to date.

Recommendations for improvements to the operations (lessons learned) are made at the end of each season. These lessons learned since the second FYR are documented in the dredge season data reports (Jacobs, 2011b; Jacobs 2013a; Jacobs 2013b; Jacobs 2014; Jacobs 2015b). Recommended improvements to the operations have been incorporated into current year operations.

The 2014 improvements to the dredge/treatment system that increased production efficiency and lowered the unit cost of dredging, as presented in the 2014 dredge-season end report (Jacobs, 2015b), are discussed below:

- Installed a larger more robust desanding unit and larger pump system to better separate sands from the slurry. These improvements led to significantly less sand being classified as TSCA material (>50 ppm). In 2014, 82% of sand was determined to be non-TSCA sand, which was shipped to a solid waste landfill accepting lower concentrations of PCB-containing waste at a cost savings to the project.
- Installed a gravity thickener in the dewatering operation to remove a portion of the water from the slurry using polymers, thereby thickening the slurry prior to dewatering by filter press. This unit also provides 45,000 gallons more slurry storage upstream of the filter presses.
- Added two additional filter presses for a total of eight presses to the dewatering system for a 33% increase in capacity. The additional slurry capacity provided by the gravity thickener helped ensure the filter presses had adequate feed material to keep them all on-line throughout the season.
- Added upgraded dredging software program to allow the dredge operator to more accurately program dredge cuts and track vertical and horizontal progress, reducing the dredge overlap to one foot which allowed dredge crews to cover more area per day and greatly reduced the amount of water introduced into the hydraulic treatment train by 42% as compared to previous seasons.

The daily dredge volume production average for the years 2005 through 2013 was approximately 454 cy per day, while for the 2014 dredge season, the average daily production was approximately 665 cy per day, a 46% increase.

In order to determine progress in meeting the target dredge elevation and to confirm the removal of contaminated sediment to concentrations at or below the remediation criteria, sediment conditions are assessed during and following dredging operations. The results indicate that the overall thickness of the highly contaminated sediment layers in the northern reaches of the Upper Harbor have been significantly reduced across all dredged regions, as presented in the sediment monitoring data since the second FYR (WHG, 2011c; WHG, 2012d; WHG, 2013b;

Battelle, 2015c). As compared to pre-dredging PCB concentrations, post-dredge concentrations have varied, but in general indicate that PCB concentrations are lower in areas where little overlying organic silt remains (i.e., where native sediment, typically clay in the northern Upper Harbor, was reached). The post-dredge monitoring also suggests that, at least in the highly contaminated northern reaches of the Upper Harbor, the z* predictive model may be underestimating the required depth of dredging. With the settlement funding now available to fund an accelerated remedial effort, EPA and USACE are in the process of performing comprehensive characterization of the remaining PCB-contaminated sediment area for implementation of remedial efforts to achieve established cleanup levels.

4.1.2 Construction and Filling of Lower Harbor Confined Aquatic Disposal Cell (LHCC)

In 2011, EPA signed a Cooperative Agreement with the City of New Bedford Harbor Development Commission to provide funding for the design and construction of the LHCC in two phases (location shown in Appendix B.13). The first phase of the CAD cell was completed during the spring of 2014. The second phase of the LHCC is scheduled to be completed in the fall of 2015. Prior to construction, in 2012, EPA held technical workgroup meetings with interested stakeholders to discuss risk assessment and modeling results, technical considerations and design of the CAD cell, dredging protocols, and ambient air information and monitoring plans. Information from those meetings, along with the LHCC plans and specifications, is available at http://www2.epa.gov/new-bedford-harbor/lower-harbor-confined-aquatic-disposal-cad-cell. In addition, in September 2014, EPA participated in a Fairhaven Board of Selectmen meeting to respond to community concerns, primarily focused on the construction and use of the LHCC. Following the meeting, EPA prepared a summary information document in an effort to respond to the majority of concerns raised by the community. The summary document is available at http://www2.epa.gov/sites/production/files/2014-10/documents/538674.pdf. Most recently, in 2015, USACE was tasked by EPA to design and contract out the dredging and disposal of PCB contaminated sediment into the LHCC. Dredging and disposal of the sediment is expected to occur beginning late-2015 through 2018. After a period of settling, the CAD will be capped and institutional controls will be implemented to ensure the integrity of the CAD. A technical workgroup meeting to discuss the design of the Lower Harbor dredge areas was held in July 2015. The information from the July 2015 meeting is available at http://www2.epa.gov/new-bedford-harbor/july-7-2015-technical-workgroup-meeting-documents.

4.1.3 Intertidal Excavations, Restorations and Monitoring

Excavation and restorations activities were completed North of Wood Street (NWS) in 2001, 2002/2003 and 2005. See also Section 3.4.5 above. These areas were targeted for accelerated cleanups due to the residential and recreational shoreline land use and the high levels of PCB contamination (prior to cleanup) in these areas. These areas are periodically monitored for soil and sediment PCB levels to assess whether recontamination due to tidal action is occurring. During this FYR period, NWS monitoring occurred in 2011 and 2012 (WHG, 2011d; WHG, 2012c). As of the most recent monitoring event for these areas, completed in 2012, there is evidence of low levels of recontamination; however, these levels have fluctuated up and down over the course of post-monitoring sampling since 2003. PCB concentrations in the NWS subtidal/river sediments have shown a general increasing trend, suggesting that PCBs have been actively transported up-river (tidally) from the known sources of PCB contamination downstream. For NWS shoreline sediment, post-remediation sampling results suggest that the remediation remains effective, although several post-remediation residential shoreline locations have been fluctuating slightly above the 1 ppm PCB cleanup level. As part of EPA's accelerated cleanup plan, any areas that have been recontaminated above the applicable cleanup levels will be reassessed as the remedial action efforts progress towards completion.

The lower PCB concentrations between shoreline/intertidal sediment and river/subtidal sediment NWS may be due to differences in exposure to contaminants transported by tidal currents. Most shoreline stations are located above mean high water (MHW) on the marsh surface and are only flooded during spring tides. Consequently, shoreline stations receive far less exposure to contaminants suspended in river water than subtidal sediment stations, reducing the likelihood of recontamination. Conversely, subtidal sediment stations can be exposed to contaminated sediment during every tidal cycle, and have a greater opportunity to accumulate contaminated sediment.

No additional intertidal remediation and restoration activities occurred during this FYR period. However, as a result of the recent settlement, EPA has now initiated planning for intertidal remediation efforts to address remaining dermal contact/incidental ingestion risks. By the end of 2015, EPA will have completed a sampling program covering the intertidal areas of both the Upper and Lower Harbor areas for delineation and remediation planning. Priority intertidal remediation efforts are expected to begin later in 2015 and all intertidal remediation and restoration efforts will be scheduled over the next 5-7 years as the accelerated cleanup progresses.

4.1.4 Construction of Confined Disposal Facilities

The 2002 and 2015 ESDs eliminated the construction of CDFs A, B, C and D. Sediment initially slated for CDFs A, B and C will be disposed off-site. Sediment slated for CDF D will be disposed off-site or in the Lower Harbor CAD Cell.

A pilot CDF to contain contaminated dredged sediment was constructed just north of the end of Sawyer Street as part of the 1988/89 pilot study. This pilot CDF was modified in the early 1990s as part of the Hot Spot ROD implementation to allow construction of a lined sediment holding cell (Cell #1). The original contents of the pilot CDF are now contained along the shoreline directly to the east of Cell #1; it is this shoreline area that is now referred to as the Pilot CDF. The Pilot CDF contains approximately 19,000 cy of PCB-contaminated sediment and debris. Groundwater and air monitoring performed at the Pilot CDF since 1992, along with groundwater modeling, demonstrate that PCBs are not migrating from the Pilot CDF area. See Section 3.4.7 above. In ESD5, EPA designated the Pilot CDF a permanent TSCA disposal facility and a final remedy for the area pursuant to TSCA 40 CFR § 761.61(c), consistent with the process described in ESD1 (EPA, 2015c).

EPA will continue to utilize the Pilot CDF area as a staging and storage area for sand from the desanding operations and debris generated from dredging operations. There may be additional incidental disposal of sand from the desanding operations in the Pilot CDF over the course of remaining remedial dredging operations. Pursuant to ESD5, following completion of remedial dredging activities, the Pilot CDF will be capped and institutional controls and long term monitoring and maintenance will be implemented.

Cell #1 is used for interim disposal of PCB- and VOC-contaminated sediments that were dredged during operations near the Aerovox shoreline area. In ESD3, EPA determined that there are no existing risks associated with the temporary disposal in Cell #1 (EPA, 2010). When funding allows, EPA intends to remove all the material from Cell #1 and dispose of it at an appropriately licensed landfill.

4.1.5 Construction and Operation of Water Treatment Facilities

A 2,000 gpm water treatment system is part of the dewatering facilities at Area D. A desanding facility at Area C, which receives slurry from the dredge to separate coarse-grained materials (e.g. sand, gravel, shells, etc.) prior to dewatering, is also part of the sediment processing operation. Both facilities have been in operation since the start of the dredge season in 2004. Since the start of full-scale dredging, a ferric sulfate injection system was added upstream of the desanding facility, along with other operational measures, to address the formation of hydrogen sulfide (H_2S) in the building. Overall, the treatment systems are functioning as intended as the effluent concentrations for PCBs and selected metals are in compliance with the stringent project effluent discharge criteria (Jacobs, 2011b – *Table C-4;* Jacobs, 2013a – *Table B-5*; Jacobs, 2013b – *Table B-5*; Jacobs, 2014 – *Table B-5*, Jacobs, 2015b – *Table B-5*).

4.1.6 Seafood Advisories and Other Institutional Controls

As discussed above, complete control of PCB-contaminated seafood consumption will continue to be problematic until the risk-based site-specific PCB level for seafood is reached. Appendix B.12 provides a summary table of planned and implemented institutional controls for the OU1 remedy. EPA has implemented the following institutional controls to minimize and, where possible, prevent exposure to contamination that could result in unacceptable risk. ICs planned for the future are also briefly discussed:

- *Fishing restrictions and advisories.* In 1979, MassDPH promulgated regulations prohibiting fishing and lobstering throughout the Site due to elevated PCB levels in area seafood (See Appendix B.2), and enforcement is the responsibility of MassDPH. EPA also performed risk assessments that led to site-specific seafood consumption advisories and recommendations. In 2010, EPA issued more stringent seafood consumption recommendations to augment the 1979 fishing restrictions, including more stringent guidance for nursing mothers, women of child-bearing age, and children. Institutional controls in the form of seafood consumption advisories are necessary since it could take many years, even after the sediment remediation efforts are completed, before PCB levels in seafood species reach safe levels for consumption. These institutional controls shall continue until protective levels for PCBs in local seafood are consistently achieved throughout the Site. In April 2015, EPA issued the *2015 CIP and Seafood IC Plan*. EPA prepared this plan based on community interviews and other relevant information. The *Seafood IC Plan* element specifies the steps EPA has and will continue to take to implement the institutional controls for seafood consumption and collaborate with others to reduce consumption of local PCB-contaminated seafood. The *2015 CIP and Seafood IC Plan* includes a new seafood consumption advisory brochure that is being used for outreach and education efforts. This brochure is available in Spanish, Portuguese, and Vietnamese. In September 2015, EPA updated its advisories to include a seafood consumption recommendation for tautog in closure area 3. The updated EPA advisories are included in Appendix C and available at http://www2.epa.gov/new-bedford-harbor/fish-consumption-regulations-and-recommendations. EPA's seafood consumption advisory brochure will be revised to reflect the updated information. The *2015 CIP and Seafood IC Plan* also includes new actions that EPA will implement going forward to minimize seafood consumption, including the creation of new signage, a new video and targeted outreach using culturally related peers.

- *Fencing.* Fencing has been erected along the New Bedford shoreline in residential and recreational shoreline areas where they abut sediment with elevated levels of PCBs that may represent dermal contact/incidental ingestion risk. As documented in the *2015 CIP and Seafood IC Plan*, EPA continues to use, monitor and maintain fencing to address both seafood consumption and dermal contact/incidental ingestion risks. EPA conducts at least annual inspections of fencing to ensure this institutional control remains in place. The results of the 2015 fencing and signage inspection is attached in Appendix B.10.

- *Signage.* Signage is used extensively at the Site, both to communicate the fishing advisory as well as to warn against dermal contact/incidental ingestion with PCB-contaminated sediment. As documented in the *2015 CIP and Seafood IC Plan*, EPA continues to use, monitor and maintain signage, including informational kiosks, to address both seafood consumption and dermal contact/incidental ingestion risks. EPA conducts annual inspections of signage to ensure this institutional control remains in place and protective. The results of the 2015 fencing and signage inspection is attached in Appendix B.10. The *2015 CIP and Seafood IC Plan* also provided for the installation of signage at additional locations along the Upper and Lower Harbor. The figure of the signage and kiosk locations is included in Appendix B.9. Further, the *2015 CIP and Seafood IC Plan* called for new signage depicting the message "do not eat fish". These new signs have been designed and will be installed at all signage locations by the end of 2015.

- *Additional Educational Materials.* In addition to outreach materials on the seafood consumption advisories and recommendations, the *2015 CIP and Seafood IC Plan* includes educational and outreach materials created in 2008 that will continue to be distributed at boating or crew-racing events in the Upper or Lower Harbor where there is a risk of exposure to contaminated sediment and physical hazards from dredging operations. The brochure explains the potential risks and the measures boaters can take to avoid exposure.

- *ICs for CDFs, LHCC, OU3 cap and other EPA property*. The only CDF that will remain as a permanent element of the OU1 remedy is the Pilot CDF. Following completion of remedial dredging activities, the Pilot CDF will require final capping, institutional controls and long term monitoring and maintenance. Institutional controls will be required to restrict reuse of the area to passive recreational use and ensure that the integrity of the cap and the Pilot CDF's sidewalls are maintained for long term protectiveness. In 2011, ICs were placed to protect the OU3 cap. Once completed and capped, the LHCC will require similar institutional controls as those already in place for the OU3 pilot cap area, and the OU3 pilot cap area will be re-evaluated with the State once the additional subtidal mitigation capping is completed. EPA maintains security, including fencing and security staff, around all of its facilities where contaminated sediment is treated or stored. EPA has issued licenses to the HDC and a local fisheries company to be able to use the marine bulkhead at the EPA's Hervey Tichon dewatering facility (Area D) for marine industrial uses (primarily for docking commercial fishing boats) that are compatible with the remedial activities being conducted at the property.

4.1.7 Long Term Monitoring Program

EPA has been collecting long term monitoring (LTM) data approximately every five years at the Site since 1993 to assess sediment conditions and quantify the long term environmental effects and effectiveness of remediation efforts in the harbor. See discussion above in Section 3.4.1. Overall, the long term monitoring program confirms that the cleanup activities to date have resulted in significant improvement in surface sediment and benthic quality in 2014 compared to the 1993 baseline data for the Lower and Outer Harbor areas (Appendix B.8).

4.1.8 Seafood Monitoring Program

Seafood tissue monitoring performed at the Site includes both the annual seafood monitoring program and the blue mussel monitoring program. See discussion above in Section 3.4.2. Overall, the levels of PCBs in New Bedford Harbor area seafood continue to be above the site-specific goal and are consistent with levels expected during ongoing, long term, active sediment remediation. EPA and USACE are continuing work on a food chain modeling effort to update the 1990 food chain model performed in support of the 1998 ROD. The food web model will be utilized to make predictions of biota PCB concentrations post remediation so EPA can estimate potential seafood consumption risk reductions over time and the estimated time after completion of the OU1 remediation to reach the risk-based fish tissue target level of 0.02 ppm. As noted above, EPA is working to optimize the seafood monitoring program towards tracking seafood tissue decreases over time to demonstrate seafood tissue reductions as the cleanup progresses and following completion of remedy construction. Following completion of remedy construction, seafood tissue data will be used to refine model predictions.

4.1.8 Summary

In summary, the remedy is proceeding as intended and with the recent settlement, this project will be accelerated to be substantially completed within 5 to 7 years. EPA will continue to work with project stakeholders to implement the remedy going forward. Major remedial activities scheduled over the next five years include: continued subtidal hydraulic dredging in the Upper Harbor; mechanical dredging of portions of the Upper Harbor and the Lower Harbor for disposal in the LHCC; intertidal/shoreline remediation and restoration; and the development of

LHCC, Pilot CDF and shoreline ICs. Long term monitoring shows an improvement in overall sediment and benthic quality in the Lower and Outer Harbor areas compared to 1993 baseline data, and the historical seafood monitoring data set has been used to establish protective seafood consumption advisories and recommendations. It could take many years, even after the sediment remediation efforts are completed, before PCB levels in seafood species reach safe levels for consumption. In the interim, EPA will continue its ongoing measures and implement the community relations activities and institutional controls for seafood consumption activities outlined in the *2015 CIP and Seafood IC Plan*. At this time, there are no known problems with the remedy that would affect its long term protectiveness.

4.2 Question B: Are the remedial action objectives (RAOs), exposure assumptions, toxicity data and cleanup levels used at the time of the remedy selection still valid?

Yes, the RAOs, exposure assumptions and cleanup levels used at the time of remedy selection are still valid; however, toxicity data used at the time of remedy selection have changed. The analysis presented below is for OU1. No evaluation is needed for OU2 because all excavated Hot Spot sediment has been disposed off-site. An evaluation was not conducted of OU3, since a remedy has not yet been selected.

4.2.1 Remedial Action Objectives

The following are the remedial action objectives as summarized in the 1998 ROD:

1. To reduce risks to human health by reducing PCB concentrations in seafood, by lowering PCB concentrations in sediment and in the water column;
2. To ensure that contact with shoreline sediment does not present excessive risks to human health as a result of dermal contact with or accidental ingestion of PCB-contaminated sediment in areas prone to beach combing or in areas where residences abut the Harbor; and
3. To improve the quality of the seriously degraded marine ecosystem by
   a) reducing marine organisms' exposure to PCB contaminated sediment while minimizing consequent harm to the environment, and
   b) reducing surface water PCB concentrations to comply with chronic AWQC by reducing PCB sediment concentrations.

These remedial action objectives remain valid. The overall long term goals of the remedy also remain appropriate (e.g., eventual lifting of the state fishing bans and EPA seafood consumption advisories (seafood consumption may not be safe for other reasons, such as due to wastes from CSOs), reduction of human health risks associated with dermal contact with and incidental ingestion of shoreline sediment, and compliance with the PCB national recommended water quality criterion).

4.2.2 Exposure Assumptions

The exposure assumptions used at the time of remedy selection are still valid. The environmental media which were considered in the 1998 ROD include surface water, harbor sediment, marine biota and Site area air. Direct contact with and incidental ingestion of shoreline sediment and ingestion of contaminated seafood were identified as the human health exposure pathways of primary concern. The original human health risk assessment in 1989 evaluated the cancer and non-cancer risks of PCBs, cadmium, copper, and lead in adults, young children (age 0-5 years), and older children (age 6-16 years) exposed via sediment contact, sediment ingestion, ingestion of aquatic biota, and inhalation of airborne contaminants. PAHs were found to be collocated with PCBs, but were not assessed for risk because it was concluded that the PAHs resulted from non-point sources and would be effectively addressed with PCB remediation. Screening results performed under conservative exposure conditions indicated that exposure to PCBs in surface water and air did not represent a significant exposure pathway. However, EPA established water quality and ambient air monitoring programs to ensure that the remediation efforts did not cause unacceptable impacts to surface water and air and to confirm ambient air levels remained below levels protective of human health. These risk assessment scenarios and exposure assumptions remain valid.

4.2.3 Toxicity Data

EPA toxicity values, including reference doses (RfDs) and cancer slope factors (CSFs), are routinely re-evaluated and updated. As such, some of the exposure factors used in the 1989 risk assessment have changed. Carcinogen Assessment Group Potency Factors have been replaced with CSFs. Currently, the primary source of toxicity values is EPA's Integrated Risk Information System (IRIS) database. In addition, some of the toxicity data used at the time of the 1989 risk assessment have also changed. These toxicity values are used in the calculations of risk and the development of site-specific and more generic risk-based screening values or clean-up goals. Changes have occurred to toxicity values used for the OU1 human health risk assessment for PCBs.

The following summarizes changes in risk assessment toxicity factors and approaches that have occurred since the time of the 1989 risk assessment:

1. Changes in Exposure Factors: In 2014, EPA finalized a Directive to update standard default exposure factors and frequently asked questions associated with these updates. http://www.epa.gov/oswer/riskassessment/superfund_hh_exposure.htm (items # 22 and #23 of this web link) (EPA, 2014a and b). Many of these exposure factors differ from those used in the 1989 risk assessment supporting the ROD. In general, these changes result in a slight decrease of the risk estimates for most chemicals. Specific changes of default exposure factors related to fish consumption include: increase in adult body weight from 70 kg to 80 kg, decrease in total resident exposure duration from 30 years to 26 years, decrease in adult resident exposure duration from 24 years to 20 years, and change of fish ingestion rate from 5×10^4 mg/day (i.e., 50 grams/day) to a recommendation to use site-specific values.

2. Changes in Toxicity and Other Contaminant Characteristics: Changes have occurred to the toxicity values for PCBs used for the fish consumption and inhalation exposure pathways in the 1989 human health risk assessment. Toxicity values for other chemicals assessed for risk at the Site (cadmium, copper, lead) have not been considered because PCBs are overwhelmingly the primary risk driver at the Site and remedial actions (dredging, excavation, isolation and subaqueous capping) for PCBs will result in the removal and/or

elimination of exposure to metals as the contaminants are collocated with PCBs. The risks of dioxin-like PCBs were not evaluated at the time of the 1989 risk assessment. Therefore, the following information on dioxin-like PCBs is offered as new information, available since the last FYR, rather than changes to toxicity data used at the time of remedy selection. Dioxin-like PCBs have been detected at very low concentrations.

a. **Total PCBs Toxicity Values:**

i. **Cancer:** PCB cancer toxicity values have changed for the fish consumption pathway and for the inhalation pathway.

- ORAL: The oral cancer slope factor (SFO) used in the 1989 seafood consumption risk assessment was 7.7 per mg/kg-day. According to the IRIS file on PCBs, the current recommended oral cancer slope factor for PCBs in fish is 2.0 mg/kg-day, representing the oral cancer slope factor for "high risk" PCBs. Since the SFO decreased since the 1989 risk assessment, the cancer risk would be lower.
- INHALATION: For inhalation cancer risk, the current recommended inhalation unit risk (IUR) for evaporated PCB congeners is 1×10^{-4} per ug/m^3, which is based on conversion of the middle tier (i.e., "low risk") SFO of 0.4 per (mg/kg)/day. Prior to this FYR, inhalation cancer risks were calculated using an inhalation slope factor calculated by route to route conversion of the SFO for Aroclor 1242. Aroclor 1242 is the Aroclor that most closely matched the congener pattern of detected PCB congeners in air samples collected prior to the dredging program.

ii. **Non-Cancer:**

- ORAL: PCB non-cancer toxicity values are available in the IRIS database for the oral route for Aroclor 1016 and Aroclor 1254. The RfD used in the 1989 risk assessment was 1×10^{-4} mg/kg-day, based on conversion from an EPA chronic drinking water health advisory. The non-cancer Reference Dose (RfD) has been revised to 2×10^{-5} mg/kg-day for Aroclor 1254. Since the RfD decreased since the 1989 risk assessment, the non-cancer risk would be higher.
- INHALATION: Non-cancer inhalation toxicity values have not been recommended under the EPA IRIS program since the time of the 1989 risk assessment. However, historically, under the air monitoring program, EPA developed non-cancer risk-based levels based on occupational limits for PCBs. However, the cancer-based values were lower than these non-cancer limits and were the driver for the monitoring program historically.

b. **Dioxin-like PCBs Toxicity Values:**

i. **Cancer:**

- ORAL: Although the EPA IRIS database does not recommend any cancer toxicity values for dioxin, the EPA Regional Screening Level database recommends the use of an oral slope factor of $1.3 \times 10^{+5}$ per (mg/kg)/day.

This value is a Tier 3 value derived from CalEPA values. The values are used in the Toxicity Equivalency Factor (TEF) approach to calculate cancer risk of dioxin-like PCBs.

- INHALATION: Although the EPA IRIS database does not recommend any cancer toxicity values for dioxin, the EPA Regional Screening Level database recommends the use of an inhalation unit risk of 3.8 x 10^{+1} per ug/m^3. This values is a Tier 3 value derived from CalEPA values. The values are used in the TEF approach to calculate cancer risk of dioxin-like PCBs.

ii. **Non-cancer:**

- ORAL: On February 17, 2012, EPA finalized the non-cancer toxicity assessment for the most potent dioxin, 2,3,7,8-Tetrachlorodibenzodioxin, or 2, 3, 7, 8-TCDD, indicating that non-cancer health effects from exposure to dioxin and dioxin-like PCB congeners can now be quantified. EPA's dioxin reassessment has been developed and undergone review for many years, with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. EPA followed current guidelines and incorporated the latest data and physiological/ biochemical research into the reassessment. With the release of the final human health non-cancer dioxin reassessment, EPA also published an oral non-cancer toxicity value, or reference dose (RfD), of 7x10^{-10} mg/kg-day, for 2, 3, 7, 8-TCDD in IRIS. The dioxin oral RfD was approved for use at Superfund sites to ensure protection of human health. As a result, non-cancer hazard from exposure to dioxin-like PCBs can now be quantified using the TEF approach, using the non-cancer toxicity factor for dioxin.
- INHALATION: Although the IRIS database does not recommend a value for non-cancer effects of dioxin via inhalation, the EPA Regional Screening Level database recommends an inhalation Reference Concentration (RfCi) of 4 x 10^{-8} mg/m^3. This value is a Tier 3 value from CalEPA. Tier 3 values are usable in the absence of an IRIS value or a Provisional Peer Reviewed Toxicity Value (PPRTV).

3. Changes in Risk Assessment Methods: Changes have occurred since the last FYR to methods used to evaluate vapor intrusion exposures, exposures to asbestos, exposure to arsenic, and exposures to mutagenic carcinogens. Of these exposures, only exposure to mutagenic carcinogens is potentially applicable because some of the PAHs are mutagenic carcinogens; however, PAH risks are not being re-evaluated because PCBs overwhelmingly drive risk at the Site and it is expected that the remedial actions will decrease or sequester PAHs to exposure levels consistent with anthropogenic background.

4.2.4 Impact of Changes to Toxicity Data

Oral: EPA evaluated the impact of the exposure factor and oral toxicity value changes outlined in Section 4.2.3 on the risk-based fish tissue target level of 0.02 ppm. Recalculation of cancer and non-cancer risks resulted in confirmation that the 0.02 mg/kg total PCB seafood tissue target level remains protective for both cancer and non-cancer effects of total PCBs. The risks of dioxin-like PCBs were also evaluated and results show that the contribution of dioxin-like PCB risk to total PCB risk was quite variable, with factors ranging from about 0.1 to 10 between dioxin-like risk and total PCB risk. Although dioxin-like PCBs contributed significantly in most species to the cancer and non-cancer risk of total PCBs, the recalculated risks of seafood consumption are approximately the same as in the original risk assessment, leading to no significant change to the seafood consumption advisories due to dioxin-like PCBs or to the site-specific fish tissue target level of 0.02 ppm total PCBs. Since the proportion of dioxin-like PCB risk to total PCB risk is quite variable among seafood species, development of a seafood tissue cleanup level for dioxin-like PCBs is not practical. As noted above, as part of the development of the *2015 CIP and Seafood IC Plan* and as part of this third FYR, EPA evaluated the seafood tissue data collected under the Seafood Monitoring Program from 2010-2014 and confirmed that the seafood advisories and recommendations established by EPA in 2010 remain protective. That update also evaluated new data for tautog, collected in 2013 and 2014, which supports a new advisory for closure area 3 for that species. In September 2015, EPA updated its advisories to include a seafood consumption recommendation for tautog in closure area 3. EPA's seafood consumption advisory brochure will be revised to reflect the updated information. The seafood consumption advisories continue to be protective if complied with by the public. EPA has documented these conclusions in a risk assessment update included in Appendix D.

Inhalation: EPA evaluated the impact of the exposure factor and inhalation toxicity value changes outlined in Section 4.2.3 on the risk-based ambient air goals used in the ambient air monitoring program. As noted above in Section 3.4.4, the EPA updated its air monitoring plan in 2015. The *2015 Air Monitoring Plan* (Jacobs, 2015c) will be implemented for all remaining remediation activities starting with the 2015 dredge season, which began in August 2015. In this Plan, EPA recalculated ambient air risks using updated exposure factor and inhalation toxicity values (Appendix A of the plan). The risks of dioxin-like PCBs were also evaluated as part of the 2015 update and recalculation of air risks (Appendix B of the plan). The calculated inhalation cancer risks were much lower using the updated IUR, with correspondingly higher risk-based goals, but, for conservativeness and consistency, the previously selected cancer risk-based goal (previously called the allowable ambient limit, or AAL) is being retained as a risk management trigger in the ambient air monitoring program. To date, the air monitoring program has demonstrated that the cumulative exposure from PCBs measured in ambient air remain below risk-based exposure budgets that are protective of human health.

In addition, in the *2015 Air Monitoring Plan*, EPA used route to route extrapolation from the oral reference dose of Aroclor 1016 to calculate a non-cancer risk-based goal. This approach was used by EPA Region 2 for the Hudson River PCBs Superfund Site to develop a risk management action level for monitoring impacts of dredging activity. The calculated non-cancer risk-based goal is 110 ng/m^3. This concentration is the chronic air concentration associated with a Hazard Quotient of one for a child resident, age birth to 6 years. This is the lowest risk-based goal for any type of human receptor at the Site. The chronic time-weighted average concentration in air samples taken at the Site is below this level; therefore protective.

The cancer risk of dioxin-like PCBs was approximately the same as the cancer risk of total PCBs, resulting in an approximate doubling of the cancer risk; however, this additional risk is not significant with regard to risk management decisions because the combined risk is lower than EPA's acceptable cancer risk range of 1 x 10^{-6} to 1 x 10^{-4}. The dioxin-like PCBs in air samples had non-cancer risks well below a hazard quotient of 1, and did not contribute significantly to the non-cancer risk of total PCBs. Therefore, continued monitoring of total PCBs in ambient air under the *2015 Air Monitoring Plan* is protective for both total PCB and dioxin-like PCB risk.

4.2.5 Cleanup Levels

The sediment cleanup levels established at the time of remedy selection are still valid. In selecting the cleanup levels for the various areas in the Harbor in the 1998 ROD, EPA balanced protection of public health and the environment. Prior to issuing the 1998 ROD, EPA performed a human health and ecological risk assessment at the Site. With respect to sediment cleanup levels that would result in safe seafood consumption, EPA first considered the U.S. Food and Drug Administration's (FDA) tolerance level of 2 ppm PCBs in seafood tissue: FDA levels are based on nationwide seafood consumption patterns of the general public and are balanced by economic considerations. Public health agencies typically use FDA levels in regulating seafood consumption. At Superfund sites, EPA assesses risk and derives target levels in seafood which are protective of public health by utilizing a site-specific risk assessment process. This process relies on reasonable assumptions about exposure and up-to-date scientific information about toxicity. Accordingly, EPA developed a target site-specific risk-based level of 0.02 ppm for PCBs in fish tissue (i.e., to achieve an incremental cancer risk of one in one hundred thousand, or 10^{-5}). Based on this target site-specific risk-based level in fish tissue, EPA determined the target cleanup level for PCB-contaminated sediment at the Site. At the time of the ROD, EPA noted that:

"*For seafood to meet both the FDA and site specific levels at the end of 10 years, EPA believes that a TCL for sediment dredging of 1 ppm would be necessary. However, dredging to that level would cause severe adverse environmental impacts to the Harbor.*"

"Although the ecological risk assessment pointed to a 1 ppm sediment PCB threshold for protection of marine organisms, achieving this TCL was believed to cause more harm than good due to the radical alterations to the harbor and adverse environmental impacts that would result given the widespread nature of the PCB contamination."

"In order to balance both protection of human health and the environment, EPA has determined that using a slightly higher TCL together with institutional controls on seafood consumption allows the remedy to remain protective of human health yet does not impose as severe adverse impacts to the Harbor ecosystem."

"The selected remedy includes various institutional controls and a long term seafood monitoring program to keep the consumption of contaminated local seafood below safe levels."

EPA selected the cleanup levels in the 1998 ROD based on careful consideration of multiple factors including: how to best balance the protection of public health with the protection of sensitive ecosystems, such as the Site's valuable saltmarsh habitat; the large geographic area covered by the Site (the Upper Harbor is approximately 187 acres and the Lower Harbor is approximately 750 acres); the wide range of potential direct contact exposure rates at the Site, varying with shoreline land uses; and the fact that portions of OU1's Lower Harbor are within the Designated Port Area (DPA), as classified by the Massachusetts Office of Coastal Zone Management, with concentrated maritime industrial uses.

EPA selected different cleanup levels for different areas of the Harbor. The site-specific rationale for these varying cleanup levels is provided below.

For subtidal areas, the cleanup levels, to attain applicable water quality and seafood consumption standards, are the following:

- **10 parts per million (ppm) PCBs for subtidal and mudflat sediment in the Upper Harbor** (north of the Coggeshall Street bridge), which has the highest concentrations of PCB contamination since the Aerovox Facility was located adjacent to the Upper Harbor shoreline. The 10 ppm PCBs cleanup level was applied to the Upper Harbor portion of the Site in order to balance protection of public health with ecological health (i.e., avoiding the adverse ecosystem impacts that would result from larger scale sediment and saltmarsh removal).
- **50 ppm PCBs for subtidal and mudflat sediment in the Lower Harbor** (between the Coggeshall Street bridge and the New Bedford Hurricane Barrier). In contrast to the Upper Harbor, much of the Lower Harbor portion of the Site is a DPA, with a working waterfront, and it is lined with industrial and commercial facilities along the New Bedford shoreline. Among other factors, EPA considered the current and future use of an area, such as an urban port, in selecting appropriate cleanup levels. In addition, most if not all of the remaining Lower Harbor will be dredged for navigational purposes over time, as provided in the 1998 OU1 ROD's State Enhanced Remedy. Therefore, the 50 ppm PCBs cleanup level for the Lower Harbor was determined to be appropriate given the Lower Harbor's current and future anticipated use and the enhancement of the cleanup due to the State Enhanced Remedy.

For the shoreline/intertidal areas, the cleanup levels, to reduce risk from human contact with contaminated sediment, are the following:

- **1 ppm PCBs for areas bordering residential areas**;
- **25 ppm PCBs for shoreline areas bordering recreational areas**; and
- **50 ppm PCBs for other shoreline areas with little or no public access, including saltmarshes**. The Upper Harbor contains large fragile saltmarsh habitats which include ecologically important breeding, nursery, and feeding areas for aquatic life. EPA selected a 50 ppm PCBs cleanup level for saltmarshes with limited expected access to minimize adverse impacts to these marshes while still protecting against dermal contact/incidental ingestion risks to the occasional beachcomber.

Based on modeling performed in support of the 1998 ROD, after the cleanup is complete, the Harbor and surrounding areas are expected in the long term to become open for safe seafood consumption in regard to the reduction of PCBs in seafood tissue. (Note that although PCB contamination will be reduced, shellfish consumption may not be safe due to bacterial contamination from CSOs). It should also be noted that the national recommended water quality criterion (formerly known as ambient water quality criterion) for PCBs in salt water of 0.03 parts per billion (ppb) is expected, based on modeling performed in support of the 1998 ROD, to be attained throughout the Harbor ten years after the cleanup is complete.

In the 1998 ROD, EPA integrated the SER of navigational dredging and onsite disposal into EPA's OU1 Remedy. The SER provides for the removal of sediment containing PCBs up to 50 ppm and co-located heavy metals that EPA's OU1 cleanup would not be addressing in the Lower Harbor. Under the SER, navigational dredging will address an estimated 1.7 million cy of sediment contaminated with heavy metals and lower levels of PCBs (below 50 ppm PCBs). Since 2005, navigational dredging under the State Enhanced Remedy of approximately 545,000 cy of sediment contaminated with low levels of PCBs from the Lower and Outer Harbor has occurred. See Appendix A.3.2, Table 4, Appendix B.13 and Appendix B.14.

It is important to note that a) the 1998 ROD states, in the Upper Harbor, with a subtidal sediment cleanup level of 10 ppm, naturally occurring sedimentation will result in residual PCB levels that will approach 1 ppm over time; and b) in the Lower Harbor, in general, navigational dredging is expected over the long term to leave residual PCB levels of 1 ppm or less over most if not all of the area.

The LTM assesses the overall remedial effectiveness by quantifying long term sediment quality and ecological effects on species abundance and richness from exposure to Upper, Lower and Outer Harbor sediment and water column. As discussed in Sections 3.4.1 and 4.1.7, EPA's LTM program, which assesses remedial effectiveness every five years, found in 2014 the average concentration levels of surficial sediment (2 cm) in the Lower Harbor to be approximately 7 ppm PCBs (Appendix B.8). In addition, the long term benthic community monitoring confirms that the cleanup activities to date have resulted in significant improvement in benthic quality in 2014 compared to the 1993 baseline data for the Lower and Outer Harbor areas (Appendix B.8).

With respect to the subtidal cleanup levels, considering that the rationale for the cleanup levels established in the 1998 ROD remains valid, the cleanup is ongoing, and the long term monitoring program confirms that cleanup activities to date have resulted in significant improvements in the sediment and benthic quality in the Lower and Outer Harbors, these cleanup levels remain valid.

With respect to the intertidal cleanup levels, EPA has evaluated the impact of the exposure factor and toxicity value changes and concluded that the changes do not significantly change the sediment cleanup levels established in the 1998 ROD for addressing dermal contact/incidental ingestion risks (see Appendix D). The use of many of the properties abutting the harbor have changed since the time of the 1998 ROD, but the ROD includes cleanup levels for various adjacent uses and those levels remain protective for associated dermal contact/incidental ingestion risk. As discussed in Section 4.2.6 below, intertidal/shoreline areas where adjacent property use has changed since the time of the 1998 ROD will be cleaned up to the level appropriate for the new actual or foreseeable future use.

4.2.6 Changes in Land Use of Shoreline Areas Abutting the Site

EPA has observed an overall trend towards a more publicly accessible shoreline in the Upper Harbor (e.g., Riverside Park and River Road Park in New Bedford and Riverview Park in Acushnet) as well as towards conversion of shoreline mills to residential use (e.g., Rope Works building, Whalers Cove assisted living, Victoria Riverside Lofts, Manomet Place, Riverbank Lofts). It is expected that additional shoreline properties developed before remediation is performed or completed will trigger the more stringent shoreline cleanup levels. Further, the City of New Bedford is in the process of designing a shoreline "Riverwalk," envisioned as a passive recreational walkway to reconnect the community with the view-scape and environmental resource that the river represents. Significant habitat restoration is planned as part of the Riverwalk. In addition, Buzzards Bay Coalition, in collaboration with the Towns of Acushnet and Fairhaven, are planning for the Acushnet River Reserve project, envisioned to provide public access trails and observation decks along a large area of the saltmarsh along the eastern shoreline of the Upper Harbor. EPA will continue to work with the local municipalities and private shoreline landowners to assess changes in shoreline land use and incorporate them into the remedy, as appropriate.

It should also be noted that the City has future plans for a boat house to be located in the vicinity of EPA's Sawyer Street facility. The City has, in past years, held rowing/boating events. In an effort to allow safe rowing in the Upper Harbor when EPA was not actively dredging, EPA, the New Bedford Harbor Development Commission (HDC) and the New Bedford Community Rowing program worked together to coordinate these past events. The HDC provided a controlled (cordoned off the bank) public viewing area near the end of Sawyer Street. EPA moved steel sheet piles used during dredging operations so that they were outside of the rowing course. Rowers launched their boats from Pope's Island and rowed to the Upper Harbor. EPA had representation at Pope's Island and the viewing area to hand out the rowing safety information for the harbor and to discuss decontamination with the rowers. Increased use of the Upper Harbor for recreational boating in the future will need to be coordinated with ongoing dredging and other remedial activities to prevent recreational exposure to contaminated sediment, as well as safety hazards.

4.2.7 ARAR Review

In order to evaluate the protectiveness of the remedy, the Applicable or Relevant and Appropriate Requirements (ARARs) in the 1998 ROD (and subsequent modifications to the ROD) were checked for changes in standards; newly promulgated standards and TBCs (to be considered) were also evaluated. An ARAR Review was only conducted for OU1, since the OU2 remedy is complete and requires no operation and maintenance, and the ROD for OU3 has not been issued.

The 2010 FYR identified certain changes to location and action-specific ARARs that were either rescinded or required as a result of modifications to the OU1 remedy. Standards promulgated at 40 CFR Part 6, Appendix A, pursuant to Executive Orders 11988 (Management of Floodplains) and 11990 (Protection of Wetlands) were rescinded. ESD1 and ESD2 included risk-based TSCA determinations for temporary storage of PCB remediation waste at the pilot study CDF and for the handling and management of PCB remediation waste for offsite disposal instead of disposal into CDF D, respectively. ESD3 modified the use of Cell #1 to include the temporary disposal of hazardous waste (VOC-impacted sediment removed during Aerovox shoreline dredging) as well as PCB-remediation waste and EPA invoked statutory waivers for certain state hazardous waste surface impoundment regulations and determined that certain identified site conditions were equally protective.

During the current FYR period, EPA issued two additional ESDs: ESD4 modified the remedy to replace off-site disposal of a certain volume of contaminated sediments with mechanical dredging and onsite disposal in a LHCC; and ESD5 eliminated the construction of the planned CDFs A, B and modified design of CDF C and selected off-site disposal for the sediment slated for disposal in those planned confined disposal facilities and confirmed that the Pilot CDF is protective and will become a permanent TSCA disposal facility.

As a result of a review of the ARARs in the 1998 ROD since the last FYR and the issuance of the two additional ESDs, certain ARARs and TBC were affected as described below.

Chemical-Specific ARARs:

Both Cancer Slope Factors (CSFs) and Reference Doses (RfD) were identified as TBCs in the 1998 ROD; therefore, EPA's only task is to identify changes to these values and determine whether the remedy remains protective. As explained above in Section 4.2.3, changes have occurred to update the standard default exposure factors (increased adult body weight, decrease exposure durations and change in fish ingestion rate) and toxicity values for PCBs used for fish consumption and inhalation exposure pathways (both cancer and non-cancer values). In addition, because dioxin-like PCBs have been detected at very low concentrations, EPA evaluated risk from dioxin-like PCBs in seafood when updating and recalculating the human health risk. As explained in Section 4.2.3, EPA's primary source of toxicity values is the IRIS database; however, because IRIS does not recommend oral or inhalation cancer toxicity values or inhalation for non-cancer toxicity values for dioxin, the CalEPA values were used to derive Tier 3 values for these pathways.

Since Table 8 of the 1998 ROD already includes EPA Cancer Slope Factors and Reference Doses, below, EPA is identifying, as additional chemical-specific TBCs, those guidance documents which affected the updated standard default exposure factors, toxicity values, and those related to toxicity values that were used to update and recalculate the human health risk at the Site.

- Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120 (February 6, 2014) (EPA, 2014a);
- Frequently Asked Questions (FAQs) about update of standard default exposure factors (OSWER Directive 9285.6-03, dated February 6, 2014) (EPA, 2014b);
- California Department of Health Services (CDHS), 1986. "Technical Support Document Report on Chlorinated Dioxins and Dibenzofurans. Part B. Health Effects of Chlorinated Dioxins and Dibenzofurans". The California EPA unit risk and slope factor for 2, 3, 7, 8-TCDD are presented in "Appendix A: Hot Spot Unit Risk and Cancer Potency Values"

http://www.oehha.ca.gov/air/hot_spots/2009/AppendixA.pdf and in http://www.oehha.ca.gov/air/hot_spots/pdf/AppCdioxinTEFs013111.pdf.

In light of these changes in exposure factors and oral toxicity values, including dioxin-like PCBs, in 2015 EPA recalculated the human health cancer and non-cancer risks of total PCBs and dioxin-like PCBs in seafood and determined that the 0.02 mg/kg total PCB seafood tissue target level remains protective. (See section 4.2.4 above for full discussion.) EPA also recalculated ambient air risks in its updated *2015 Air Monitoring Plan* using the updated exposure factor and inhalation toxicity values, including dioxin-like PCBs, and determined the cancer risks were much lower using the updated IUR; however, more conservative risk-based levels will be used as risk management triggers in the air monitoring program. A non-cancer risk-based goal of 110 ng/m^3 was also established in the *Plan* (see section 4.2.4 for further discussion). To date, the cumulative exposure from PCBs measured in ambient air remain below these risk-based exposure budgets that are protective of human health. Non-cancer and cancer risks from dioxin-like PCBs in air were less than EPA's hazard quotient of 1 and within EPA's cancer risk range of 10^{-4} and 10^{-6}. Continued monitoring of total PCBs in ambient air under the *2015 Air Monitoring Plan* is protective for both total PCB and dioxin-like PCB risk.

Location Specific ARARs

With the rescission of the former floodplain and wetland regulations, both ESD4 and ESD5 identified as relevant and appropriate FEMA regulations at 44 C.F.R. Section 9 which set forth the policy, procedures and responsibilities to implement and enforce Executive Orders 11988 (Management of Floodplains) and 11990 (Protection of Wetlands). In each ESD, after soliciting public comment on this issue, EPA determined that citing a LHCC (ESD4) and the Pilot CDF (ESD5) in floodplains was the least damaging practicable alternative and that these remedial actions would be implemented in compliance with the FEMA regulations within the 500-year floodplains of New Bedford Harbor.

Subsequent to the issuance of ESD4, but prior to the issuance of ESD5, in January 2015 Executive Order 13690 was issued that revised Executive Order 11988 which included a Floodplain Standard to address the impacts of climate change and required that all federal agencies issue regulations to implement the new Executive Order. Draft regulations were issued for public comment until February 2015, later extended to May 2015. Final regulations have not yet been promulgated.

Although the substantive requirements of Executive Order 13690 were not identified as a TBC in ESD5, EPA finds that the remedy, as modified by its subsequent ESDs, remains protective. This finding is based on a number of factors including: (1) The 1998 ROD no longer includes CDFs A, B, C or D, all of which would have occupied and modified the floodplains; (2) both ESD4 and ESD5 included the FEMA regulations as ARARs (many provisions of the FEMA regulations were included in the proposed draft regulations, including the 500-year flood elevation requirement); (3) each ESD contains independent risk-based determinations of protectiveness pursuant to TSCA 40 CFR section 761.61(c) provided certain conditions are met as well as detailed findings pursuant to Section 404 Guidelines of the CWA and 314 CMR 9.06(1-2) that the modifications represent the least damaging environmental alternative; and (4) consistent with ESD3, the storage of material in Cell #1 is temporary and all material will be removed and disposed at an off-site TSCA- and/or RCRA hazardous waste-permitted facility under the OU1 cleanup plan. EPA will review the final promulgated regulations and determine if the remedy remains protective in light of any substantive provisions in the final regulations.

In 2012, the Atlantic sturgeon was divided into four distinct population segments which were federally listed as endangered with a fifth segment listed as threatened. Although New Bedford Harbor is not designated as critical habitat for the Atlantic Sturgeon, as part of the SER South Terminal Project, National Marine Fisheries Service (NMFS) stated that the Atlantic sturgeon may use New Bedford Harbor for foraging from March through November. As part of EPA's annual dredging plan, EPA has instituted mitigation measure to ensure fish, including the Atlantic sturgeon, have passage during all dredging activities and therefore does not believe dredging activities will adversely affect the Atlantic sturgeon. As part of its yearly consultation with NMFS, EPA has communicated to NMFS its determination that, based on our past experiences dredging in the harbor and the continued successful implementation of the Fish Migration Plan, our dredging activities will not adversely affect the Atlantic sturgeon. NMFS has noted that, based on the location of the action in New Bedford Harbor, and the rare occurrence of Atlantic sturgeon in that area, NMFS is not be opposed to EPA making a no effect determination. Should NMFS provide additional information in the future, EPA will evaluate whether or not a supplement to this Five Year review is necessary.

Based on a review of the ARARs in Table 8 of the 1998 ROD and those identified in subsequent ESDs, this FYR identified updated CSFs and RfD values, noted the addition of the Atlantic sturgeon as a newly identified endangered species that may forage in the harbor during certain times of the year, and noted the issuance of a new Executive Order to address climate change impacts on floodplains. A re-evaluation of the human health risks in light of the changes to the CSFs and RfD concluded the remedy remains protective of human health. With respect to the identification of FEMA regulations, EPA determined that the LHCC and the Pilot CDF will be constructed in compliance with these FEMA regulations within the 500-year flood plain of New Bedford Harbor. In addition, EPA has communicated to NMFS its determination that, based on our past experiences dredging in the harbor and the continued successful implementation of the Fish Migration Plan, our dredging activities will not adversely affect the Atlantic sturgeon. All of these findings enables EPA to conclude that the remedy is also protective of the environment during implementation.

4.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

4.4 Technical Assessment Summary

Based on the data reviewed, observations from regular Site inspections, and the interviews conducted, the remedy continues to function as intended by the ROD. There have been no changes in regulatory statutes that affect target sediment cleanup levels, and no new pathways for exposure identified, that would call into question the goals of the remedy as set forth in the 1998 ROD as modified by the five ESDs. Some of the toxicity data used at the time of the 1989 risk assessment have changed. In 2015, EPA updated the evaluation of risks for seafood consumption and dermal contact/incidental ingestion and concluded that the changes in toxicity data did not significantly change the target site-specific risk-based level of 0.02 ppm for PCBs in fish tissue or the cleanup levels established for dermal contact/incidental ingestion risks (Appendix D). The seafood consumption risk update also evaluated new data for tautog, collected in 2013 and 2014, which supports a new advisory for closure area 3 for that species. In September 2015, EPA updated its seafood consumption advisories to include a seafood consumption recommendation for tautog in closure area 3. Further, in 2015, EPA updated the ambient air monitoring plan and updated risk-based goals in the *2015 Air Monitoring Plan* are reflective of updated toxicity data and include even more conservative risk-based goals. In addition, subtidal and intertidal cleanup levels established in the 1998 ROD remain valid.

A new Executive Order and draft regulations concerning climate change impacts to floodplains was noted; however, EPA's incorporation of FEMA floodplains regulations into ESD4 and ESD5, which include construction of structures or facilities in floodplains, ensure the remedy remains protective. Likewise, EPA has communicated to NMFS its determination that, based on our past experiences dredging in the harbor and the continued successful implementation of the Fish Migration Plan, our dredging activities will not adversely affect the Atlantic sturgeon.

Two issues that were identified in 2010 FYR as impacting the short term protectiveness of the remedy to human health were: 1) the ongoing consumption of local PCB-contaminated seafood, and 2) the potential for access to unremediated PCB-contaminated shorelines. EPA continues to work to control these risks to the maximum extent practicable through the use of educational and outreach efforts and with institutional controls such as fencing and signage. In 2015, EPA issued the *CIP and Seafood IC Plan* that documents the actions EPA has and will continue to take to implement institutional controls to minimize ingestion of local PCB-contaminated seafood and dermal contact/incidental ingestion risk, as well as new actions it will take to augment existing controls. See Sections 2.2.2 and 2.2.3 for additional details on how EPA has addressed these issues since the 2010 FYR.

Finally, ecological risks from the PCB contamination continue in the interim until the remedy is complete.

5.0 ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

This Five-Year Review did not identify any issues or recommendations that could impact the protectiveness of the remedy.

The following recommendations will improve the effectiveness of the remedy, but do not affect the current protectiveness of the remedy:

- EPA must continue to implement the *2015 CIP and Seafood IC Plan* to minimize ingestion of local PCB-contaminated seafood and minimize dermal contact/incidental ingestion risks. The Plan outlines educational and outreach actions, along with institutional controls such as fencing and signage, including informational kiosks, to control these risks to the maximum extent practicable. Further, consistent with the Plan, EPA will continue to collaborate with others to reduce consumption of local PCB-contaminated seafood, including providing advisory brochures for inclusion in local shellfishing and State finfishing licenses and collaborating with MassDPH through participation in Grand Rounds at local hospitals when MassDPH schedules such events. The Plan includes new implementation actions to minimize seafood consumption, including the creation of new signage, a new video and targeted outreach using culturally related peers. It is recommended that, after these new actions have been implemented, EPA assess their effectiveness, along with the effectiveness of other continued outreach and education and IC actions, and update the *2015 CIP and Seafood IC Plan*, if necessary, to address any lessons learned that support further educational and outreach and/or IC improvements.

- As noted above, the 2015 updated risk evaluation of seafood tissue data included an evaluation of new data for tautog, collected in 2013 and 2014 (Appendix D). Data for this species was not available prior to 2013. The 2013-2014 data supports a new advisory for closure area 3 for tautog of consumption of no more than 1 meal per month. In September 2015, EPA updated its advisories to include a seafood consumption recommendation for tautog in closure area 3. The updated EPA advisories are included in Appendix C and are available at http://www2.epa.gov/new-bedford-harbor/fish-consumption-regulations-and-recommendations. EPA's seafood consumption advisory brochure will be revised to reflect the updated information as soon as possible and no later than early-2016.

- As noted above, as a result of the recent settlement, EPA has now initiated planning for intertidal remediation efforts to address remaining dermal contact/incidental ingestion risks. By the end of 2015, EPA will have completed a sampling program covering the intertidal areas of both the Upper and Lower Harbor for delineation and remediation planning. It is recommended that, once adequate intertidal PCB sampling data is available for remediation planning, EPA assess the need for interim actions where PCB levels in intertidal sediments exceed applicable cleanup levels and prioritize intertidal cleanup efforts, considering potential human health risks and the overall remediation schedule, taking into consideration the potential for recontamination from subtidal sediments. Priority intertidal remediation efforts are expected to begin later in 2015 and all intertidal remediation efforts to address dermal contact/incidental ingestion risks will be scheduled over the next 5-7 years as the accelerated cleanup progresses. EPA is also reviewing state laws concerning various types of land use restrictions to determine appropriate institutional controls for properties abutting the intertidal remediation areas once cleanup levels have been achieved. It is recommended that EPA complete its evaluation of the various land use restrictions and make a determination on the potential institutional controls that could be employed for shoreline properties, where needed.

6.0 PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: OU1	*Protectiveness Determination:* Will be Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy for OU1 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks have been or are being controlled to the maximum extent practicable.		
Operable Unit: OU2	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: The remedy for OU2 currently protects human health and the environment because the sediment with the highest concentrations of PCBs (ranging from 4,000 ppm to over 100,000 ppm) have been dredged from the Upper Harbor and have been safely transported to an off-site TSCA landfill. However, in order for the remedy to be protective in the long term, the remaining contaminated sediment in this geographical area will be addressed under OU1. All future work, including institutional controls, are now within the scope of OU1.		
Operable Unit: OU3	*Protectiveness Determination:* Cannot be made at this time.	*Addendum Due Date (if applicable):* NA
Protectiveness Statement: A remedy has not been selected for OU3, thus a protectiveness statement for it cannot be made at this time. An RI/FS has been initiated to characterize the nature and extent of contamination.		

7.0 NEXT REVIEW

The next FYR report for the New Bedford Harbor Superfund Site is required five years from the completion date of this review in September 2020.

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APPENDIX A – ADDITIONAL SITE INFORMATION

A.1 SITE CHRONOLOGY

Table 1.A lists the chronology of major Site investigation and remedy selection events for the New Bedford Harbor Site. Table 1.B lists the chronology of major remedial action or cleanup events for the Site.

TABLE 1.A: CHRONOLOGY OF MAJOR SITE INVESTIGATIONS AND REMEDY SELECTION EVENTS

Date	Major Site Investigation and Remedy Selection Event
1976-1982	Discovery of widespread contamination of PCBs and heavy metals in sediment and marine life throughout the Harbor.
1983	EPA adds the Site to the NPL.
1988-89	Pilot dredging and disposal study performed.
1989	EPA issues its Proposed Plan for the Hot Spot OU2.
April 1990	EPA issues its Record of Decision (ROD) for the Hot Spot OU2.
August 1990	EPA issues a Feasibility Study & Risk Assessment for the entire Harbor.
January 1992	EPA issues a Proposed Plan for the Upper and Lower Harbor OU1.
April 1992	The first of two ESDs to the 1990 Hot Spot ROD is issued to include permanent containment of incinerator ash at the on-site Confined Disposal Facility (CDF).
May 1992	EPA issues an Addendum Proposed Plan for OU1 focusing on Outer Harbor issues.
1993	EPA suspends the incineration component of Hot Spot remedy in response to community opposition. New Bedford Harbor Community Forum established to help find an alternative to on-site incineration.
1995	EPA issues the second ESD to the 1990 Hot Spot ROD for interim storage of the dredged sediment while non-incineration options are evaluated.
1996	EPA issues a revised Proposed Plan for the Upper and Lower Harbor OU1 after extensive consensus-building with the Community Forum. The Outer Harbor area is separated into a new OU3.
1997	EPA issues its OU2 Hot Spot FS Addendum Report.
August 1998	EPA issues its Proposed Plan to amend the 1990 Hot Spot OU2 ROD.

TABLE 1.A: CHRONOLOGY OF MAJOR SITE INVESTIGATIONS AND REMEDY SELECTION EVENTS *(Cont'd)*

Date	Major Site Investigation and Remedy Selection Event
September 1998	EPA issues the ROD for the Upper and Lower Harbor OU1, including disposal of 450,000 cy of dredged sediment in four shoreline CDFs.
April 1999	EPA issues the Amended ROD for the Hot Spot OU2.
September 2001	EPA issues the first ESD for the 1998 OU1 ROD. This ESD addresses the use of the Pilot CDF at EPA's Sawyer Street facility for temporary storage of PCB-contaminated sediment, the need for mechanical dewatering, a stone dike wall design for CDF D, and the need for rail to help build CDF D.
August 2002	EPA issues the second ESD for the OU1 1998 ROD which replaces CDF D with off-site disposal.
September 2005	First Five-Year Review completed.
November 2009	Field sampling for the Remedial Investigation/Feasibility study of the Outer Harbor OU3 begins.
March 2010	EPA issues the third ESD for the OU1 1998 ROD which addresses the use of Cell #1 at EPA's Sawyer Street facility for temporary storage of PCB-contaminated sediment.
March 2011	EPA issues the fourth ESD for the OU1 1998 ROD which selects the use of a Confined Aquatic Disposal (CAD) Cell in the Lower Harbor for disposal of contaminated sediment.
November 2012	EPA issues the Final Determination for the South Terminal Project providing for the Commonwealth to construct an approximately 28-acre marine terminal under the State Enhanced Remedy. The Final Determination was modified in February 2013, September 2013 and September 2014.
September 2013	Supplemental Consent Decree with AVX
September 2015	EPA issues the fifth ESD for the OU1 1998 ROD which selects off-site disposal for the sediment slated for disposal in CDFs A, B and C and addresses the use of the Pilot CDF as a permanent TSCA facility.

TABLE 1.B: CHRONOLOGY OF MAJOR REMEDIAL ACTION EVENTS

Date	Major Remedial Action Event
1994-1995	14,000 cy of Hot Spot sediment, with PCB levels reported as high as ten to 20 percent (100,000 - 200,000 ppm), are dredged from the harbor.
2001	Early Action cleanup is completed on highly contaminated (up to 20,000 ppm) residential properties in Acushnet and New Bedford, MA.
2001	The relocation of the combined sewer overflow (CSO) at Sawyer Street is completed.
2001	Construction of a clean corridor for the relocation of the submerged power lines in the vicinity of the Hot Spot sediment is completed
2002	Removal of thirteen derelict commercial fishing vessels and barges is completed at the former Herman Melville shipyard, to allow for remedial dredging and the relocation of a commercial barge pier.
June 2003	The six acre North of Wood Street cleanup is completed, removing PCB levels as high as 46,000 ppm from residential and recreational shoreline areas.
2003	The remedial dredging at the former Herman Melville shipyard is completed.
2003	The marine bulkhead for the Area D dewatering facility is completed
2004	Relocation of two CSOs at Area D is completed
2004	Construction of the dewatering facility at Area D is finished.
2004	Full scale dredging performed in the vicinity of the Aerovox mill.
January 2005	Construction of a relocated commercial barge pier and associated navigational channel is completed (relocation necessary to allow Area D).
July 2005	The pilot underwater cap in the vicinity of the Cornell-Dubilier mill is completed.
2005	The second annual season of full scale dredging is performed.
2006	The third annual season of full scale dredging is performed in area along and immediately north of the former Aerovox facility.

TABLE 1.B: CHRONOLOGY OF MAJOR REMEDIAL ACTION EVENTS *(CONT'D)*

Date	Major Remedial Action Event
2007	The fourth season of dredging is performed, focused on two areas: one just north of the former Aerovox facility; and the second off shore of the northern Cliftex Mill.
2008	The fifth season of full-scale dredging is performed, including mechanical excavation of the highly contaminated sediment along the former Aerovox facility and hydraulic dredging in Pierce Mill Cove between Sawyer Street and Coffin Avenue.
April 2009	EPA receives $30 million in funding from the American Recovery and Reinvestment Act (ARRA or "the Recovery Act"), allowing dredging of a larger volume of contaminated sediment from the Upper Harbor due to the extension of the dredging season by approximately four extra months in 2009 and one extra month in 2010.
2009	The sixth season of full scale dredging is performed in the northern portion of the Upper Harbor.
2010	The seventh season of full scale dredging is performed in the northern portion of the Upper Harbor.
2011	The eighth season of full scale dredging is performed in the Upper Harbor.
2012	The ninth season of full scale dredging is performed in the Upper Harbor.
November 2013	LHCC Phase I construction begins.
2013	The tenth season of full scale dredging is performed in the Upper Harbor.
June 2014	LHCC Phase I construction completed.
March 2014	The eleventh season of full scale dredging is performed in the Upper Harbor. EPA dredges for almost 8 months as a result of availability of settlement funding.
November 2014	Construction begins on LHCC Phase II. Scheduled for completion in late 2015.
February 2015	The construction of the South Terminal, under the SER, is substantively completed. Mitigation activities and other ancillary activities ongoing.

A.2 BACKGROUND

A.2.1 Physical Characteristics and Land and Resource Use

The Site, located in Bristol County, Massachusetts, extends from the shallow northern reaches of the Acushnet River estuary south through the commercial harbor of New Bedford and into 17,000 adjacent areas of Buzzards Bay (Appendix B.1 – Site Location Map). The Site has been divided into three areas consistent with geographical features of the area and gradients of contamination. The Upper Harbor comprises approximately 200 acres. The boundary between the Upper and Lower Harbor is the Coggeshall Street bridge where the width of the harbor narrows to approximately 100 feet. The Lower Harbor comprises approximately 750 acres. The boundary between the Lower and Outer Harbor is the 150 foot wide opening of the New Bedford hurricane barrier (constructed in the mid-1960s). The Outer Harbor is comprised of approximately 17,000 acres with its southern extent (and the Site's boundary) formed by an imaginary line drawn from Rock Point (the southern tip of West Island in Fairhaven) southwesterly to Negro Ledge and then southwesterly to Mishaum Point in Dartmouth. The Site is also defined by three fishing closure areas, promulgated by the Massachusetts Department of Public Health (MassDPH) in 1979, extending approximately 6.8 miles north to south and encompassing approximately 18,000 acres in total (See Appendix B.2).

The City of New Bedford (the City), located along the western shore of the Site, is approximately 55 miles south of Boston. During most of the 1800s, New Bedford was a world renowned center of the whaling industry, which attracted a large community of immigrants from Portugal and the Cape Verde islands. As of 2010, more than 1/3 of New Bedford’s 93,768 residents spoke a language other than English in their homes (US Census Bureau, 2010). Including the neighboring towns of Acushnet, Fairhaven and Dartmouth, the combined 2010 population was approximately 155,000. New Bedford is currently home port to a large offshore fishing fleet and is a densely populated manufacturing and commercial center. By comparison, the eastern shore of New Bedford Harbor is predominantly saltmarsh and open space in the Upper Harbor and residential and commercial/industrial marine use in the Lower Harbor. A large, approximately 70 acre, saltmarsh system has formed along almost the entire eastern shore of the Upper Harbor.

The Acushnet River discharges to New Bedford Harbor in the northern reaches of the Site, contributing relatively minor volumes of fresh water to the tidally influenced harbor. Numerous storm drains, combined sewer overflows (CSOs) and industrial discharges, as well as smaller brooks and creeks, also discharge directly to the Site. The Upper and Lower Harbors are believed to be areas of net groundwater discharge and are generally described as a shallow, well-mixed estuary.

A.2.2 History of Contamination

Industrial and urban development surrounding the harbor has resulted in sediment becoming contaminated with high concentrations of many pollutants, notably polychlorinated biphenyls (PCBs) and heavy metals, with contaminant gradients decreasing from north to south. From the 1940s into the 1970s two capacitor manufacturing facilities, one located near the northern boundary of the site (Aerovox) and one located just south of the New Bedford Harbor hurricane barrier (Cornell Dubilier Electronics, Inc.) discharged PCB-wastes either directly into the harbor or indirectly via discharges to the City's sewerage system.

Identification of PCB-contaminated sediment and seafood in and around New Bedford Harbor was first made in the mid-1970s as a result of EPA region-wide sampling programs. In 1979, MassDPH promulgated regulations prohibiting fishing and lobstering throughout the Site due to elevated PCB levels in area seafood (See Appendix B.2). Elevated levels of heavy metals in sediment (notably cadmium, chromium, copper and lead) were also identified during this time frame.

PCB levels in the Upper Harbor sediment currently range from below detection to greater than 10,000 ppm. PCB levels in the Lower Harbor sediment range from below detection to approximately 400 ppm. Sediment PCB levels in the Outer Harbor are generally low, mostly around 1 ppm or less, with only a small localized areas of PCBs in the 10-20 ppm range near the Cornell-Dubilier facility based on 2009 sampling. The area of highest contamination near the Cornell-Dubilier mill was capped in 2005. Further characterization of the Outer Harbor OU3 area continues as part of the OU3 RI/FS, initiated in 2009.

A.2.3 Initial Response

The Site was proposed for the Superfund NPL in 1982, and finalized on the NPL in September 1983. Pursuant to 40 CFR 300.425(c)(2), the Commonwealth of Massachusetts (the Commonwealth) nominated the Site as its priority site for listing on the NPL. In addition to listing the harbor and pursuing a remedial action for the Site, separate CERCLA removal actions have been conducted in past years, as described below, to address various mainland sources of PCBs that have contributed contamination to the Harbor.

Prior to the listing of the Site on the NPL, in 1982 signs were erected around the Site warning against fishing and wading. Upon listing, EPA's site-specific remedial investigations began in 1983 and 1984 with a Remedial Action Master Plan and the Acushnet River Estuary Feasibility Study. Site investigations continued throughout the rest of the 1980s and early 1990s, including among others a pilot dredging and disposal study in 1988 and 1989, and extensive hydrodynamic and bioaccumulation computer modeling, additional feasibility studies and risk assessments all published in 1990. These studies are summarized in more detail in the 1998 ROD for the Upper and Lower Harbor (EPA, 1998).

Information collected by the remedial investigations identified the Aerovox facility as the primary source of PCBs to the Site[1]. PCB wastes were discharged from Aerovox's operations directly to the Upper Harbor through open trenches and discharge pipes, or indirectly throughout the Site via CSOs and the City's sewage treatment plant outfall. Additional inputs of PCBs were also made from the Cornell Dubilier Electronics, Inc. (CDE) facility just south of the New Bedford hurricane barrier[2].

[1] The Aerovox facility is a separate CERCLA removal site (in addition to being regulated under TSCA and State authority) and is not part of the harbor NPL Site.
[2] The CDE facility is a separate CERCLA removal site (in addition to being regulated under TSCA and the Clean Water Act) and is not part of the harbor NPL Site.

In May 1982, Aerovox, Inc. signed an administrative Consent Order with EPA regarding contamination on its property adjacent to the Upper Harbor. As a result of investigations conducted pursuant to that Consent Order, Aerovox installed a sheet pile wall along the eastern side of its property as well as a cap system over contaminated soil. Through a subsequent Supplemental Order, Aerovox instituted a Long Term Monitoring and Maintenance Plan.

Also in May 1982, CDE and EPA signed an administrative consent agreement and final order under the Toxic Substance Control Act (TSCA). This agreement addressed PCB handling procedures, discharges, releases to the municipal sewer system and surrounding areas, and groundwater monitoring requirements. Subsequently, in September 1983, EPA issued an administrative order, as part of a separate CERCLA removal action, requiring CDE to remove PCB-contaminated sediment from portions of the municipal sewer system downstream of the CDE plant. The removal and disposal of this sediment took place in the fall of 1984.

EPA also issued an administrative order to the City of New Bedford under section 106 of CERCLA, as part of a separate CERCLA removal action, in September 1983 requiring the City to assist CDE in the sewer line clean-up and to monitor PCB levels from the City's municipal wastewater treatment plant[3].

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 at and near the Site caused by releases of PCBs. The next day, the Commonwealth of Massachusetts (the Commonwealth) filed its own section 107 action. The cases were subsequently consolidated. In February 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, and for injunctive relief under section 106 of CERCLA and other environmental statutes. The United States brought this action against six companies which, at various times, owned and/or operated either of the two capacitor manufacturing facilities at the Site.

On December 31, 1985, the Commonwealth issued a notification of responsibility to the City of New Bedford pursuant to the state's hazardous waste regulations regarding the build-up of PCB-contaminated grit in one of the main interceptors of the City's sewerage system. Severe amounts of PCB-contaminated grit had accumulated within the interceptor especially in the area between Coffin Avenue and Campbell Street; PCB levels in this grit averaged 265 ppm on a dry weight basis. The City subsequently encased and abandoned approximately one and one-half mile of this sewer interceptor.

In 1991 and 1992, the Unites States, the Commonwealth and five defendants in the litigation - Aerovox Incorporated, Belleville Industries, Inc., AVX Corporation, Cornell-Dubilier Electronics, Inc., and Federal Pacific Electric Company (FPE) - reached settlement regarding the governments' claims. The government's claims against the sixth defendant, RTE Corporation,

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[3] The City's sewer system and wastewater treatment plant are not part of the harbor NPL Site, but has previously been addressed under EPA's CERCLA removal and State authority, and currently is regulated under TSCA and the federal Clean Water Act.

were dismissed on jurisdictional grounds. The federal and state governments recovered a total of $99.6 million, plus interest, from the five settling defendants.

The terms of the settlements are set forth in three separate consent decrees. Under the first consent decree, Aerovox Incorporated and Belleville Industries, Inc. were required to pay a total of $12.6 million, plus interest, to the United States and the Commonwealth for damages to natural resources and for past and future Site remedial response costs. The court approved and entered this consent decree in July 1991. Under the second consent decree, AVX Corporation was required to pay $66 million, plus interest, to the governments for natural resource damages and for past and future Site remedial response costs. This decree was approved and entered by the court in February 1992. Under the third consent decree, CDE and FPE paid $21 million, plus interest, to the governments for natural resource damages and for past and future Site remedial response costs. This decree was approved and entered by the Court in November 1992.

A.2.4 Basis for Taking Action

Hazardous substances that have been detected at the Site in each media are identified below. A more complete discussion can be found in Section V of the 1998 ROD for the Upper and Lower Harbor Operable Unit (EPA, 1998).

Sediment	Surface Water	Biota	Air
PCBs	PCBs	PCBs	PCBs
PAHs	Copper		
Cadmium			
Chromium			
Copper			
Lead			

A baseline public health risk assessment was performed to estimate the probability and magnitude of potential adverse health effects, both carcinogenic and non-carcinogenic, from exposure to Site contaminants. In addition to PCBs, this evaluation also identified cadmium, copper and lead as contaminants that could potentially contribute to significant adverse health effects. The exposure pathways found to be of most concern were:

- ingestion of contaminated seafood
- direct contact with contaminated shoreline sediment, and
- (for children ages 1-5) incidental ingestion of contaminated shoreline sediment.

Ecological risk studies have concluded that aquatic organisms are at significant risk due to exposure to PCBs in New Bedford Harbor. A more complete discussion of the human health and ecological risks posed by the Site can be found in Section VI of the OU1 1998 ROD.

A.3 REMEDIAL ACTIONS

The Site has been divided into three operable units (OUs), or phases of site cleanup: The Upper and Lower Harbor (OU1); the Hot Spot (OU2); and the Buzzards Bay or Outer Harbor (OU3). A summary of the remedy selection and implementation is presented below for OU1 and OU2. The ROD for OU3 is currently unscheduled pending the completion of the RI/FS investigations in the Outer Harbor.

A.3.1 Operable Unit 1 Remedy Selection

The ROD for OU1 was signed on September 25, 1998 (1998 ROD). The remedial action objectives developed for the OU1 remedy are presented in Section 4.2.1. The cleanup plan selected in the 1998 ROD consisted of the following components:

1. construction of four shoreline confined disposal facilities (CDFs) and water treatment facilities;
2. dredging of sediment and shoreline soils with PCB concentrations above the selected cleanup goals (See Section 4.2.5);
3. operation of the CDFs and water treatment facilities;
4. saltmarsh excavation, restoration and monitoring;
5. preliminary capping and sediment consolidation within the filled CDFs;
6. final capping, long term monitoring and maintenance, and beneficial reuse of the CDFs;
7. long term site wide monitoring, and
8. seafood advisories and other institutional controls.

The 1998 ROD also included, at the request of the Commonwealth, a State Enhanced Remedy (SER) pursuant to 40 CFR 300.515(f) for the removal of navigational sediment not otherwise covered by the ROD. This portion of the remedy is funded and managed by the Commonwealth in conjunction with the City of New Bedford and the New Bedford Harbor Development Commission (HDC), with oversight by EPA. It serves to increase the remedy's protectiveness since lower concentration PCB-contaminated sediment, not covered by the OU1 ROD, are removed and disposed of as part of the port's navigational dredging program. As discussed in Section 2.4, the SER has also provided clean underwater cap material for contaminated sediment near the Cornell-Dubilier facility.

In September 2001 EPA issued a change to the 1998 harbor cleanup plan using a process known as an Explanation of Significant Difference (ESD) (EPA, 2001). This ESD described five refinements of the remedy that arose as the design phase progressed following issuance of the 1998 ROD. These changes included: (i) the use of mechanical dewatering for the dredged sediment (to among other things reduce the volume of processed sediment needing disposal); (ii) the incorporation of a rail spur; (iii) a revised wall design at CDF D – the largest of the CDFs, (iv) ongoing use of the pilot CDF at EPA's Sawyer Street facility as an interim TSCA facility; and (v) the remediation and monitoring of two additional intertidal areas near residential land use areas in the Upper Harbor along the Acushnet River, in order to reduce dermal contact/incidental ingestion risks. The 2001 ESD also noted that the estimate of in situ sediment requiring disposal pursuant to the ROD could be as high as 800,000 cy.

In August 2002 EPA issued a second ESD for the 1998 ROD (EPA, 2002). This ESD eliminated the construction of the 17 acre CDF D, and instead selected off-site disposal for the dredged and dewatered PCB contaminated sediment slated for the CDF. A smaller shoreline facility, now known as Area D, replaced CDF D in the same area to support both the sediment dewatering building and the rail car (or truck or barge) loading area required for off-site disposal of the dredged sediment.

In March 2010 EPA issued a third ESD for OU1 (EPA, 2010), which documents EPA's use of Cell #1 (located at Sawyer Street) for temporary storage of both PCB- and hazardous waste-contaminated sediment from OU1[4]. EPA invoked a CERCLA waiver of the Massachusetts Hazardous Waste Regulations that requires temporary storage facilities to have a double liner rather than the single liner. The basis for the waiver was that the single liner, in combination with site conditions and facility monitoring, is equally as protective as a double liner for the temporary storage facility. In addition, this ESD documented that Cell #1 does not pose a risk to health and the environment due to the temporary storage of PCBs under TSCA, and that the use of Cell #1 for temporary storage of contaminated sediment is consistent with a previous risk-based finding concerning the facility made in 2001 in the first OU1 ESD.

In March 2011, EPA issued the fourth ESD revising the OU1 remedy (ESD4) (EPA, 2011). ESD4 incorporated the construction and use of the LHCC for permanent disposal of approximately 300,000 cy of mechanically dredged sediment. The fourth ESD also updated the volume of total *in situ* contaminated sediment to be addressed to meet cleanup levels to be approximately 900,000 cy, of which approximately 425,000 cy would be disposed of off-site[5], approximately 300,000 cy would be disposed of in the LHCC, and approximately 175,000 cy would be disposed of in remaining CDFs A, B, and C.[6]

In January 2014, EPA modified the conceptual design of CDF C such that no CDF structure would be constructed within the area between the southern boundary of Sawyer Street and Coggeshall Street or within the Acushnet River adjacent to these properties. Therefore, the overall size of CDF C could be limited to only the area adjacent to the Pilot CDF. This remedial design change was determined to be a non-significant or minor change. This change was estimated to result in a reduction in capacity of CDF C by one-half to two-thirds the original conceptual design capacity (CDF modified-C).

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[4] A limited area of removed contaminated sediment abutting the former Aerovox facility (as discussed in Section 4.2.5, below) contained sufficient volatile organic compounds (VOCs) to exceed thresholds for being regulated as hazardous waste. No other contaminated sediment removed from the Harbor, to date, have exceeded hazardous waste standards and, so only applicable TSCA standards have applied to these PCB-contaminated sediment under the CERCLA remedy.

[5] Included in this estimate of 425,000 cy is approximately 10,000 cy of contaminated sediment in the Outer Harbor just south of the New Bedford Hurricane Barrier near the New Bedford shore that have been addressed by a pilot underwater cap.

[6] It is important to note that these volumes represent the amount of sediment to be dredged, not the reduced volumes of material that will be disposed of after desanding and dewatering processes are applied to the dredged sediment. See Section III.A, below, for further discussion of this issue.

In July 2015, EPA issued the fifth ESD which eliminated the construction of the planned CDFs A, B and modified-C and selected off-site disposal for the sediment slated for disposal in those planned confined disposal facilities (EPA, 2015c). Further, in the fifth ESD, EPA confirmed that the Pilot CDF is protective, and made the Pilot CDF a permanent TSCA disposal facility. As part of the cleanup plan, following completion of remedial dredging activities, the Pilot CDF will be covered with a clean cover/cap meeting all applicable federal and state standards that is technically equivalent to a cap conforming to the design requirements at 40 CFR § 761.61(a)(7). Appropriate institutional controls will also be implemented.

ESDs as well as other Site information are available for review at the New Bedford Free Public Library at 613 Pleasant Street, New Bedford (in the reference section) and at EPA's Boston records center at 5 Post Office Square and on-line at the New Bedford Harbor website (www.epa.gov/ne/nbh).

A.3.2 Operable Unit 1 Remedy Implementation

Remedial implementation activities for the OU1 remedy were discussed in the body of the FYR. This section is limited to historical activities not covered in the body of the FYR report and supplemental remedial action information in support of data discussed in the body of the FYR.

Early Cleanup Activities

The first remedial action taken after issuance of the 1998 ROD was to erect fencing in 1999 along the New Bedford shoreline in residential and public access areas where new sediment sampling showed very high levels of shoreline PCBs. Additional "no fishing" signs were also added throughout the Site. This was followed in 2000/2001 by the "Early Action" cleanup which excavated approximately 2,500 cy of highly contaminated residential shoreline areas in Acushnet followed by restoration of the impacted shoreline.

These early actions were followed by the accelerated cleanup of approximately six acres of the Acushnet River north of the Wood Street bridge, including the riverbed and shoreline areas in 2002/2003 and 2005. EPA prioritized this effort due to the very high PCB levels along the shoreline in this area (up to 46,000 ppm) along with the fact that two parks and many residences abut the shoreline in this stretch of the river. Two temporary dams were built to dewater this stretch of the river, to allow approximately 15,600 cy of contaminated sediment to be excavated in near-dry conditions. Approximately 2,500 cy (2,606 tons) of vegetated soil was excavated and trucked off-site for disposal. The remaining excavated soil and sediment was transported to EPA's Sawyer Street facility and placed in cell #1 for interim storage.

Upon removal of the contaminated sediment to the target PCB clean-up levels applicable to each area, the shorelines were restored with imported clean fill and native riparian plantings. As part of this shoreline restoration, large stands of the invasive common weed (*Phragmites australis*) were removed and replaced with a higher value native saltmarsh. This North of Wood Street (NWS) cleanup was completed in March 2003, with the saltmarsh and upland plantings completed in June 2003 (TTFW, 2005a). Annual post-remediation monitoring of the NWS area identified two small areas on the eastern shoreline requiring additional remediation, which was performed in 2005. Judging from the monitoring data and the fact that this area had been thickly vegetated when initially sampled, it is believed that these two areas are areas that the initial NWS characterization missed, rather than areas that were recontaminated from the harbor to the south.

Preparation for Full Scale Dredging

In addition to accelerated cleanups in the northern-most part of the Site, numerous advance projects and business relocations had to be completed to prepare for full scale dredging (see Table 1.B). Dredging of a clean corridor across the Upper Harbor to relocate thirteen submerged high voltage power cables was completed in 2001. Construction of a five acre sediment dewatering and transfer facility (the dewatering facility or Area D) at Hervey Tichon Avenue in New Bedford for processing the dredged sediment was completed in 2004. Relocation of two CSOs that previously discharged in the area of the dewatering facility at Area D was also completed in 2004. Relocation of a commercial barge pier necessary for construction of Area D was completed in 2005, including removal of abandoned fishing vessels and associated environmental dredging (TTFW, 2005b).

Dredged sediment is sent through a pipeline in the harbor to the desanding facility at EPA's Sawyer Street facility, where sand, gravel, shells and other coarse material within the dredged slurry are removed. The slurry is then sent through an underwater pipeline in the harbor to the dewatering facility at Area D. Using a series of mechanical processes, the plant squeezes most of the water out of the slurry so that a "filter cake" is produced. The "filter cake" is then sent off-site to a TSCA disposal facility in Michigan via rail or truck.

Full Scale Dredging

See Section 4.1.2. Table 2 summarizes the volumes of dredging performed in the Upper Harbor by hydraulic dredging (Jacobs, 2011b; Jacobs 2013a; Jacobs 2013b; Jacobs 2014; Jacobs 2015b), while Tables 3 and 4 summarize volumes of dredging in the Lower Harbor by mechanical dredging with CAD Cell disposal. All the volume in Table 2 and 3 have been carried out with funding by EPA.

TABLE 2: SUMMARY OF UPPER HARBOR SEDIMENT AREAS REMEDIATED TO DATE

Project	**Remediated Area** *(see Appendix B.4)*	**Date**	**Sediment volume remediated (cy)**
1. First pilot study	Pilot Study 1 & 2	1988/89	2,900
2. Hot spot dredging (OU2)	Hot Spots B - E, & G	1994/95	14,000
3. Early action area	EAA-A & -B	200/2001	3,000
4. Pre-design field test (PDFT)	PDFT	2000	1,985
5. North of Wood Street (NWS)	NWS	2002/03	15,619
6. North Lobe Dredging	North Lobe	2003	3,952
7. Full scale dredging - season 1	Area A	2004	12,000
8. Full scale dredging - season 2	Area A, B & NWS	2005	25,179
9. Pilot underwater cap	Cap south of hurricane barrier near NB shore	2005	10,000
10. Full scale dredging - season 3	Area G & H	2006	20,096
12. Full scale dredging - season 4	Area G & H	2007	23,307
13. Full scale dredging - season 5	Area B, A & NWS	2008	26,800
14. Full scale dredging - season 6	Area J, L, M & G	2009	49,809
15. Full scale dredging – season 7	Area M, G, J &K	2010	26,411
16. Full scale dredging – season 8	Areas K, N, G & Q	2011	26,074
17. Full scale dredging – season 9	Areas L & P	2012	18,502
18. Full scale dredging – season 10	Areas L & P	2013	18,995
19. Full scale dredging – season 11	Areas L, O, P, R & S	2014	77,312
20. Full scale dredging – season 12	Areas L, P, S and H	2015	47,000 (estimated)
Total remediated volume to date (OU1)		**1988-2015**	**401,570cy (estimated)**
Total remediated volume to date (OU1 and OU2)		**1988-2015**	**415,570 cy (estimated)**

In addition, it should be noted that approximately 13,000 cy of additional *navigational* sediment was dredged in 2004/05 as part of the commercial barge business relocation[7].

[7] This sediment was used to fill a pier as part of the relocated barge-loading facility.

TABLE 3: SUMMARY OF EPA'S LOWER HARBOR CAD CELL RELATED PROJECT DREDGING— CONTAMINATED DREDGE MATERIAL ONLY

Component	Date	Approximate Sediment Volume (cy)
Top of LHCC, Phase I; Disposal in CAD 3	November 2013 to July 2014	24,800
Top of LHCC, Phase II; Disposal in LHCC Phase I	November 2014 to March 2015	36,000
Total		60,800

State Enhanced Remedy

The Commonwealth in conjunction with the City is performing navigational dredging pursuant to the state enhanced remedy (SER) portion of the 1998 OU1 ROD. As of September 2015, numerous dredging projects have been undertaken pursuant to the SER. The City has used an existing depression in the harbor bottom (the "borrow pit") and a series of excavated CAD cells for the disposal of contaminated navigational sediment. Clean glacial material excavated to create the CAD cells has been used for EPA's pilot capping project in the Outer Harbor or disposed of at an approved open water disposal site.

These projects are summarized in Table 4 below and shown in Appendix B.13 and B.14. As part of the reporting for the SER, based on pre- and post-dredging sediment PCB levels, it has been estimated that over 545,000 cy of PCB contaminated sediment have been dredged (AGM, 2012; Apex 2007; Apex, 2010; Apex, 2014; Apex, 2015; MassDEP 2012c). EPA has issued TSCA Determinations in support of the disposal of PCB-contaminated sediment as part of the SER navigational dredging in SER CAD cells.

The totals of Table 3 and 4 show that over 605,000 cy of contaminated sediment have been dredged from the Lower and Outer Harbor and disposed in State or EPA CAD Cells between the efforts of EPA (under CERCLA) and the Commonwealth of Massachusetts (under SER).

TABLE 4: SUMMARY OF STATE ENHANCED REMEDY NAVIGATIONAL DREDGING PERFORMED TO DATE –CONTAMINATED VOLUME ONLY

State Enhanced Remedy Project	Date	Approximate Sediment Volume (cy)
Top of CAD #1 contaminated sediment to borrow pit CAD	Summer 2005	20,000
Phase II contaminated sediment dredged to borrow pit and CAD#1	2005 - 2006	52,000
Top of CAD #2 contaminated sediment to CAD #1	Summer 2008	34,000
Phase III Dredging to CAD #2 – 12 Projects	September 2008 to September 2009	53,000
Hurricane Barrier and AGM Marine dredging to CAD#2	2012	6,000
Top of CAD #3 contaminated sediment to CAD #2	2013-2014	31,000
South Terminal	January 2014-December 2014	232,000
Interim Federal Navigational Dredging	January 2015-June 2015	117,000
Phase II and III, South Terminal, and Interim Federal Navigation Dredging - Total volume of *contaminated* sediment, including top of CADs dredged (i.e., not including the clean bottom of CAD material)		**545,000**

Excavation of Aerovox Shoreline

In early summer 2008, EPA and the USACE excavated highly contaminated shoreline sediment immediately adjacent to the vacant Aerovox mill on Belleville Avenue in New Bedford. The area of sediment remediated extended approximately 100 feet from the shore and extended north-south along the entire eastern border of the Aerovox property. The dredging team was prevented from hydraulically dredging this area due to the very high levels of trichloroethene (TCE) in this sediment; some areas contained percent levels of PCBs and solvents. The excavated sediment was stabilized at Aerovox with Portland cement and trucked in water tight containers to EPA's Sawyer Street facility, where they are currently being temporarily stored in Cell #1 pursuant to OU1 ESD #3. A layer of clean soil has been placed on top of these sediment during temporary storage, and surface water runoff is drained to a separate holding area and tested (and treated, if required) prior to discharge.

An extensive air monitoring program at both the Aerovox and Sawyer St locations showed that the project was performed safely without cause for concern to the local abutters.

EPA continues to monitor airborne PCBs and VOCs at the Sawyer Street facility (as well as groundwater) while this sediment is temporarily being stored. Based on air monitoring data to date, no airborne PCB levels were detected that pose a health risk to cleanup workers or area residents. Groundwater data has consistently shown that PCBs are not migrating from areas of EPA's Sawyer Street facility.

A.3.3 Operable Unit 2 Hot Spot Remedy Selection

The ROD for OU2 was signed on April 6, 1990. The remedial action objectives developed for the OU2 remedy were to:

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 sediment in 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 sediment.

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

The cleanup plan selected in the 1990 OU2 ROD consisted of the following components:

1. Dredging about 10,000 cy of Hot Spot sediment (PCB concentrations ranging from a minimum of 4,000 to over 100,000 ppm);

2. treatment of the large volume of water co-dredged along with the sediment;

3. passive dewatering of the dredged sediment;

4. on-site incineration of the dewatered sediment;

5. stabilization of the incinerator ash (if determined to be necessary); and

6. on-site disposal of the incinerator ash.

In April 1992, EPA issued an OU 2 ESD (EPA, 1992) to change the storage of ash generated from the incineration of Hot Spot sediment from temporary storage in an on-site CDF to permanent storage in an on-site CDF at EPA's Sawyer Street facility.

In 1993, due to a vehement reversal in public support for the incineration component of the cleanup plan at about the time the incinerator was being mobilized, EPA agreed to terminate the incineration contract and begin studies of other possible options for treating the Hot Spot sediment. The New Bedford Harbor Superfund Site Community Forum was created in late 1993 to develop a consensus based cleanup plan to replace the on-site incineration component of the original cleanup plan.

During the 1994-95 construction seasons the dredging component of the 1990 Hot Spot remedy decision was implemented. Dredging of about 14,000 cubic-yards in volume over an area covering five acres began in April 1994 and was completed in September 1995.

In October 1995, EPA issued a second OU2 ESD (EPA, 1995) to document the need for interim storage of the dredged Hot Spot sediment in Cell #1 at EPA's Sawyer Street facility while studies of treatment options other than on-site incineration were conducted.

In December 1997, EPA issued a Hot Spot Feasibility Study Addendum Report which presented the evaluation of the non-incineration treatment options investigated. In August 1998, EPA issued a Proposed Plan to amend the incineration component of the 1990 Hot Spot cleanup plan. The 1998 Proposed Plan called for dewatering the Hot Spot sediment and transporting them to a permitted off-site hazardous waste landfill.

In April 1999, EPA signed an amendment to the 1990 ROD (EPA, 1999) which calls for off-site landfilling instead of on-site incineration. The amended cleanup plan consisted of the following activities:

1. Upgrade the existing site facilities as needed;
2. Sediment dewatering and water treatment;
3. Transportation of dewatered sediment to an off-site TSCA permitted landfill;
4. Air monitoring program.

The dredging component of the remedy remained unchanged.

A.3.4 Operable Unit 2 Remedy Implementation

The implementation of the OU2 remedy is briefly summarized below. A more detailed description can be found in the Report on the Effects of the Hot Spot Dredging Operations (EPA, 1997) and the Remedial Action Report for OU2 (EPA, 2000).

About 14,000 cubic-yards of Hot Spot sediment were dredged from the Upper Harbor during the 1994-95 construction seasons. The Hot Spot sediment was temporarily stored in Cell #1 at EPA's Sawyer Street facility while alternatives to on-site incineration were evaluated. As discussed above, in April 1999, EPA signed an amendment to the 1990 OU2 ROD which called for off-site landfilling instead of on-site incineration. A contract to implement the amended Hot Spot remedy was awarded in October 1999. The sediment was stabilized with lime, excavated from Cell #1, and loaded on to trucks for off-site disposal. Transportation of the passively dewatered Hot Spot sediment to an off-site TSCA permitted hazardous waste disposal facility started in December 1999 and was completed in May 2000. One of the Hot Spot areas, designated as Area B, was not dredged during the Hot Spot dredging operations due to its proximity to submerged high voltage power lines serving the City of New Bedford. This area will be addressed under OU1.

In order for the remedy to be protective in the long term, this geographical area will also be addressed under OU1. All future work, including institutional controls, for this area will be a part of OU1.

A.3.5 Operable Unit 3 (Outer Harbor) Remedy Selection

The EPA has not yet selected a remedy for the 17,000 acre OU3, but is currently performing a remedial investigation for this area.

APPENDIX B – ADDITIONAL MAPS, FIGURES AND DATA

1 - Site Location Map

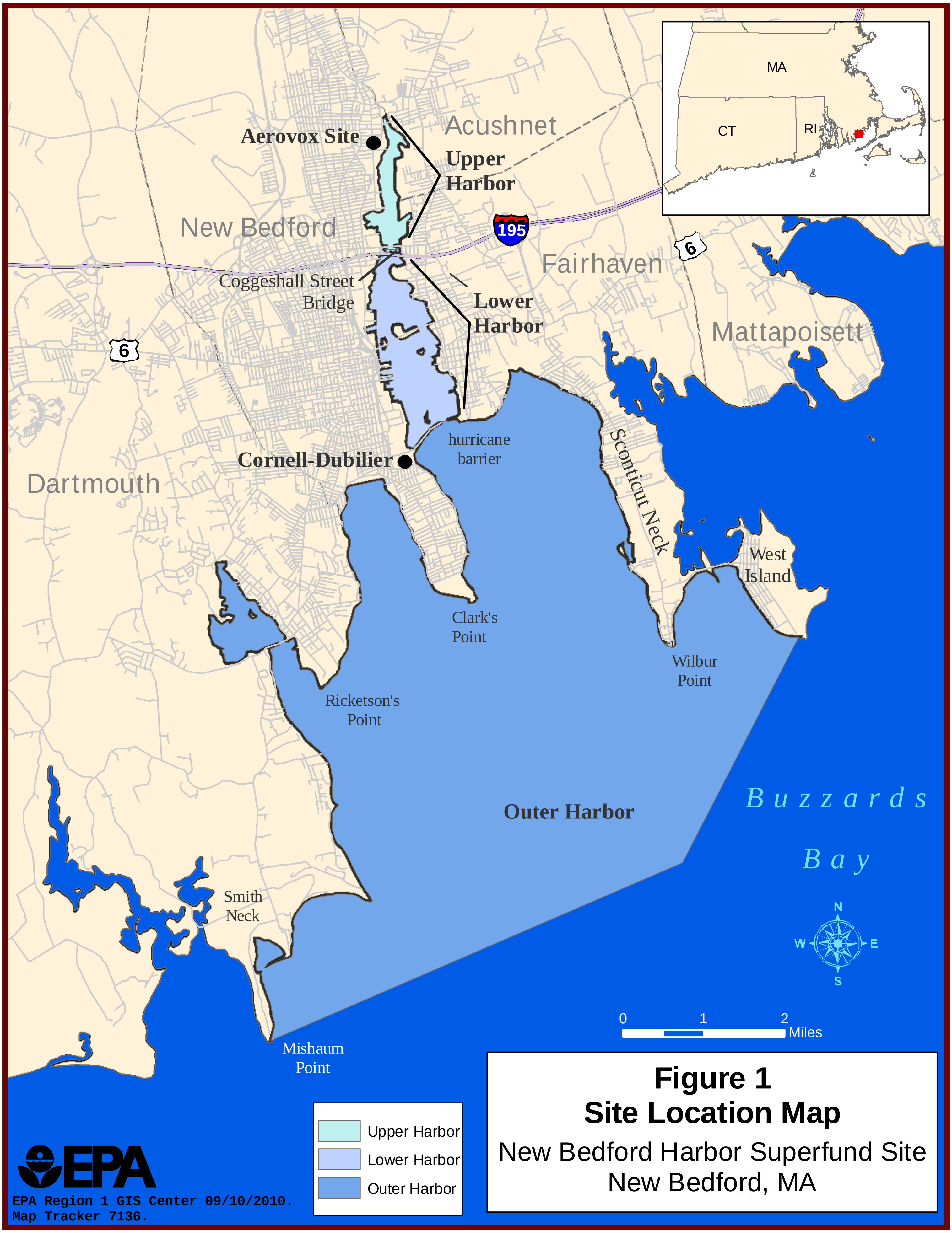
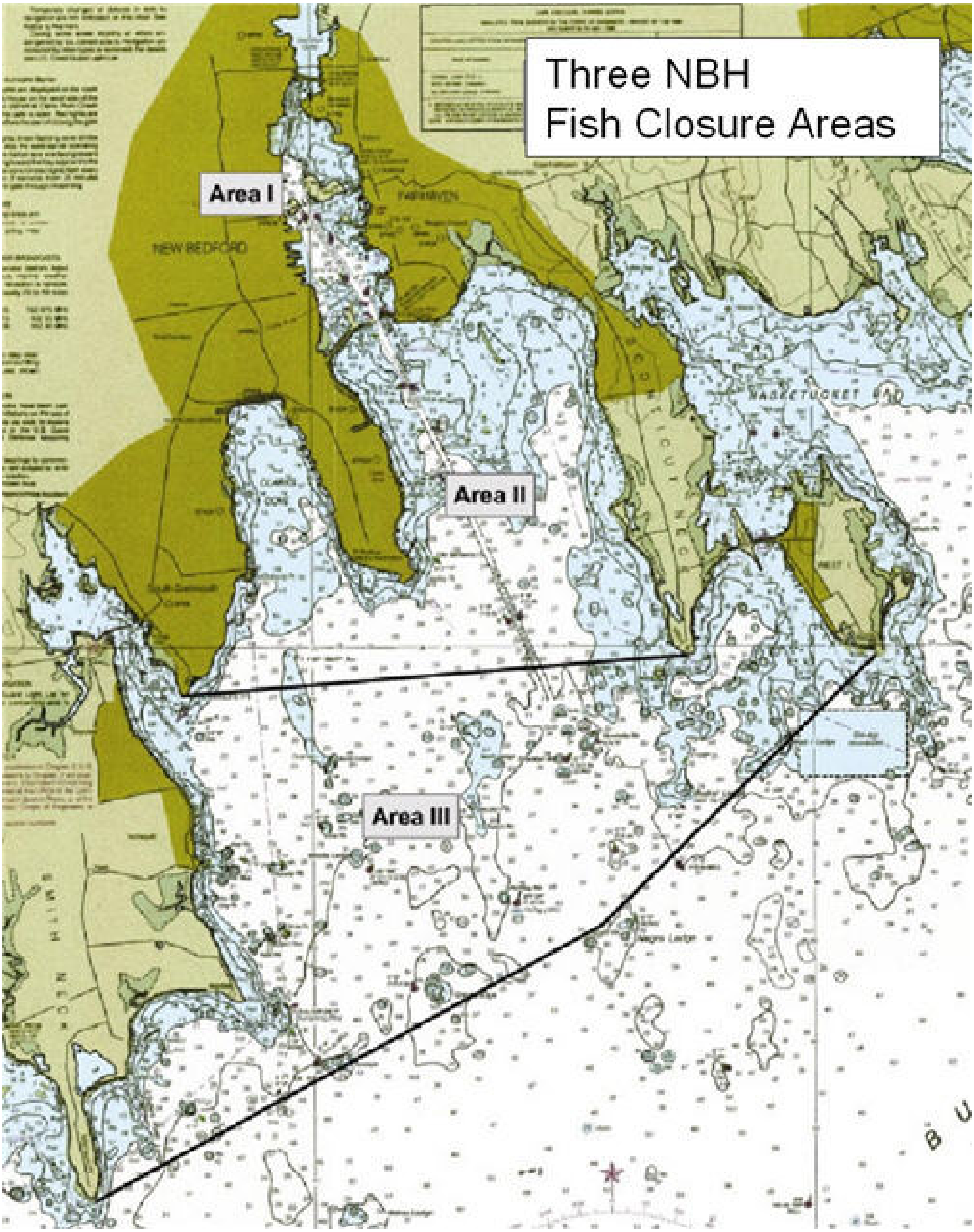


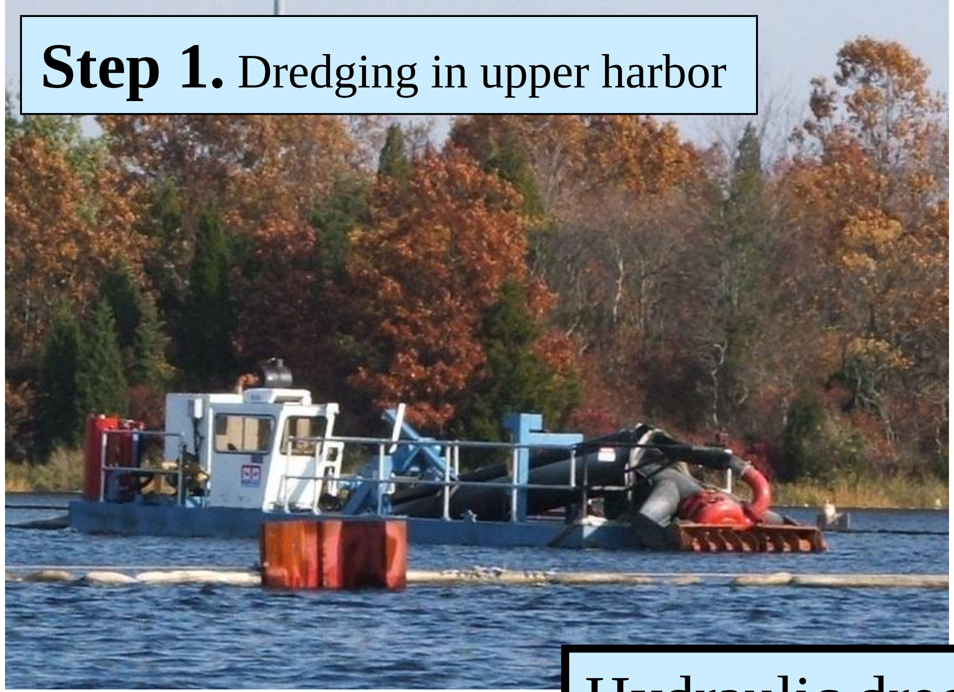
Figure 1
Site Location Map
New Bedford Harbor Superfund Site
New Bedford, MA

2 - THE 1979 STATE FISHING BAN – MAP OF FISH CLOSURE AREAS


Three NBH
Fish Closure Areas
Area I
Area II
Area III
NEW BEDFORD
FAIRHAVEN
NASKETUCKET BAY

3 - MAJOR COMPONENTS OF THE HYDRAULIC DREDGING PROCESS

Hydraulic dredging and disposal



Step 1. Dredging in upper harbor

Step 2. Desanding

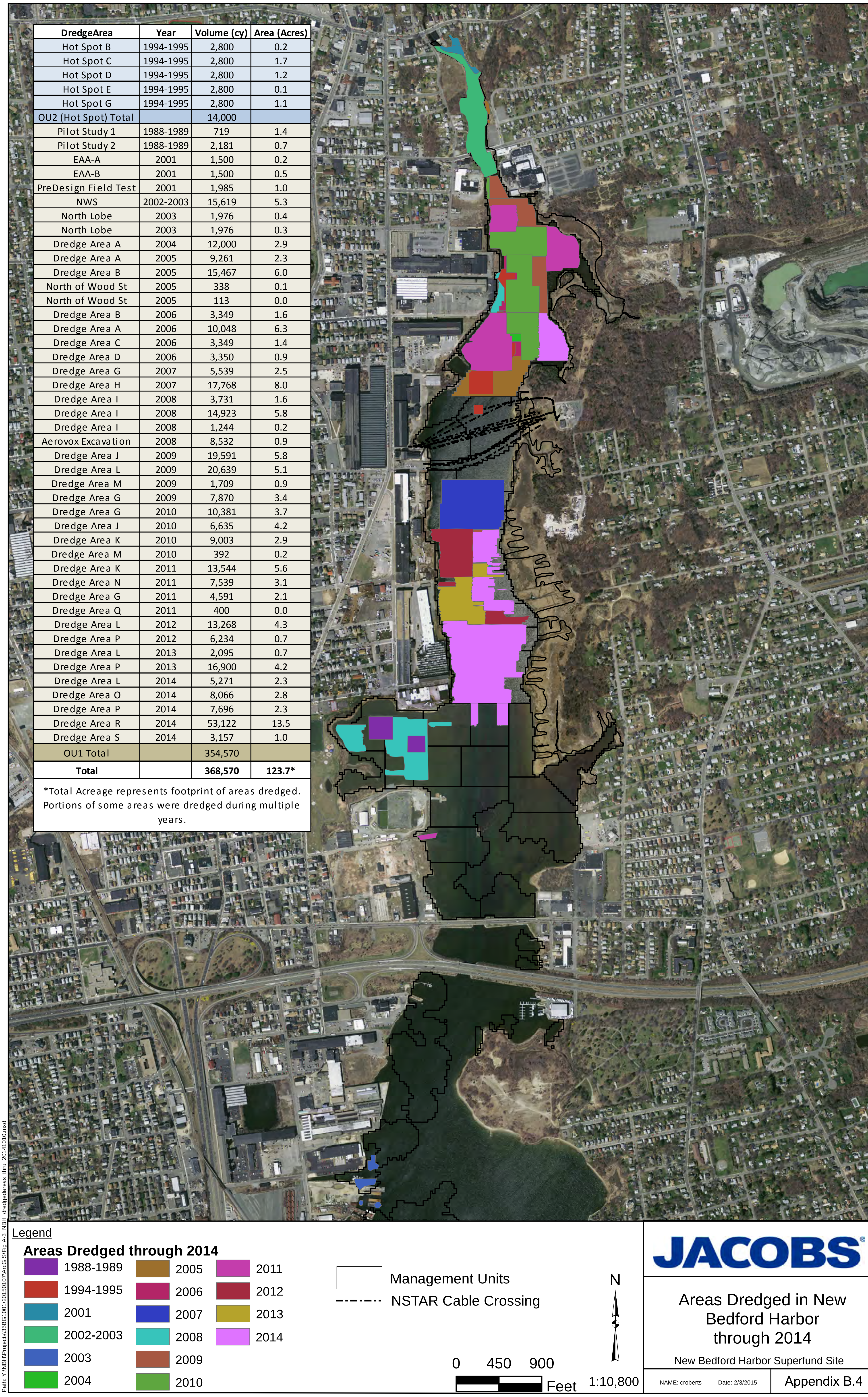
Step 3. Dewatering

Step 4. Loading to rail for offsite disposal

4 - AREAS DREDGED THROUGH 2014
2015 HYDRAULIC DREDGE AREAS

DredgeArea	Year	Volume (cy)	Area (Acres)
Hot Spot B	1994-1995	2,800	0.2
Hot Spot C	1994-1995	2,800	1.7
Hot Spot D	1994-1995	2,800	1.2
Hot Spot E	1994-1995	2,800	0.1
Hot Spot G	1994-1995	2,800	1.1
OU2 (Hot Spot) Total		14,000	
Pilot Study 1	1988-1989	719	1.4
Pilot Study 2	1988-1989	2,181	0.7
EAA-A	2001	1,500	0.2
EAA-B	2001	1,500	0.5
PreDesign Field Test	2001	1,985	1.0
NWS	2002-2003	15,619	5.3
North Lobe	2003	1,976	0.4
North Lobe	2003	1,976	0.3
Dredge Area A	2004	12,000	2.9
Dredge Area A	2005	9,261	2.3
Dredge Area B	2005	15,467	6.0
North of Wood St	2005	338	0.1
North of Wood St	2005	113	0.0
Dredge Area B	2006	3,349	1.6
Dredge Area A	2006	10,048	6.3
Dredge Area C	2006	3,349	1.4
Dredge Area D	2006	3,350	0.9
Dredge Area G	2007	5,539	2.5
Dredge Area H	2007	17,768	8.0
Dredge Area I	2008	3,731	1.6
Dredge Area I	2008	14,923	5.8
Dredge Area I	2008	1,244	0.2
Aerovox Excavation	2008	8,532	0.9
Dredge Area J	2009	19,591	5.8
Dredge Area L	2009	20,639	5.1
Dredge Area M	2009	1,709	0.9
Dredge Area G	2009	7,870	3.4
Dredge Area G	2010	10,381	3.7
Dredge Area J	2010	6,635	4.2
Dredge Area K	2010	9,003	2.9
Dredge Area M	2010	392	0.2
Dredge Area K	2011	13,544	5.6
Dredge Area N	2011	7,539	3.1
Dredge Area G	2011	4,591	2.1
Dredge Area Q	2011	400	0.0
Dredge Area L	2012	13,268	4.3
Dredge Area P	2012	6,234	0.7
Dredge Area L	2013	2,095	0.7
Dredge Area P	2013	16,900	4.2
Dredge Area L	2014	5,271	2.3
Dredge Area O	2014	8,066	2.8
Dredge Area P	2014	7,696	2.3
Dredge Area R	2014	53,122	13.5
Dredge Area S	2014	3,157	1.0
OU1 Total		354,570	
Total		**368,570**	**123.7***

*Total Acreage represents footprint of areas dredged. Portions of some areas were dredged during multiple years.



JACOBS

Areas Dredged in New Bedford Harbor through 2014

New Bedford Harbor Superfund Site

NAME: croberts Date: 2/3/2015

Appendix B.4

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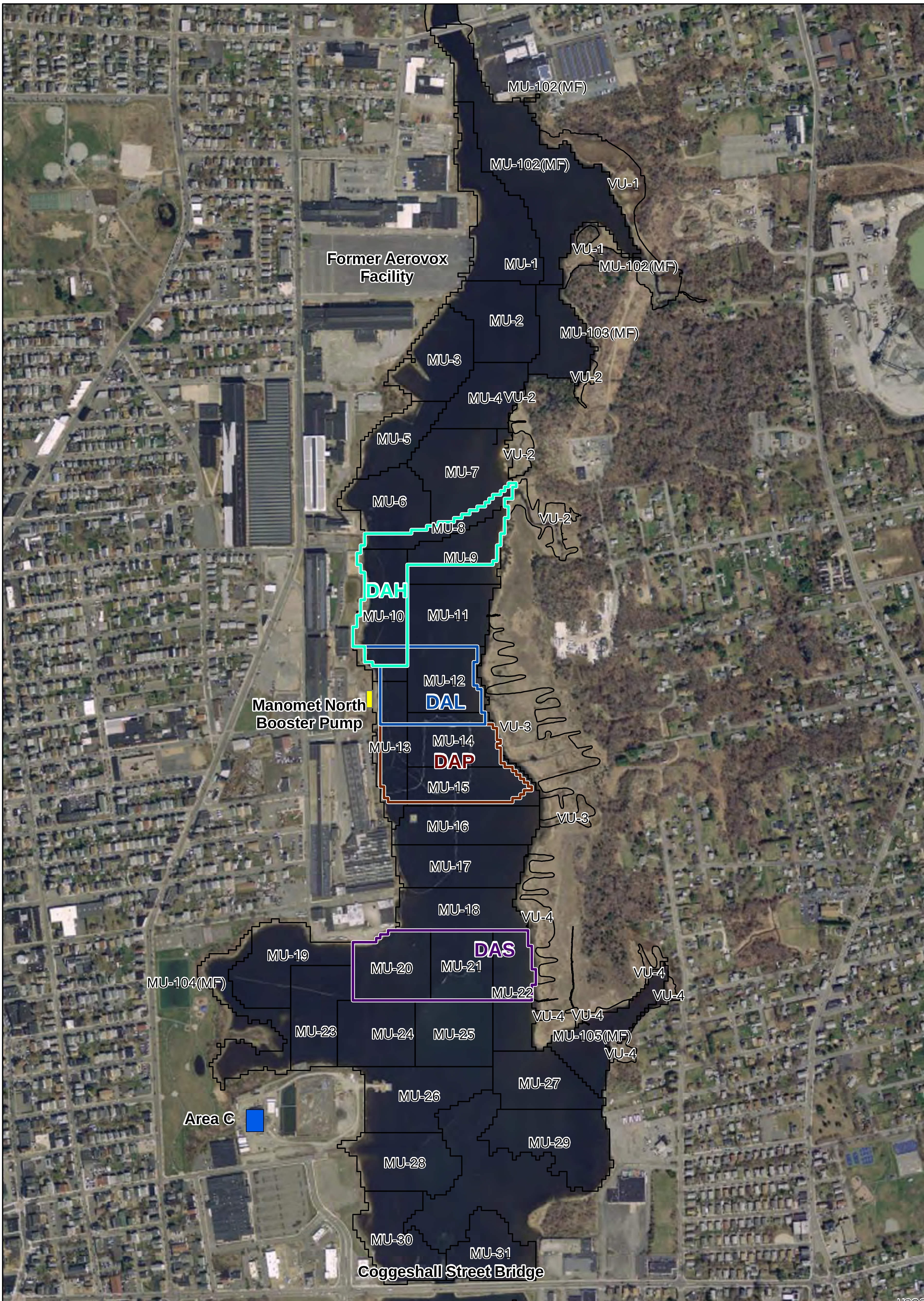


Legend

- Manoment North Booster Pump
- Management Units
- DAH
- DAS
- DAL
- DAP

0 300 600 Feet

1:7,200

N

Aerial Photography MASSGIS 2003

JACOBS

2015 Hydraulic Dredge Areas

New Bedford Harbor Superfund Site

NAME: jpiccuito | Date: 7/30/2015 | Figure 3-1

Path: Y:\NBH\Projects\35BG1001\20150730\ArcGIS\Fig3-1_hydraulic_dredge_areas_2015.mxd

5 - AMBIENT AIR DATA:

- TABLE E-1 AMBIENT AIR MONITORING PROGRAM - TOTAL DETECTABLE PCB HOMOLOGUES (AS OF AUGUST 2015)
- AMBIENT AIR MONITORING STATION LOCATIONS
- PUBLIC EXPOSURE TRACKING SYSTEM (PETS) CURVES FOR THE AEROVOX AND COFFIN AVE AMBIENT AIR MONITORING LOCATIONS

Table E-1
Ambient Air Monitoring Program - Total Detectable PCB Homologues
New Bedford Harbor Superfund Site
Current as of 8/19/2015

Sampling Date	PCB Concentration by Location (ng/m^3 in 24-hour time-weighted average)																								Activity Period
	24 Aerovox	25 Manomet	25 Cliftex	27 Porter	30 Fibre Leather	42 NSTAR North	43 Veranda	44 Taber	46 Coffin	Area C			Area D			53 Dredge	55 Aerovox West	56 Acushnet Park	57 Riverside Park	61 South Fence	62 Century House	63 Boathouse	64 Pilgrim	65 LHCC Dredge	
										47	48	49	50	51	52										
8/26/2015	62	45.9/35.3		21.9	18.8	35.5	83.9	13.23	20.7	35.2	NS	NS	32.5	NS	NS	1902.3	1.16	NS					14.62		2015 Hydraulic Dredging in Upper Harbor - Area S. Unvalidated results.
7/21/2015	44.1	47.6		10.3	44.1	20.1	37.2	19	27.2	15.8	NS	NS	11.1/15.4d	NS	NS	NS	7.19	NS					11.5		2015 Pre-Dredge Samples for the Upper Harbor. Unvalidated results.
6/3/2015	44.8	37.5		0.973	17.1	4.23	8.58	1.24	5.59	12.7/14.1d	NS	NS	16.1	NS	NS	NS	1.89	1.15					1.25	NS	2015 Off Season Data Collection. Unvalidated results.
4/22/2015	52.1	25.9		NA	20.3	3.4	15.9	7.57	12.3	0.0391	NS	NS	3.62	NS	NS	NS	4.94	NS					5.72	NS	2015 Off Season Data Collection and Pre-dredge sampling for the Upper Harbor. Pump at Station #27 failed to run long enough to collect a viable sample so it was not analyzed. Unvalidated results.
4/6/2015	NS	NS		NS	NS	NS	NS	5.12	NS	NS	NS	NS	8.46	NS	NS	NS	NS	NS					2.23	NS	Lower Harbor CAD Cell Construction Phase II (Post Top of CAD Cell dredging); Unvalidated results. Pump at Station #50 failed to run the same duration as the duplicate so only the duplicate sample was analyzed. This sample is considered the primary sample so there is no duplicate for this post-dredge sampling event.
3/11/2015	NS	0.552/0.386d		NS	0.191	NS	NS	0.53	0.147	1.00	NS	NS	0.558	NS	NS	NS	0.115	NS					0.527	2.43	Lower Harbor CAD Cell Construction Phase II (Top of CAD Cell dredging); Unvalidated results. Stations 24, 27, 42, and 43 were inaccessible for sampling due to obstructions from snow/ice piles.
2/6/2015	NS	NS		NS	NS	NS	NS	0.1419/0.1738	NS	NS	NS	NS	0.0992	NS	NS	NS	NS	NS					0.1469	NS	Lower Harbor CAD Cell Construction Phase II (Top of CAD Cell dredging); Unvalidated results. The dredge sample media was found broken at the dredge and therefore was not analyzed.
1/13/2015	0.58	0.55		0.1600	0.11 / 0.15d	0.87	1.4	0.17	0.075	0.43	NS	NS	1.3	NS	NS	NS	0.05	0.12					0.230	2.48	Lower Harbor CAD Cell Construction Phase II (top of CAD Cell dredging).
12/29/2014	NS	NS		NS	NS	NS	NS	0.98	NS	NS	NS	NS	0.5	NS	NS	NS	NS	NS					1.6/1.9d	3.5	Rapid TAT data. Lower Harbor CAD Cell Construction Phase II (top of CAD Cell dredging).
12/18/2014	NS	NS		NS	NS	NS	NS	1.00	NS	NS	NS	NS	0.49	NS	NS	NS	NS	NS					2.3	3.5/4.6d	Rapid turn around time (TAT) data. Lower Harbor CAD Cell Construction Phase II (top of CAD Cell dredging). Reissue of data due to error in laboratory calculations.
12/15/2014	6.7	7.2		0.73	5.6	2.3	3.6	1.6	2.7	4.4	NS	NS	3.7/4.3d	NS	NS	NS	1.6	0.51					1.1	4.7	Lower Harbor CAD Cell Construction Phase II (top of CAD Cell dredging). Off-season data collection included on January 5, 2015 as received from laboratory.
11/4/2014	43	21.4		9.9	26.8	8.9	17.41	24.2	21	4.85	NS	NS	7.43	NS	NS	NS	4.38	7.05					15.72/5.19d	NS	2014 Post-Dredge Operation for Upper Harbor. Pre-Dredge sampling for the Lower Harbor CAD Cell Phase II (#44, 50 and 64).
10/6/2014	150	98/110d		5.2	180	3.6	17	21	70	21	NS	NS	21	NS	NS	90	NS	NA					12	NS	2014 Hydraulic Dredging in Areas L & S.
9/3/2014	91	44		9.1	39	36	53	12/10d	10	20	NS	NS	11	NS	NS	100	NS	3.8					11		2014 Hydraulic Dredging in Area R-east.
8/5/2014	75	72		8	61	17	37	17	42	55	NS	NS	23	NS	NS	260	NS	4.9					8.5		2014 Hydraulic Dredging in Area R-east.
7/8/2014	82	25		23	36	19	43	34	24	33/33d	NS	NS	22	NS	NS	110	NS	4.2					15		2014 Hydraulic Dredging in Area R-east.
6/16/2014	200	90		12/13d	100	25	35	27	50	25	NS	NS	20	NS	NS	320	NS	21					8.6		2014 Hydraulic Dredging in Area R.
5/7/2014	56.9	32.6		NS	33.8	10.86	29.7	24.3	38.28	13.38	NS	NS	10.96	NS	NS	194	NS	7.01					11.56		2014 Hydraulic Dredging in Area R.
3/18/2014	17	5.8		0.36/0.42d	4.5	2.2	1.7	0.41	ND	3.3	NS	NS	2.8	NS	NS	NS	NS	0.14					0.22		2014 Pre-Dredge Samples for the Upper Harbor.
3/18/2014								0.41					2.8										0.22	NS	Post-Dredge Samples for the Lower Harbor.
12/19/2014								2.32					3.5/3.02d										3.13	0.89	Lower Harbor CAD Cell Construction Phase 1 (top of CAD Cell dredging)
12/4/2013								3.31/3.0d					0.643										2.16	3.57	
11/20/2013								2.17					3.55										1.68/2.0d	6.21	
9/25/2013	25.6	26.5		2.65	14.7	8.05	11.2	NS	4.1	NS	NS	NS	13.3/12.8d	NS	NS	NS	NS	NS					NS		2013 Post-Dredge Operation.
8/20/2013	230	130		15	160	18	61	NS	60/57d	29	NS	NS	29	NS	NS	240	NS	NS					NS		2013 Hydraulic Dredging in Area P.
7/16/2013	240	110		8.1	130	22	36	16	48	110	NS	NS	69	NS	NS	510	NS	NS					14.4		2013 Hydraulic Dredging in Area P.
3/26/2013	14	1.4		3.2	NS	6.6	8.3	1.1	0.65	NS	NS	NS	NS	NS	0.49	NS	NS	NS					1.8/1.8d		2013 Pre-Dredge Samples for the Upper Harbor.
3/26/2013								1.1							0.49								1.8/1.8d	NS	2013 Pre-Dredge Samples for the Lower Harbor.
10/1/2012	98	18		17/18d	25	17	87		18	NS	NS	14	0.56	NS	NS	NS	15	NS			NA				2012 Post Dredge Operation; Sample at Station 62 had insufficient air volume and was not analyzed. Due to several vandalized samples this station has been discontinued.
8/21/2012	67	28		23	17	19	67		14/16d	NS	NS	20	4	NS	NS	NA	0.00033	NS			18				2012 Hydraulic Dredging in Area P; Sample at Station 53 had insufficient air volume and was not analyzed.
7/16/2012	220	1.2		24/24d	110	36	140		26	NS	NS	57	10	NS	NS	280	10	NS			3.3				2012 Hydraulic Dredging in Area L.
7/2/2012	NA	NA		NA	NA	NA	NA		NA	NS	NS	NA	NA	NS	NS	NA	NA	NA			NA				All samples collected were voided due to out of temperature specification upon arrival at laboratory.
5/21/2012	51	NS	67/66d	0.81	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS			0.0029				2012 Pre-Dredge Samples; Station 27 is a new location in 2012 season for eastern residential receptor.
10/11/2011	36	NS	NS		42	10	18		11	NS	NS	25	17	NS	NS	NS	420	18			0.29				2011 Post-Dredge Operation.
9/14/2011	480	NS	NS		120	29	61		93	NS	NS	220	0.62	NS	NS	460	28	57			NS				2011 Hydraulic Dredging in Area N. Sample at Station 62 was tampered and not analyzed.
8/23/2011	280	NS	NS		60	80	94		NS	NS	NS	220/200d	16	NS	NS	1800	48	13			52				2011 Hydraulic Dredging in Area K.
7/26/2011	NS	NS	NS		NS	NS	NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS			NS	51			Excavation of Area Q.
7/13/2011	1100	NS	NS		130	40	43		43	NS	NS	78	110	NS	NS	1000/1100d	79	25			6.7	NS			2011 Hydraulic Dredging in Area K.

Table E-1
Ambient Air Monitoring Program - Total Detectable PCB Homologues
New Bedford Harbor Superfund Site
Current as of 8/19/2015

Sampling Date	PCB Concentration by Location (ng/m^3 in 24-hour time-weighted average)																								Activity Period
	24 Aerovox	25 Manomet	25 Cliftex	27 Porter	30 Fibre Leather	42 NSTAR North	43 Veranda	44 Taber	46 Coffin	Area C 47	Area C 48	Area C 49	Area D 50	Area D 51	Area D 52	53 Dredge	55 Aerovox West	56 Acushnet Park	57 Riverside Park	61 South Fence	62 Century House	63 Boathouse	64 Pilgrim	65 LHCC Dredge	
5/25/2011	56	NS	NS		NS	NS	NS		NS	NS	NS	NS	NS	NS	NS	NS	93/97d	NS			0.68	25			2011 Pre-Dredge Samples; Station 63 is a new location in 2011 season for Area Q.
10/13/2010	80	NS	NS		36	9	7.4		21	NS	NS	24	4.4	NS	NS	NS	19	5.9			1.1	NS			2010 Post-Dredge Operation.
8/18/2010	1800	NS	NS		300	25	36		31	NS	NS	130	37	NS	NS	560/580d	200	11			13				2010 Hydraulic Dredging.
7/20/2010	270	NS	NS		29	NS	26		47	NS	NS	79/73d	37.0	NS	NS	450	93	26			2.7				
6/30/2010	120.0	NS	NS		7.3	0.0013	82.0		13	NS	NS	32	3.3	NS	NS	230	3.20	12.0			44/41d				
5/21/2010	86	NS	NS		NS	0.042	NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS			ND/NDd				2010 Pre-Dredge Samples.
5/13/2010	void	NS	NA		NS	void	NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS			void				2010 pre-dredge samples. Sample location at Century House Resturant (#62) in Acushnet added at the direction of the EPA. Samples taken on 5/13/10 were damaged during shipment.
12/16/2009	3.3	NS	NS		0.134	23.8	9.12		0.171	NS	NS	1.78	NS	0.184	NS	NS	0.372/0.353d	0.63							2009 Post-Dredge Operation.
11/9/2009	45.2	NS	NS		20.4/31d	25.3	55.2		32.8	NS	NS	51.8	NS	2.92	NS	205.1	8.31	17.2							2009 Hydraulic Dredging.
10/14/2009	48.79	NS	NS		11.77	17.92	10.01		8.8/8.07d	NS	NS	13.26	NS	3.75	NS	0.13	10.00	2.62							
9/17/2009	160	NS	NS		24	2.2	51		13	NS	NS	35	NS	42	NS	180	14	10/9.8d							
8/13/2009	130	NS	NS		21	14	49		14	NS	NS	32	NS	31	NS	130	28/30d	20							
7/13/2009	130	NS	NS		18	39	110		36	NS	NS	77/76d	NS	5.3	NS	290	7.4	6							
6/16/2009	150	NS	NS		77	10	33		35	43	NS	NS	NS	32	NS	120	33	8.2							
11/10/2008	NS	NS	NS		NS	NS	15		1.3	NS	NS	6.2	NS	ND	NS	NS	NS	NS	0.11						2008 Post-Dredge Operation.
10/7/2008	NS	NS	NS		NS	NS	NS		5.2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS						2008 Hydraulic Dredging.
9/24/2008	NS	NS	NS		NS	NS	18		NS	NS	NS	42	NS	NS	NS	1.5	NS	NS	15.0						
8/21/2008	NS	NS	NS		NS	NS	31.66		121.9	NS	NS	123.4/116.4d	NS	2.85	NS	178.0	NS	NS	37.46						
7/16/2008	NS	NS	NS		NS	NS			NS	NS	NS	NS	NS	NS	NS	NA	68.6	NS		286.5					2008 Land-Based Excavation of Shoreline at Aerovox. Sample Station 61 - South Fence was used only during the excavation timeframe.
7/8/2008	NS	NS	NS		NS	NS			NS	NS	NS	NS	NS	NS	NS	NA	8.7	NS		26.1					
6/25/2008	NS	NS	NS		NS	NS			NS	NS	NS	NS	NS	NS	NS	NA	5.52	NS		NS					
6/19/2008	NS	NS	NS		NS	NS			NS	NS	NS	NS	NS	NS	NS	NA	8.9	NS		NS					
6/12/2008	NS	NS	NS		NS	NS			NS	NS	NS	NS	NS	NS	NS	NA	7.3	NS		43.1					
6/8/2008	NS	NS	NA		NS	NS			NS	NS	NS	NS	NS	NS	NS	NA	25.9	NS		34.4					
11/9/2007	19.7	NS	20.2		NS	15.7			1.86	9.29	NS	NS	NS	4.39	NS	NA	NS	NS							2007 Post-Dredge Operation.
9/18/2007	176	NS	120		NS	16.3			21.4	57.1	NS	NS	48.7	NS	NS	130	NS	NS							2007 Hydraulic Dredging
8/21/2007	282	NS	147		NS	19.2			36.1	46.9	NS	NS	36.7	NS	NS	138	NS	NS							
11/19/2006	41.1	NS	0.14		NS	NS			4.05	NS	NS	81.4	2.6	NS	NS	NA	NS	NS							2006 Post-Dredge Operation.
10/6/2006	2,357	NS	451		NS	NS			108	NS	NS	157	NS	NS	197	13430	NS	NS							2006 Hydraulic Dredging.
8/31/2006	1,629	NS	176		NS	NS			70.4	39.2	NS	NS	NS	67.3	NS	2336	NS	NS							
12/29/2005	83.2	NS	10.9		NS	21.4			65.1	7.4	NS	NS	NS	2.2	NS	NA	10.8	13.5							2005 Post-Dredge Operation.
11/18/2005	15.9	NS	0.1		NS	63.6			0.1	NS	0.1	3.7	NS	NS	NS	913.0	0.1	3.8							2005 Hydraulic Dredging.
10/28/2005	15.4	NS	NS		NS	32.3			2.1	NS	4.6	12.3	0.0	NS	NS	505.0	4.0	2.7							
10/6/2005	1822.0	NS	251.0		NS	119.0			130.0	NS	60.1	114.0	81.7	NS	NS	6315.0	222.0	180.0							
9/29/2005	383.0	NS	104.0		NS	5.3			124.0	NS	17.3	44.2	24.2	NS	NS	391.0	87.0	77.9							
9/23/2005	178.0	NS	35.2		NS	83.3			115.0	NS	19.1	97.0	0.3	NS	NS	780.0	2.6	23.9							
9/15/2005	1490.0	NS	58.2		NS	22.5			99.8	NS	14.9	83.6	0.5	NS	NS	1280.0	37.6	102.0							
8/11/2005	216.0	NS	103.0		NS	25.9			37.2	NS	NS	29.3	NS	NS	21.3	NA	42.1	49.9							2005 Pre-Dredge Samples.
12/3/2004	30	NS	27		NS	40			15	22	NS	26	22	NS	31	NA	9.33	1.52							2004 Post-Dredge Operation.
11/5/2004	578	NS	61		NS	73			80	NS	NS	28	NS	NS	NS	351	28.42	39.08							2004 Hydraulic Dredging.
10/19/2004	559	NS	259		NS	NS			36	47	48	66	17	74	100	704	NS	NS							
9/28/2004	9557	NS	423		NS	NS			342	35	165	207	80	75	115	2734	NS	NS							
9/23/2004	588	NS	97		NS	NS			5	7	10	17	6	5	19	1212	NS	NS							
9/14/2004	1449	NS	229		NS	NS			48	64	64	86	38	39	61	98	NS	NS							Initial MU-2 Dredging During Startup.
9/9/2004	1024	NS	167		NS	NS			145	28	37	56	20	16	47	723	NS	NS							
6/29/2004	2286	NS	NS		NS	NS			NS	NS	NS	NS	NS	56	NS		NS	NS							No Dredging Activities.
March-May 2000	76	NS	35		NS	29			35	61	61	61	6.8	6.8	6.8		NS	NS							No Dredging Activities. Data from Foster-Wheeler.
Dec 1999-Feb 2000	32	NS	3.2		NS	9.9			3.2	89	89	89	3.4	3.4	3.4		NS	NS							
Sept-Nov 1999	67	NS	22		NS	24			22	43	43	43	5.9	5.9	5.9		5.2	5.2							
June-August 1999	130	NS	46		NS	31			46	33	33	33	12	12	12		NS	NS							

Notes:

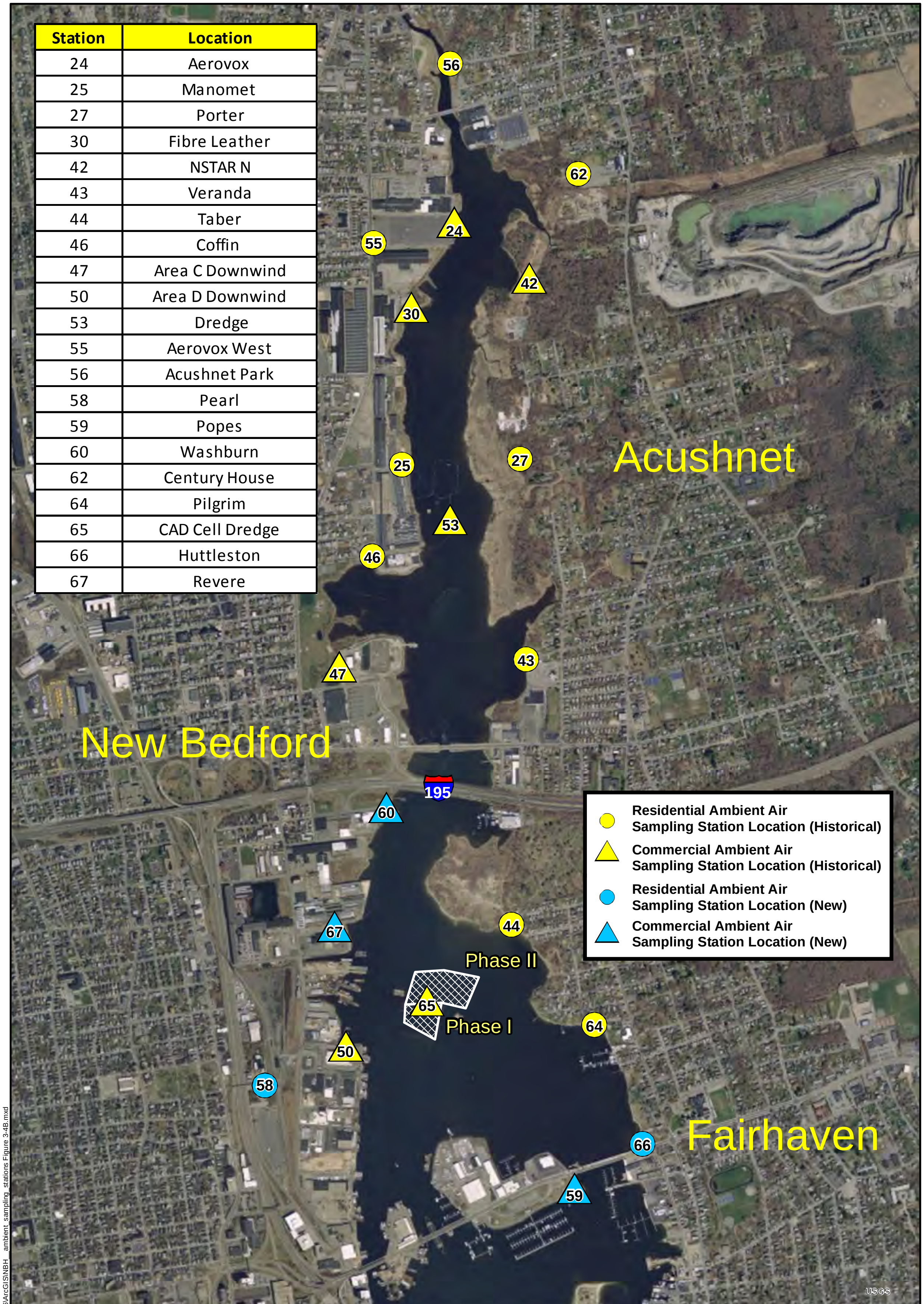
d = field duplicate result   P = Pending results

NA = sample collected but not analyzed

Table E-1
Ambient Air Monitoring Program - Total Detectable PCB Homologues
New Bedford Harbor Superfund Site
Current as of 8/19/2015

Sampling Date	PCB Concentration by Location (ng/m^3 in 24-hour time-weighted average)																								Activity Period
	24 Aerovox	25 Manomet	25 Cliftex	27 Porter	30 Fibre Leather	42 NSTAR North	43 Veranda	44 Taber	46 Coffin	Area C			Area D			53 Dredge	55 Aerovox West	56 Acushnet Park	57 Riverside Park	61 South Fence	62 Century House	63 Boathouse	64 Pilgrim	65 LHCC Dredge	
										47	48	49	50	51	52										

ng/m^3 = nanograms per cubic meter of air
NS = not sampled
PCB = polychlorinated biphenyl
ND = no detections (non-detect)
Sample station with gray blocking is a newer station added to the air sampling program or discontinued station (no activity).



Station	Location
24	Aerovox
25	Manomet
27	Porter
30	Fibre Leather
42	NSTAR N
43	Veranda
44	Taber
46	Coffin
47	Area C Downwind
50	Area D Downwind
53	Dredge
55	Aerovox West
56	Acushnet Park
58	Pearl
59	Popes
60	Washburn
62	Century House
64	Pilgrim
65	CAD Cell Dredge
66	Huttleston
67	Revere

Legend

EPA CAD CELL

Aerial Photography MASSGIS 2014

N

0 750 1,500 Feet

1:21,600

JACOBS

Available Ambient Air Sampling Station Locations

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 8/6/2015

Figure 3-4

Path: Y:\NBH\Projects\35BG1001\20150806\ArcGIS\NBH_ambient_sampling_stations Figure 3-4B.mxd

Air Sampling Status Report
New Bedford Harbor Superfund Site

Station #: 24 Aerovox
Exposure Budget Slope (EBS) = 344 nanograms per cubic meter per day (ng/m3-day)

Collection Date: 6/3/2015

This report summarizes sample results for the above referenced location and date. The samples were collected on polyurethane foam (PUF)/XAD sample media with a glass fiber pre-filter using a BGI, PQ-1 Low-Volume sampler. The samples were analyzed using high-resolution mass spectrometry (HRGCMS) for total PCB homologue groups. Results are evaluated relative to the Exposure Budget Tracking Process described in the *Development of PCB Air Action Levels for the Protection of the Public, New Bedford Harbor Superfund Site*, August 2001.

Summary of Dredging Activities This Sampling Period:

2014 hydraulic dredge season mobilization activities began March 25,2014 and lasted until April 14, 2014. Hydraulic dredging activities were conducted in the Upper Harbor, Areas L and P, from April 18, 2014 to October 10, 2014. Demobilization activities began October 14, 2014 and ended October 24, 2014.

Summary of Sampling Activities at Location 24 Aerovox in 2014:

A pre-dredge sampling event was conducted that includes this location. Baseline sample data was used to continue the production of the PETS curves for 2014. To date, the cumulative exposure budget expended for cancer is approximately 43%. The cumulative exposure budget expended for non-cancer effects is approximately 14.5%.

Summary of Previous Sampling Activities:

Previous ambient air sampling data and PETS curves are in the Draft 2013 Ambient Air Monitoring Report, ACE-J23-35BG0708-M17-0012.

Sample Results, Calculated Budget and Exposure Values
Station: 55 Aerovox West

Monitoring Station		24 Aerovox
Exposure Budget Slope		344
Work Start Date		11/12/2002
Projected Work End Date		11/10/2022
Occupational Limit Used as Ceiling	[ng/m^3]	500,000
TEL for Worker in Public	[ng/m^3]	50,000
NTEL for Worker in Public	[ng/m^3]	1,789
Minimum of TEL/NTEL	[ng/m^3]	1,789
Background Concentration	[ng/m^3]	5.2
Background Concentration (100%)	[ng/m^3]	5.2
Background Concentration (200%)	[ng/m^3]	10.4
Project Duration (10% left)	[days]	730.3
Project Duration (25% left)	[days]	1825.75
Project Duration (50% left)	[days]	3651.5

Notes:
TEL - Threshold Effects Exposure Limit
NTEL - Non-Threshold Effects Exposure Limits
The EPA periodically assesses this Projected Work End Date, which is subject to change.
NC = Not Calculated
Column F shading represents actual sampling data. All others are
projected quarterly averages of PCB concentrations for that period.

Sample Results, Calculated Budget and Exposure Values
Station: 24 Aerovox

(A) Event	(B) Sampling Date	(C) Days Since Previous Sampling Event	(D) Work Effort Elapsed Time	(E) Estimated Work Effort Remaining	(F) PCB Concentration Result	(G) Average of Most Recent Two Concentration Results	(H) Weighted Average of Concentration Results	(I) Cancer Risk Exposure Budget for the Period	(J) Cumulative Cancer Risk Exposure Budget for Work Effort to Date	(K) Measured Cancer Risk Exposure During the Period	(L) Calculated Cumulative Cancer Risk Exposure for Work Effort to Date	(M) Cancer Risk Exposure Budget Expended During the Period	(N) Cumulative Cancer Risk Exposure Expended for Work Effort to Date
			Running Sum of Column (C) to Date				Column (L)/Column (D)	EBS * Column (C)	Sum of Column (I)	Column (G)* Column (C)	Sum of Column (K)	Column (K) /Column (I)	Column (L) /Column (J)
[#]	[month/day/year]	[days]	[days]	[days]	[ng/m^3]	[ng/m^3]	[ng/m^3]	[ng/m^3-days]	[ng/m^3-days]	[ng/m^3-days]	[ng/m^3-days]	[%]	[%]
1	11/12/2002	0	0	7303	67	67	67	NC	NC	NC	NC	NC	NC
2	11/30/2002	18	18	7285	67	67	67	6,192	6,192	1,206	1,206	19.5%	19.5%
3	12/1/2002	1	19	7284	32	50	66	344	6,536	50	1,256	14.4%	19.2%
4	2/28/2003	89	108	7195	32	32	38	30,616	37,152	2,848	4,104	9.3%	11.0%
5	5/31/2003	92	200	7103	76	54	45	31,648	68,800	4,968	9,072	15.7%	13.2%
6	8/31/2003	92	292	7011	130	103	64	31,648	100,448	9,476	18,548	29.9%	18.5%
7	11/30/2003	91	383	6920	67	99	72	31,304	131,752	8,964	27,511	28.6%	20.9%
8	2/28/2004	90	473	6830	32	50	68	30,960	162,712	4,455	31,966	14.4%	19.6%
9	5/31/2004	93	566	6737	76	54	65	31,992	194,704	5,022	36,988	15.7%	19.0%
10	8/31/2004	92	658	6645	130	103	71	31,648	226,352	9,476	46,464	29.9%	20.5%
11	9/8/2004	8	666	6637	67	99	71	2,752	229,104	788	47,252	28.6%	20.6%
12	9/9/2004	1	667	6636	1024	545.50	71.66	344	229,448	546	47,798	158.6%	20.8%
13	9/14/2004	5	672	6631	1449	1236.50	80.33	1,720	231,168	6,183	53,980	359.4%	23.4%
14	9/23/2004	9	681	6622	588	1018.50	92.73	3,096	234,264	9,167	63,147	296.1%	27.0%
15	9/27/2004	4	685	6618	790	689.00	96.21	1,376	235,640	2,756	65,903	200.3%	28.0%
16	10/19/2004	22	707	6596	559	674.50	114.20	7,568	243,208	14,839	80,742	196.1%	33.2%
17	11/5/2004	17	724	6579	578	568.50	124.87	5,848	249,056	9,665	90,406	165.3%	36.3%
18	12/3/2004	28	752	6551	30	304.00	131.54	9,632	258,688	8,512	98,918	88.4%	38.2%
19	2/28/2005	87	839	6464	32	31.00	121.11	29,928	288,616	2,697	101,615	9.0%	35.2%
20	5/31/2005	92	931	6372	76	54.00	114.48	31,648	320,264	4,968	106,583	15.7%	33.3%
21	8/10/2005	71	1002	6301	130	103.00	113.67	24,424	344,688	7,313	113,896	29.9%	33.0%
22	8/11/2005	1	1003	6300	216	173.00	113.73	344	345,032	173	114,069	50.3%	33.1%
23	9/15/2005	35	1038	6265	1490	853.00	138.66	12,040	357,072	29,855	143,924	248.0%	40.3%
24	9/23/2005	8	1046	6257	178	834.00	143.97	2,752	359,824	6,672	150,596	242.4%	41.9%
25	9/29/2005	6	1052	6251	383	280.50	144.75	2,064	361,888	1,683	152,279	81.5%	42.1%
26	10/6/2005	7	1059	6244	1822	1102.50	151.08	2,408	364,296	7,718	159,997	320.5%	43.9%
27	10/28/2005	22	1081	6222	15.4	918.70	166.70	7,568	371,864	20,211	180,208	267.1%	48.5%
28	11/18/2005	21	1102	6201	15.9	15.65	163.83	7,224	379,088	329	180,537	4.5%	47.6%
29	12/29/2005	41	1143	6160	83.2	49.55	159.73	14,104	393,192	2,032	182,568	14.4%	46.4%
30	2/28/2006	61	1204	6099	32	57.60	154.55	20,984	414,176	3,514	186,082	16.7%	44.9%
31	5/31/2006	92	1296	6007	76	54.00	147.41	31,648	445,824	4,968	191,050	15.7%	42.9%
32	8/15/2006	76	1372	5931	130	103.00	144.95	26,144	471,968	7,828	198,878	29.9%	42.1%
33	8/16/2006	1	1373	5930	1629	879.50	145.49	344	472,312	880	199,757	255.7%	42.3%
34	8/31/2006	15	1388	5915	1629	1629.00	161.52	5,160	477,472	24,435	224,192	473.5%	47.0%
35	10/5/2006	35	1423	5880	2357	1993.00	206.57	12,040	489,512	69,755	293,947	579.4%	60.0%
36	10/19/2006	14	1437	5866	41.1	1199.05	216.24	4,816	494,328	16,787	310,734	348.6%	62.9%
37	11/19/2006	31	1468	5835	41.1	41.10	212.54	10,664	504,992	1,274	312,008	11.9%	61.8%
38	11/30/2006	11	1479	5824	67	54.05	211.36	3,784	508,776	595	312,603	15.7%	61.4%
39	2/28/2007	90	1569	5734	32	49.50	202.08	30,960	539,736	4,455	317,058	14.4%	58.7%
40	5/31/2007	92	1661	5642	76	54.00	193.87	31,648	571,384	4,968	322,026	15.7%	56.4%
41	8/6/2007	67	1728	5575	130	103.00	190.35	23,048	594,432	6,901	328,927	29.9%	55.3%
42	8/7/2007	1	1729	5574	282	206.00	190.36	344	594,776	206	329,133	59.9%	55.3%
43	8/21/2007	14	1743	5560	282	282.00	191.10	4,816	599,592	3,948	333,081	82.0%	55.6%
44	9/18/2007	28	1771	5532	176	229.00	191.70	9,632	609,224	6,412	339,493	66.6%	55.7%
45	10/13/2007	25	1796	5507	67	121.5	190.72	8,600	617,824	3,038	342,530	35.32%	55.4%
46	11/9/2007	27	1823	5480	19.7	43.35	188.54	9,288	627,112	1,170	343,701	12.60%	54.8%
47	11/30/2007	21	1844	5459	67	43.35	186.88	7,224	634,336	910	344,611	12.60%	54.3%
48	2/28/2008	90	1934	5369	32	49.5	180.49	30,960	665,296	4,455	349,066	14.39%	52.5%
49	5/31/2008	93	2027	5276	76	54	174.69	31,992	697,288	5,022	354,088	15.70%	50.8%

Notes:
NC = Not Calculated

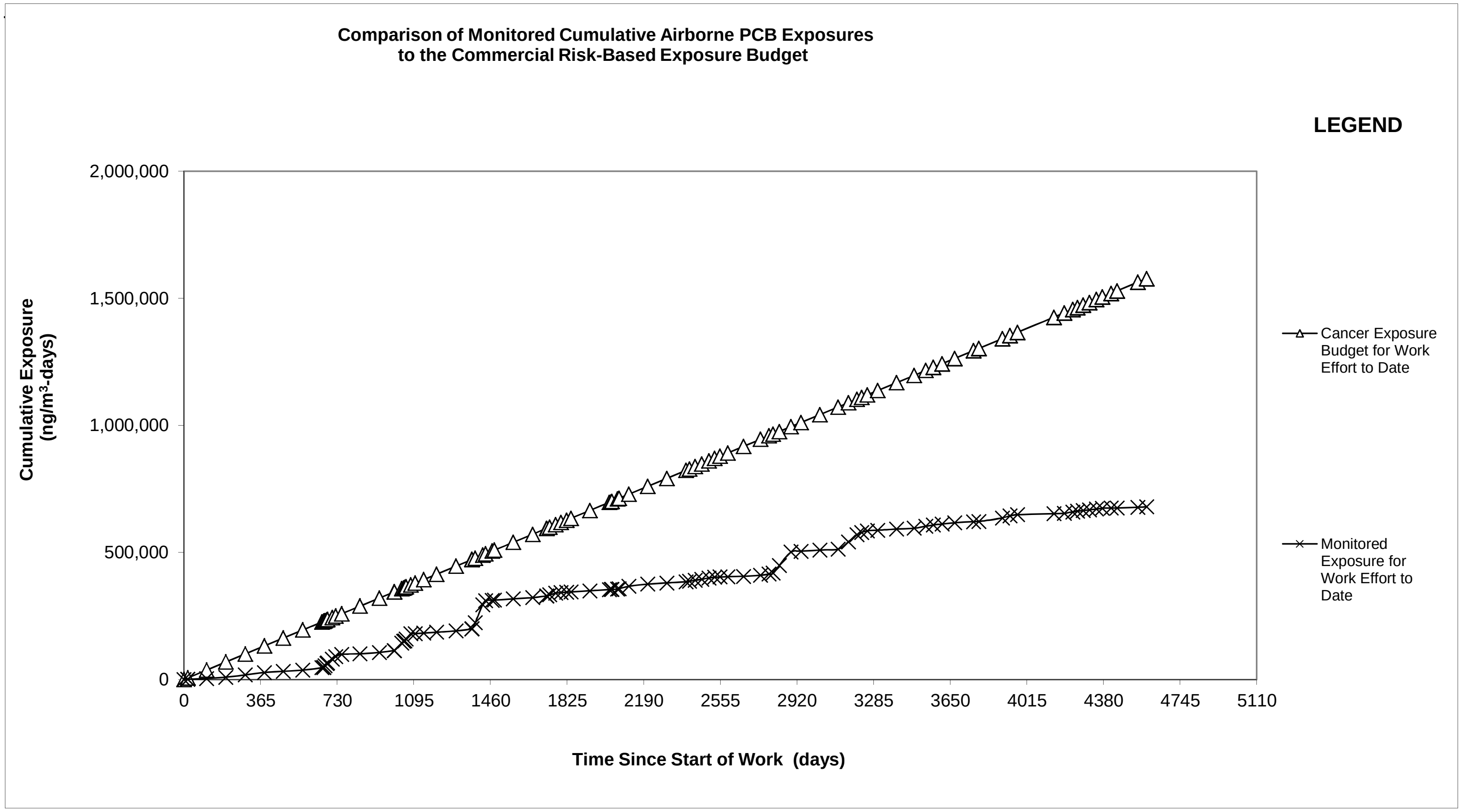
Sample Results, Calculated Budget and Exposure Values
Station: 24 Aerovox

(A) Event	(B) Sampling Date	(C) Days Since Previous Sampling Event	(D) Work Effort Elapsed Time	(E) Estimated Work Effort Remaining	(F) PCB Concentration Result	(G) Average of Most Recent Two Concentration Results	(H) Weighted Average of Concentration Results	(I) Cancer Risk Exposure Budget for the Period	(J) Cumulative Cancer Risk Exposure Budget for Work Effort to Date	(K) Measured Cancer Risk Exposure During the Period	(L) Calculated Cumulative Cancer Risk Exposure for Work Effort to Date	(M) Cancer Risk Exposure Budget Expended During the Period	(N) Cumulative Cancer Risk Exposure Expended for Work Effort to Date
50	6/8/2008	8	2035	5268	34.4	55.2	174.22	2,752	700,040	442	354,529	16.05%	50.6%
51	6/12/2008	4	2039	5264	43.1	38.75	173.95	1,376	701,416	155	354,684	11.26%	50.6%
52	7/8/2008	26	2065	5238	26	34.55	172.20	8,944	710,360	898	355,583	10.04%	50.1%
53	7/16/2008	8	2073	5230	290	158	172.14	2,752	713,112	1,264	356,847	45.93%	50.0%
54	8/31/2008	46	2119	5184	130	210	172.96	15,824	728,936	9,660	366,507	61.05%	50.3%
55	11/30/2008	91	2210	5093	67	98.5	169.90	31,304	760,240	8,964	375,470	28.63%	49.4%
56	2/28/2009	90	2300	5003	32	49.5	165.18	30,960	791,200	4,455	379,925	14.39%	48.0%
57	5/31/2009	92	2392	4911	76	54	160.91	31,648	822,848	4,968	384,893	15.70%	46.8%
58	6/16/2009	16	2408	4895	150	113	160.59	5,504	828,352	1,808	386,701	32.85%	46.7%
59	7/13/2009	27	2435	4868	130	140	160.36	9,288	837,640	3,780	390,481	40.70%	46.6%
60	8/13/2009	31	2466	4837	130	130	159.98	10,664	848,304	4,030	394,511	37.79%	46.5%
61	9/17/2009	35	2501	4802	160	145	159.77	12,040	860,344	5,075	399,586	42.15%	46.4%
62	10/14/2009	27	2528	4775	48.79	104.395	159.18	9,288	869,632	2,819	402,405	30.35%	46.3%
63	11/9/2009	26	2554	4749	45.2	46.995	158.04	8,944	878,576	1,222	403,627	13.66%	45.9%
64	12/16/2009	37	2591	4712	2.59	23.895	156.12	12,728	891,304	884	404,511	6.95%	45.4%
65	2/28/2010	74	2665	4638	32	17.295	152.27	25,456	916,760	1,280	405,791	5.03%	44.3%
66	5/21/2010	82	2747	4556	86	59	149.48	28,208	944,968	4,838	410,629	17.15%	43.5%
67	6/30/2010	40	2787	4516	120	103	148.82	13,760	958,728	4,120	414,749	29.94%	43.3%
68	7/20/2010	20	2807	4496	270	195	149.14	6,880	965,608	3,900	418,649	56.69%	43.4%
69	8/18/2010	29	2836	4467	1800	1035	158.20	9,976	975,584	30,015	448,664	300.87%	46.0%
70	10/13/2010	56	2892	4411	80	940	173.34	19,264	994,848	52,640	501,304	273.26%	50.4%
71	11/30/2010	48	2940	4363	67	73.5	171.71	16,512	1,011,360	3,528	504,832	21.37%	49.9%
72	2/28/2011	90	3030	4273	32	49.5	168.08	30,960	1,042,320	4,455	509,287	14.39%	48.9%
73	5/25/2011	86	3116	4187	56	44	164.66	29,584	1,071,904	3,784	513,071	12.79%	47.9%
74	7/13/2011	49	3165	4138	1100	578	171.06	16,856	1,088,760	28,322	541,393	168.02%	49.7%
75	8/23/2011	41	3206	4097	280	690	177.69	14,104	1,102,864	28,290	569,683	200.58%	51.7%
76	9/14/2011	22	3228	4075	480	380	179.07	7,568	1,110,432	8,360	578,043	110.47%	52.1%
77	10/11/2011	27	3255	4048	36	258	179.73	9,288	1,119,720	6,966	585,009	75.00%	52.2%
78	11/30/2011	50	3305	3998	67	51.5	177.79	17,200	1,136,920	2,575	587,584	14.97%	51.7%
79	2/28/2012	90	3395	3908	32	49.5	174.39	30,960	1,167,880	4,455	592,039	14.39%	50.7%
80	5/21/2012	83	3478	3825	51	41.5	171.21	28,552	1,196,432	3,445	595,483	12.06%	49.8%
81	7/16/2012	56	3534	3769	220	135.5	170.65	19,264	1,215,696	7,588	603,071	39.39%	49.6%
82	8/21/2012	36	3570	3733	67	143.5	170.37	12,384	1,228,080	5,166	608,237	41.72%	49.5%
83	10/1/2012	41	3611	3692	98	82.5	169.38	14,104	1,242,184	3,383	611,620	23.98%	49.2%
84	11/30/2012	60	3671	3632	67	82.5	167.96	20,640	1,262,824	4,950	616,570	23.98%	48.8%
85	2/28/2013	90	3761	3542	32	49.5	165.12	30,960	1,293,784	4,455	621,025	14.39%	48.0%
86	3/26/2013	26	3787	3516	14	23	164.15	8,944	1,302,728	598	621,623	6.69%	47.7%
87	7/16/2013	112	3899	3404	240	127	163.08	38,528	1,341,256	14,224	635,847	36.92%	47.4%
88	8/20/2013	35	3934	3369	230	235	163.72	12,040	1,353,296	8,225	644,072	68.31%	47.6%
89	9/25/2013	36	3970	3333	25.6	127.8	163.39	12,384	1,365,680	4,601	648,673	37.15%	47.5%
90	3/18/2014	174	4144	3159	17	21.3	157.43	59,856	1,425,536	3,706	652,379	6.19%	45.8%
91	5/7/2014	50	4194	3109	56.9	36.95	155.99	17,200	1,442,736	1,848	654,226	10.74%	45.3%
92	6/16/2014	40	4234	3069	200	128.45	155.73	13,760	1,456,496	5,138	659,364	37.34%	45.3%
93	7/8/2014	22	4256	3047	82	141	155.65	7,568	1,464,064	3,102	662,466	40.99%	45.2%
94	8/5/2014	28	4284	3019	75	78.5	155.15	9,632	1,473,696	2,198	664,664	22.82%	45.1%
95	9/3/2014	29	4313	2990	91	83	154.67	9,976	1,483,672	2,407	667,071	24.13%	45.0%
96	10/6/2014	33	4346	2957	150	120.5	154.41	11,352	1,495,024	3,977	671,048	35.03%	44.9%
97	11/4/2014	29	4375	2928	43	96.5	154.02	9,976	1,505,000	2,799	673,846	28.05%	44.8%
98	12/15/2014	41	4416	2887	6.7	24.85	152.82	14,104	1,519,104	1,019	674,865	7.22%	44.4%
99	1/13/2015	29	4445	2858	0.58	3.64	151.85	9,976	1,529,080	106	674,971	1.06%	44.1%
100	4/22/2015	99	4544	2759	52.1	26.34	149.11	34,056	1,563,136	2,608	677,578	7.66%	43.3%
101	6/3/2015	42	4586	2717	44.8	48.45	148.19	14,448	1,577,584	2,035	679,613	14.08%	43.1%

Notes:
NC = Not Calculated

Sample Results, Calculated Cancer Budget and Exposure Values
Station: 24 Aerovox

Sample Station :	24 Aerovox
Collection Date:	6/3/2015
Measured PCB Concentration (ng/m^3):	44.8
Exposure Budget Expended During This Period:	14.1%
Cumulative Exposure Budget Expended to Date:	43.1%
Response Level:	No Triggers Identified
Response:	No Response Necessary



Air Sampling Status Report
New Bedford Harbor Superfund Site

Station #: 46 Coffin
Exposure Budget Slope (EBS) = 202 nanograms per cubic meter per day (ng/m^3-day)

Collection Date: 12/15/2014

This report summarizes sample results for the above referenced location and date. The samples were collected on polyurethane foam (PUF)/XAD sample media with a glass fiber pre-filter using a BGI, PQ-1 Low-Volume sampler. The samples were analyzed using high-resolution mass spectrometry (HRGCMS) for total PCB homologue groups. Results are evaluated relative to the Exposure Budget Tracking Process described in the *Development of PCB Air Action Levels for the Protection of the Public, New Bedford Harbor Superfund Site*, August 2001.

Summary of Dredging Activities This Sampling Period:

2014 hydraulic dredge season mobilization activities began March 25,2014 and lasted until April 14, 2014. Hydraulic dredging activities were conducted in the Upper Harbor, Areas L and P, from April 18, 2014 to October 10, 2014. Demobilization activities began October 14, 2014 and ended October 24, 2014.

Summary of Sampling Activities at Location 46 Coffin in 2014:

Baseline sample data was used to continue the production of the PETS curves for 2014. The cumulative non-cancer exposure budget for a child receptor expended is approximately approximately 30% as a six-year running average. The cumulative cancer budget for an adult residential resident expended to date is approximately 16%.

Summary of Previous Sampling Activities:

Previous ambient air sampling data and PETS curves are in the Draft 2012 Ambient Air Monitoring Report, ACE-J23-35BG0708-M17-0012.

Sample Results, Calculated Budget and Exposure Values
Station: 46 Coffin Ave

Monitoring Station		46 Coffin Ave
Exposure Budget Slope		202
Work Start Date		11/12/2002
Projected Work End Date		11/10/2022
Occupational Limit Used as Ceiling	[ng/m^3]	500,000
TEL for Worker in Public	[ng/m^3]	50,000
NTEL for Worker in Public	[ng/m^3]	1,789
Minimum of TEL/NTEL	[ng/m^3]	1,789
Background Concentration	[ng/m^3]	115
Background Concentration (100%)	[ng/m^3]	115

Sample Results, Calculated Budget and Exposure Values
Station: 55 Aerovox West

(A) Event	(B) Sampling Date	(C) Days Since Previous Sampling Event	(D) Work Effort Elapsed Time	(E) Estimated Work Effort Remaining	(F) PCB Concentration Result	(G) Average of Most Recent Two Concentration Results	(H) Weighted Average of Concentration Results	(I) Cancer Risk Exposure Budget for the Period	(J) Cumulative Cancer Risk Exposure Budget for Work Effort to Date	(K) Measured Cancer Risk Exposure During the Period	(L) Calculated Cumulative Cancer Risk Exposure for Work Effort to Date	(M) Cancer Risk Exposure Budget Expended During the Period	(N) Cumulative Cancer Risk Exposure Expended for Work Effort to Date
			Running Sum of Column (C) to Date				Column (L)/Column (D)	EBS * Column (C)	Sum of Column (I)	Column (G)* Column (C)	Sum of Column (K)	Column (K) /Column (I)	Column (L) /Column (J)
[#}	[month/day/year]	[days]	[days]	[days]	[ng/m^3]	[ng/m^3]	[ng/m^3]	[ng/m^3-days]	[ng/m^3-days]	[ng/m^3-days]	[ng/m^3-days]	[%]	[%]
1	9/9/2004	0	0	7303	145	145	145	NC	NC	NC	NC	NC	NC
2	9/14/2004	5	5	7298	48	97	97	1010	1010	483	483	47.8%	47.8%
3	9/23/2004	9	14	7289	5	27	52	1818	2828	239	721	13.1%	25.5%
4	9/28/2004	5	19	7284	342	174	84	1010	3838	868	1589	85.9%	41.4%
5	10/19/2004	21	40	7263	36	189	139	4242	8080	3969	5558	93.6%	68.8%
6	11/5/2004	17	57	7246	80	58	115	3434	11514	986	6544	28.7%	56.8%
7	12/3/2004	28	85	7218	15	48	93	5656	17170	1330	7874	23.5%	45.9%
8	8/11/2005	251	336	6967	37.2	26	43	50702	67872	6551	14425	12.9%	21.3%
9	9/15/2005	35	371	6932	99.8	69	45	7070	74942	2398	16822	33.9%	22.4%
10	9/23/2005	8	379	6924	115	107	47	1616	76558	859	17681	53.2%	23.1%
11	9/29/2005	6	385	6918	124	120	48	1212	77770	717	18398	59.2%	23.7%
12	10/6/2005	7	392	6911	130	127.00	49.20	1414	79184	889	19287	62.9%	24.4%
13	10/28/2005	22	414	6889	2.1	66.05	50.10	4444	83628	1453	20740	32.7%	24.8%
14	11/18/2005	21	435	6868	0.1	1.10	47.73	4242	87870	23	20764	0.5%	23.6%
15	12/29/2005	41	476	6827	65.1	32.60	46.43	8282	96152	1337	22100	16.1%	23.0%
16	8/31/2006	245	721	6582	70.4	67.75	53.67	49490	145642	16599	38699	33.5%	26.6%
17	10/6/2006	36	757	6546	108	89.20	55.36	7272	152914	3211	41910	44.2%	27.4%
18	11/19/2006	44	801	6502	4.05	56.03	55.40	8888	161802	2465	44375	27.7%	27.4%
19	8/21/2007	275	1076	6227	36.1	20.08	46.37	55550	217352	5521	49896	9.9%	23.0%
20	9/18/2007	28	1104	6199	21.4	28.75	45.92	5656	223008	805	50701	14.2%	22.7%
21	11/9/2007	52	1156	6147	1.86	11.63	44.38	10504	233512	605	51306	5.8%	22.0%
22	8/21/2008	286	1442	5861	121.94	61.90	47.86	57772	291284	17703	69009	30.6%	23.7%
23	10/7/2008	47	1489	5814	5.2	63.57	48.35	9494	300778	2988	71997	31.5%	23.9%
24	11/10/2008	34	1523	5780	1.3	3.25	47.35	6868	307646	111	72107	1.6%	23.4%
25	6/16/2009	218	1741	5562	35	18.15	43.69	44036	351682	3957	76064	9.0%	21.6%
26	7/13/2009	27	1768	5535	36	35.50	43.56	5454	357136	959	77022	17.6%	21.6%
27	8/13/2009	31	1799	5504	14	25.00	43.24	6262	363398	775	77797	12.4%	21.4%
28	9/17/2009	35	1834	5469	13	13.50	42.68	7070	370468	473	78270	6.7%	21.1%
29	10/14/2009	27	1861	5442	8.8	10.90	42.22	5454	375922	294	78564	5.4%	20.9%
30	11/9/2009	26	1887	5416	32.8	20.80	41.92	5252	381174	541	79105	10.3%	20.8%
31	12/16/2009	37	1924	5379	0.171	16.49	41.43	7474	388648	610	79715	8.2%	20.5%
32	6/30/2010	196	2120	5183	13	6.59	38.21	39592	428240	1291	81006	3.3%	18.9%
33	7/20/2010	20	2140	5163	47	30.00	38.13	4040	432280	600	81606	14.9%	18.9%
34	8/18/2010	29	2169	5134	31	39.00	38.15	5858	438138	1131	82737	19.3%	18.9%
35	10/13/2010	56	2225	5078	21	26.00	37.84	11312	449450	1456	84193	12.9%	18.7%
36	7/13/2011	273	2498	4805	43	32.00	37.20	55146	504596	8736	92929	15.8%	18.4%
37	9/14/2011	63	2561	4742	93	68.00	37.96	12726	517322	4284	97213	33.7%	18.8%
38	10/11/2011	27	2588	4715	11	52.00	38.11	5454	522776	1404	98617	25.7%	18.9%
39	7/16/2012	279	2867	4436	26	18.50	36.20	56358	579134	5162	103778	9.2%	17.9%

Notes:
NC = Not Calculated
Column F shading represents actual sampling data. All others are projected quarterly averages of PCB concentrations for that period.

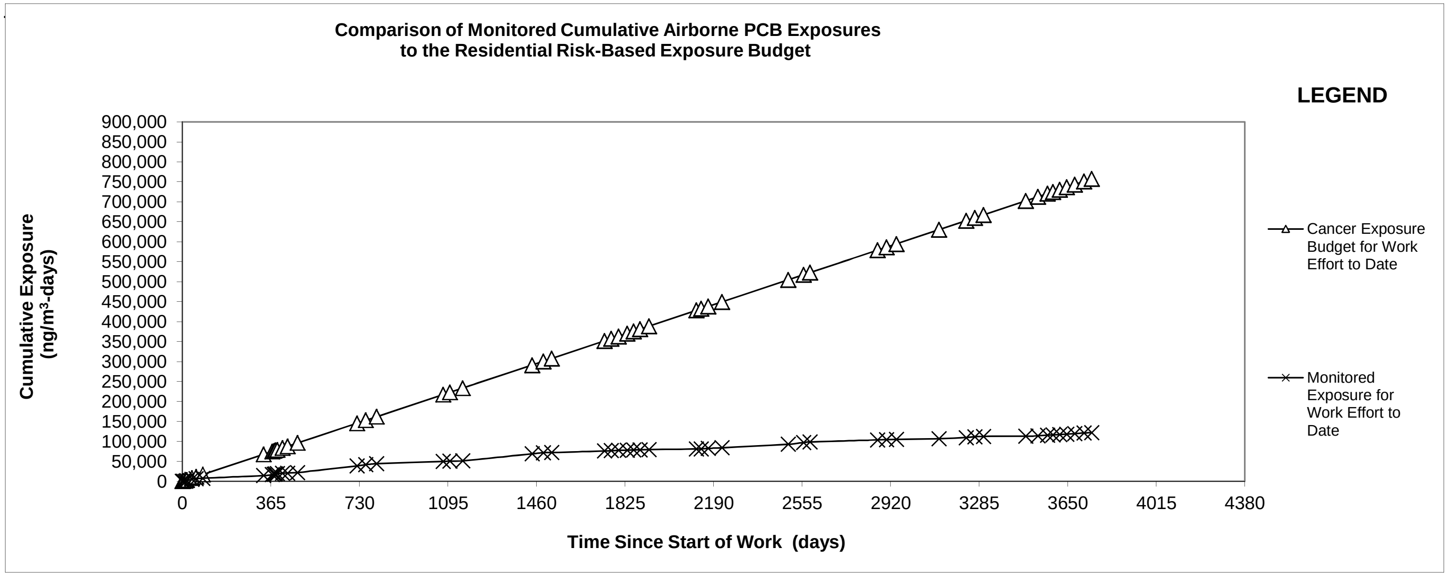
Sample Results, Calculated Budget and Exposure Values
Station: 55 Aerovox West

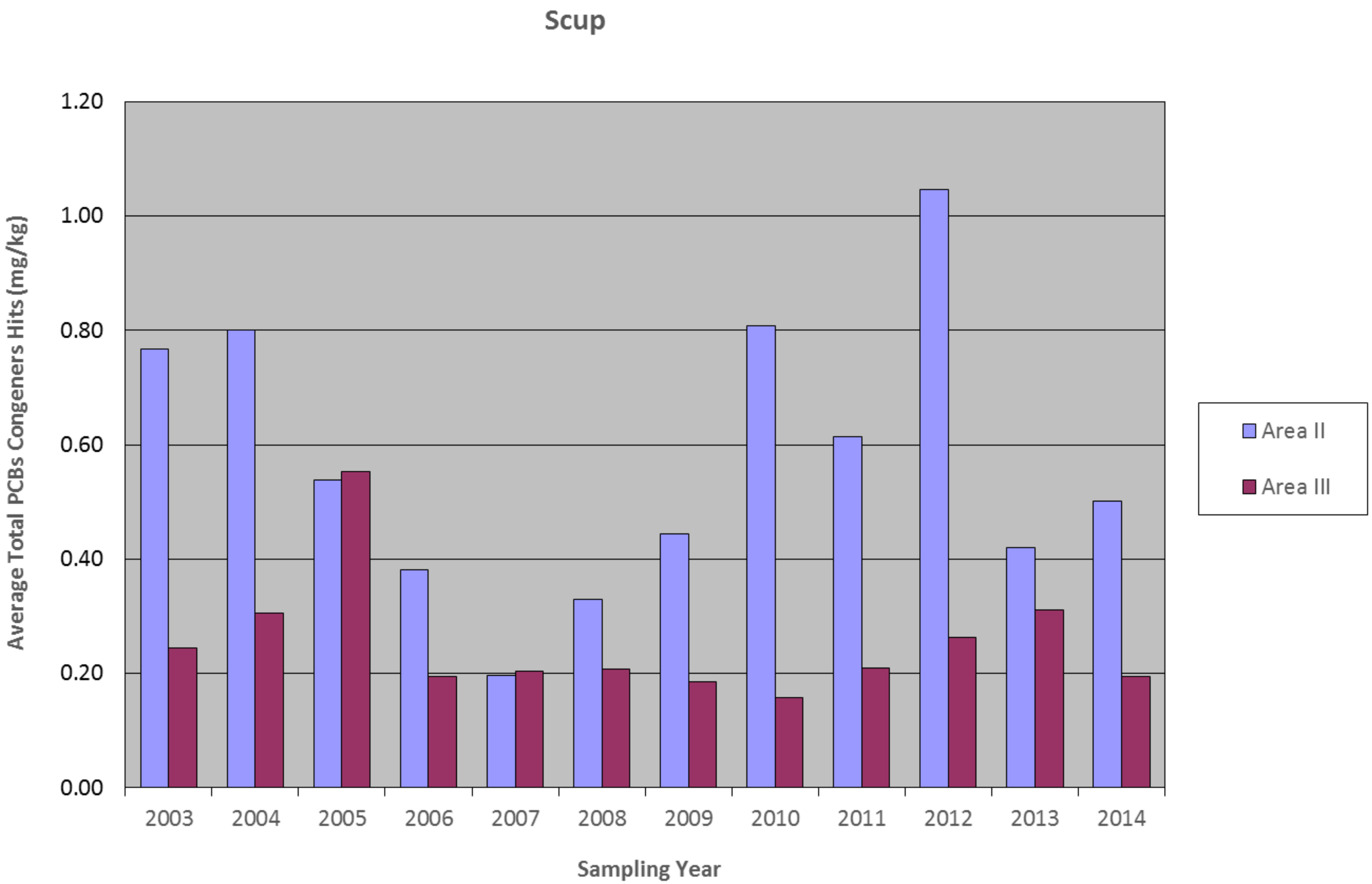
(A) Event	(B) Sampling Date	(C) Days Since Previous Sampling Event	(D) Work Effort Elapsed Time	(E) Estimated Work Effort Remaining	(F) PCB Concentration Result	(G) Average of Most Recent Two Concentration Results	(H) Weighted Average of Concentration Results	(I) Cancer Risk Exposure Budget for the Period	(J) Cumulative Cancer Risk Exposure Budget for Work Effort to Date	(K) Measured Cancer Risk Exposure During the Period	(L) Calculated Cumulative Cancer Risk Exposure for Work Effort to Date	(M) Cancer Risk Exposure Budget Expended During the Period	(N) Cumulative Cancer Risk Exposure Expended for Work Effort to Date
40	8/21/2012	36	2903	4400	16	21.00	36.01	7272	586406	756	104534	10.4%	17.8%
41	10/1/2012	41	2944	4359	18	17.00	35.74	8282	594688	697	105231	8.4%	17.7%
42	3/26/2013	176	3120	4183	0.65	9.33	34.25	35552	630240	1641	106872	4.6%	17.0%
43	7/16/2013	112	3232	4071	48	24.33	33.91	22624	652864	2724	109597	12.0%	16.8%
44	8/20/2013	35	3267	4036	60	54.00	34.13	7070	659934	1890	111487	26.7%	16.9%
45	9/25/2013	36	3303	4000	4.1	32.05	34.10	7272	667206	1154	112641	15.9%	16.9%
46	3/18/2014	174	3477	3826	0	2.05	32.50	35148	702354	357	112997	1.0%	16.1%
47	5/7/2014	50	3527	3776	38.28	19.14	32.31	10100	712454	957	113954	9.5%	16.0%
48	6/16/2014	40	3567	3736	50	44.14	32.44	8080	720534	1766	115720	21.9%	16.1%
49	7/8/2014	22	3589	3714	24	37.00	32.47	4444	724978	814	116534	18.3%	16.1%
50	8/5/2014	28	3617	3686	42	33.00	32.47	5656	730634	924	117458	16.3%	16.1%
51	9/3/2014	29	3646	3657	10	26.00	32.42	5858	736492	754	118212	12.9%	16.1%
52	10/6/2014	33	3679	3624	70	40.00	32.49	6666	743158	1320	119532	19.8%	16.1%
53	11/14/2014	39	3718	3585	21	45.50	32.63	7878	751036	1775	121306	22.5%	16.2%
54	12/15/2014	31	3749	3554	2.7	11.85	32.46	6262	757298	367	121674	5.9%	16.1%

Notes:
NC = Not Calculated
Column F shading represents actual sampling data. All others are projected quarterly averages of PCB concentrations for that period.

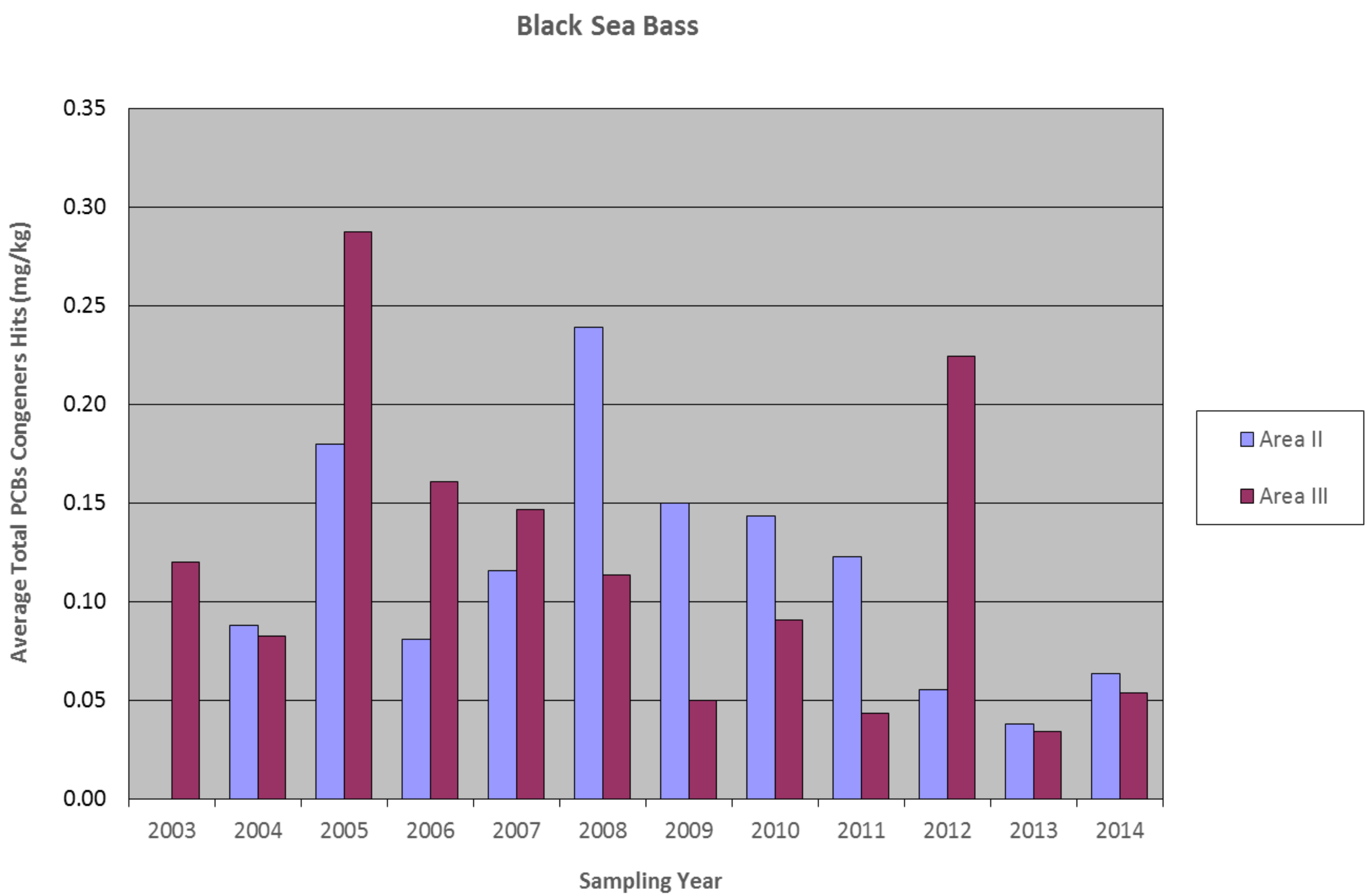
Sample Results, Calculated Cancer Budget and Exposure Values
Station: 46 Coffin Ave

Sample Station :	46 Coffin Ave
Collection Date:	12/15/2014
Measured PCB Concentration (ng/m^3):	2.7
Exposure Budget Expended During This Period:	5.9%
Cumulative Exposure Budget Expended to Date:	16.1%
Response Level:	No Triggers Identified
Response:	No Response Necessary

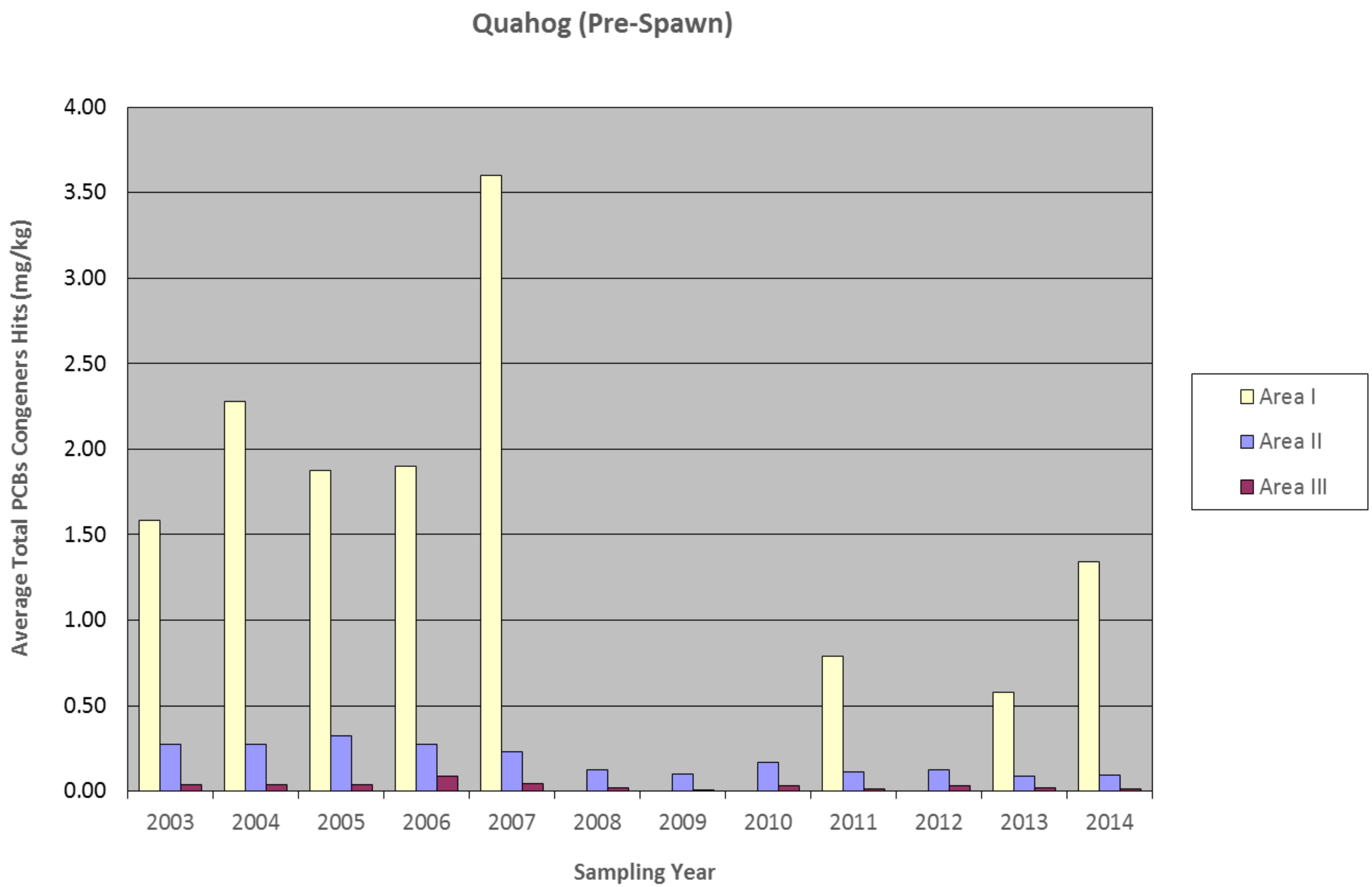




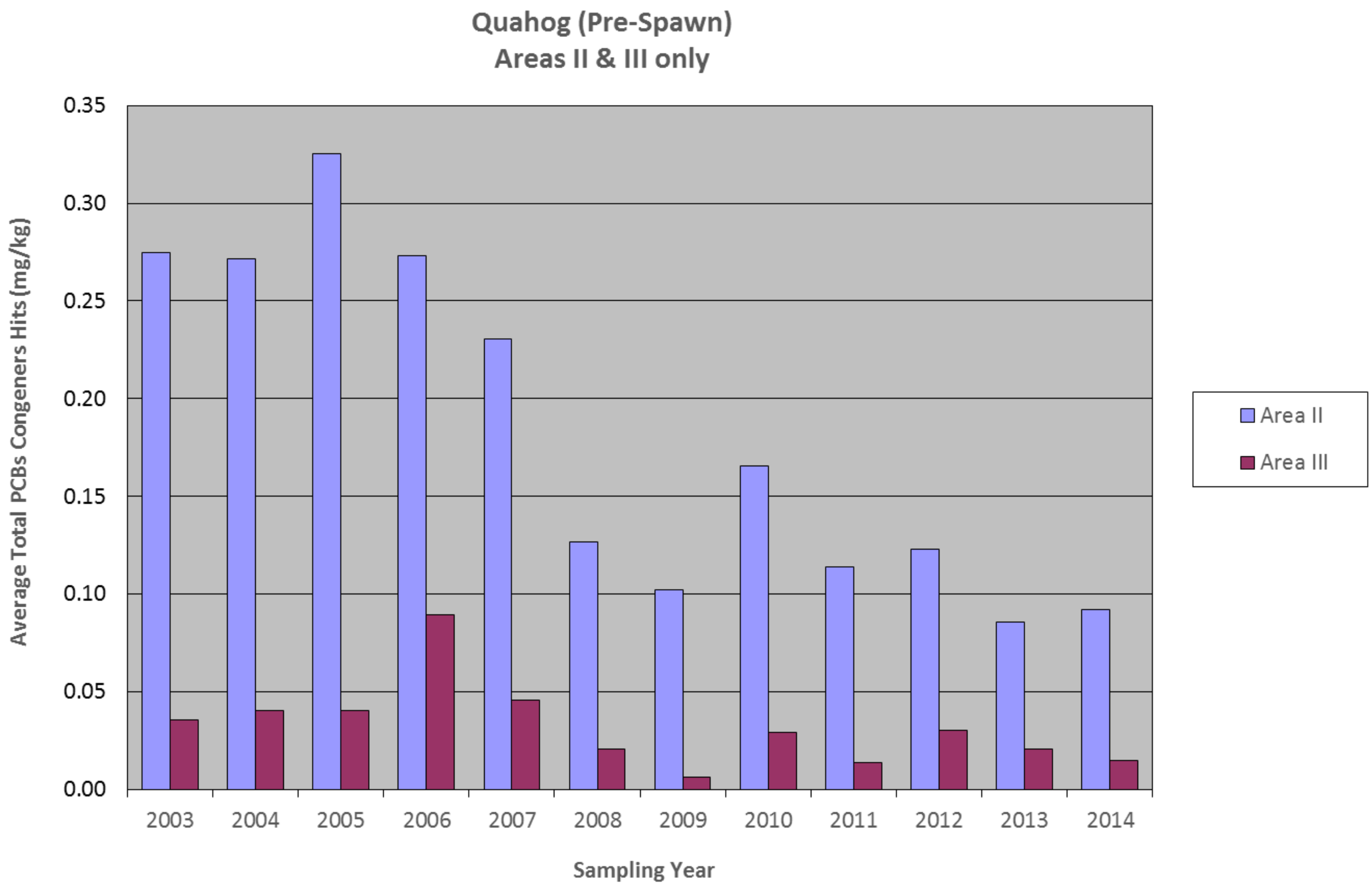
Note: Scup was not sampled in Area 1.



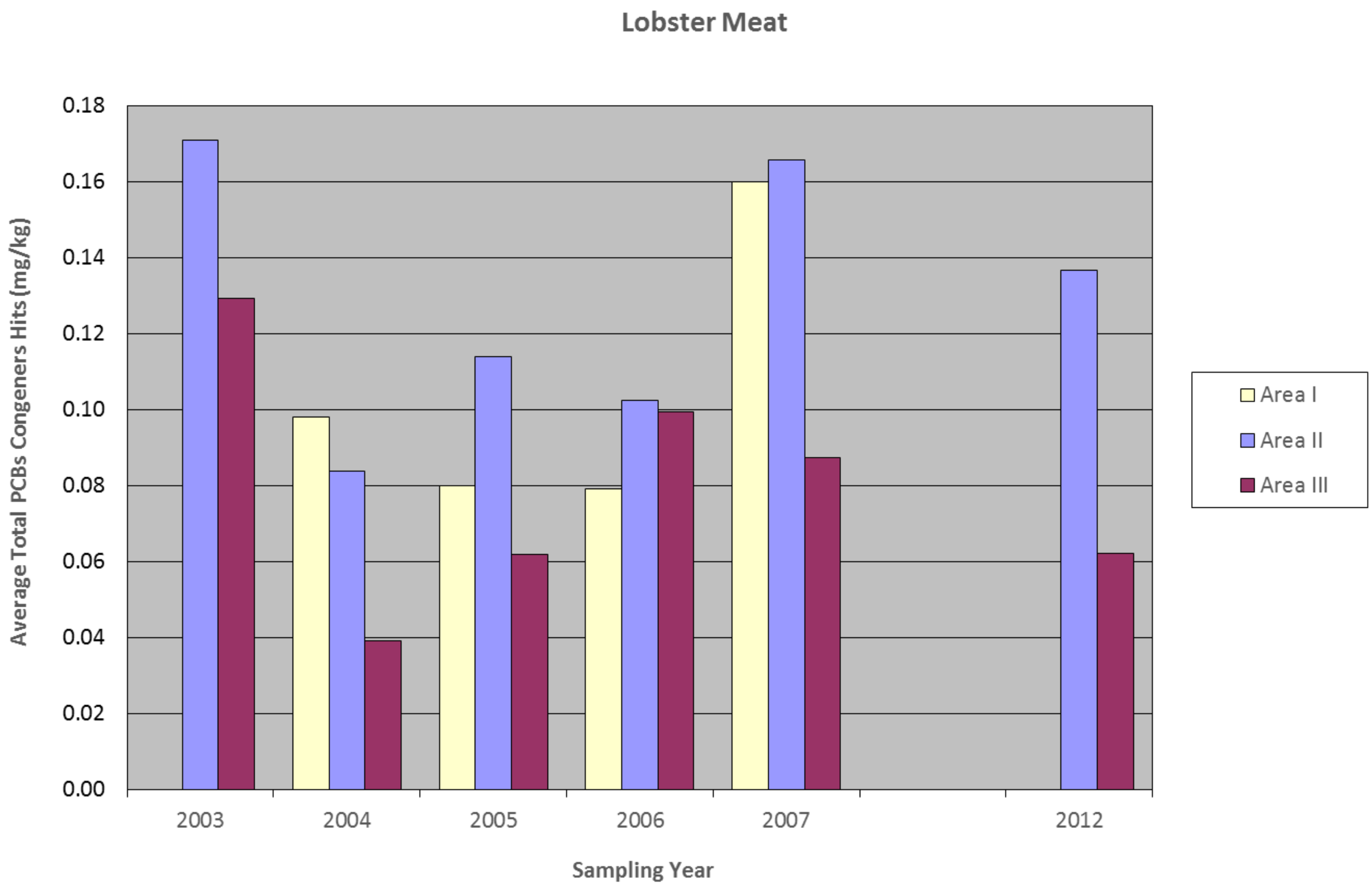
Note: Black Sea Bass was not sampled in Area 1.



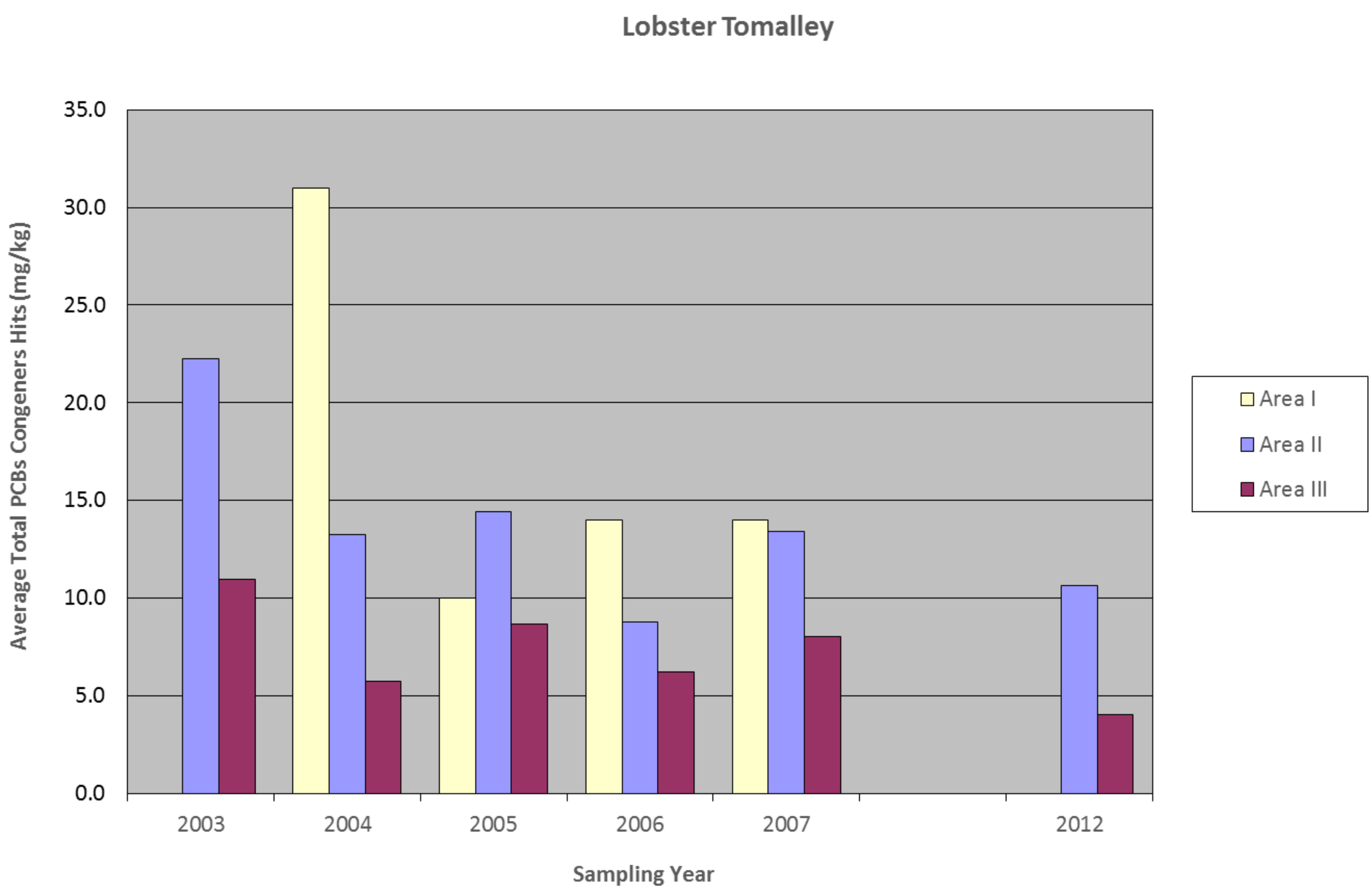
Note: Quahog samples were not taken in 2008-2010 or 2012 in Area 1.



Quahog (Pre-Spawn)
Areas II & III only
Average Total PCBs Congeners Hits (mg/kg)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Sampling Year
Area II
Area III

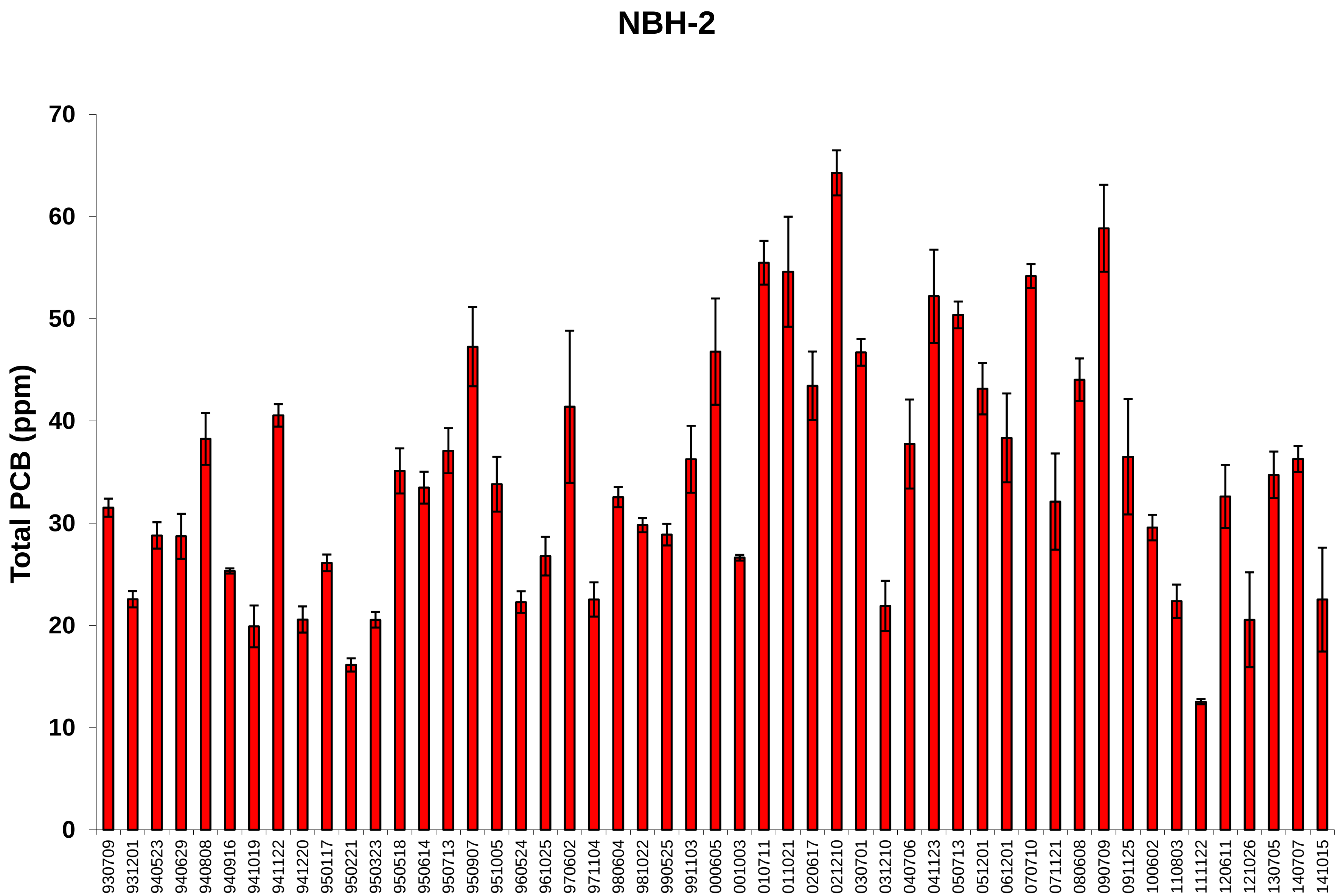


Note: Lobster samples were not taken in 2003 or 2012 in Area 1. Lobster samples were not taken 2008-2011 or after 2012.



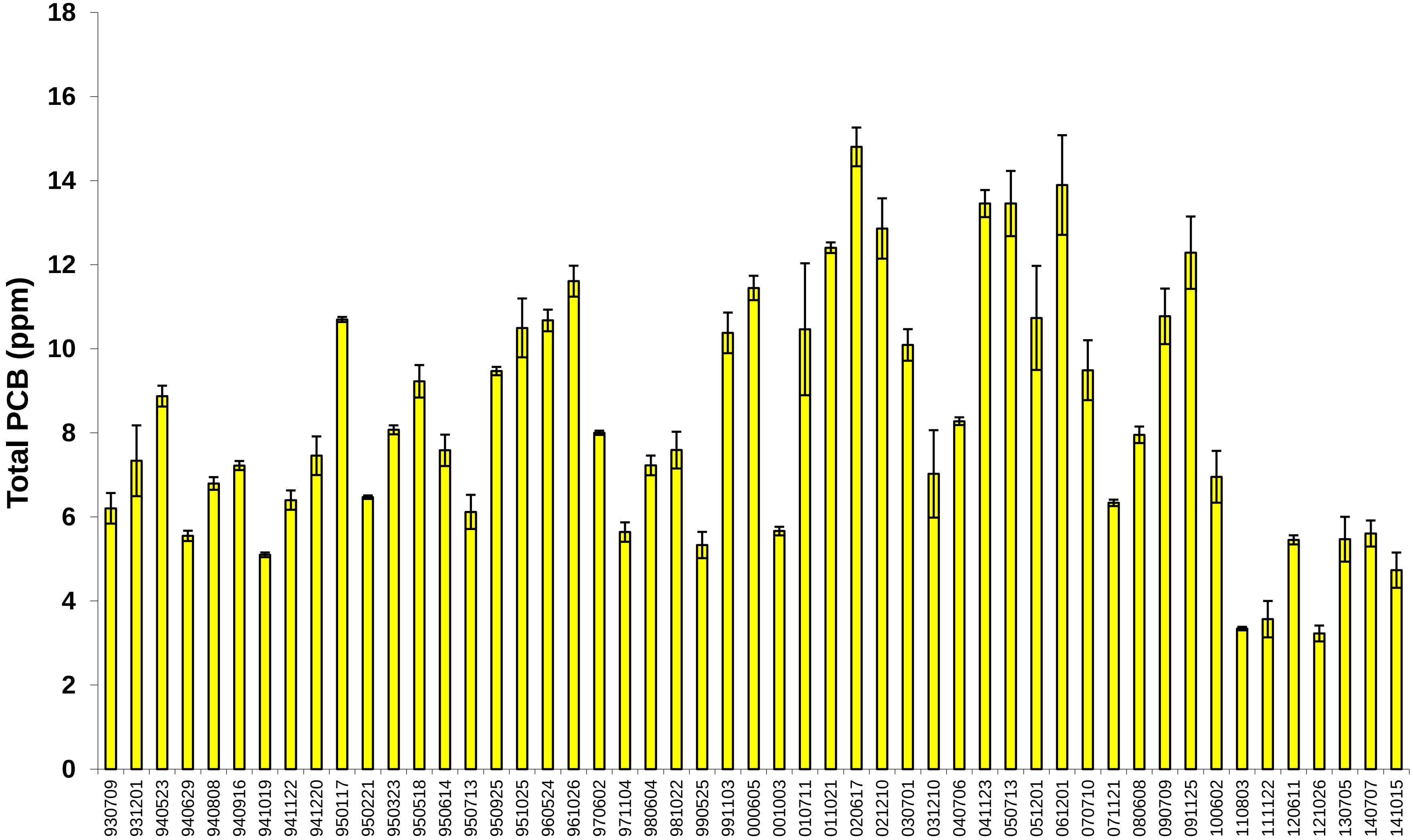
Note: Lobster samples were not taken in 2003 or 2012 in Area 1. Lobster samples were not taken 2008-2011 or after 2012.

7 - BLUE MUSSEL PCB BIOACCUMULATION DATA

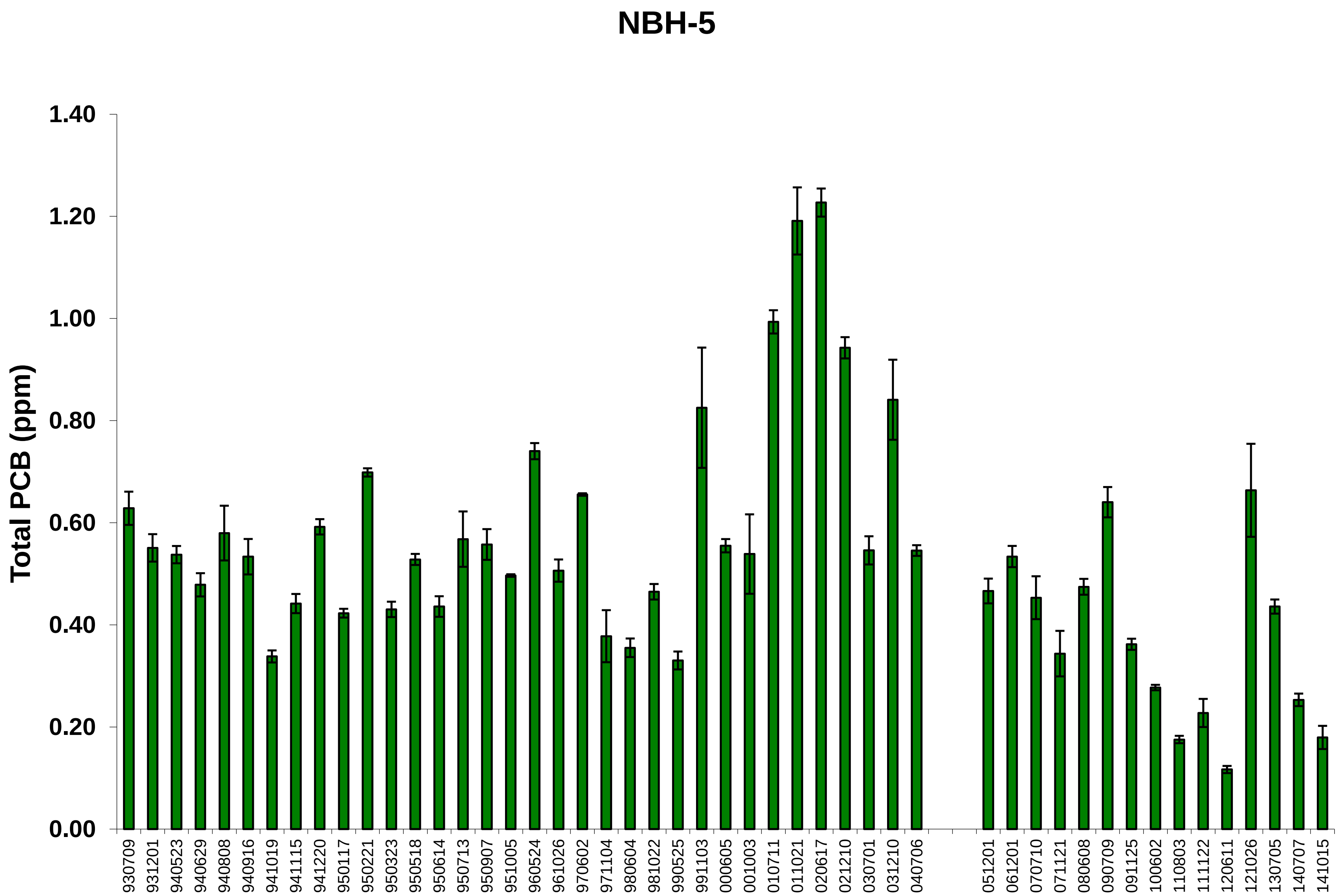


NBH-2
Total PCB (ppm)
0
10
20
30
40
50
60
70
930709
931201
940523
940629
940808
940916
941019
941122
941220
950117
950221
950323
950518
950614
950713
950907
951005
960524
961025
970602
971104
980604
981022
990525
991103
000605
001003
010711
011021
020617
021210
030701
031210
040706
041123
050713
051201
061201
070710
071121
080608
090709
091125
100602
110803
111122
120611
121026
130705
140707
141015

NBH-4

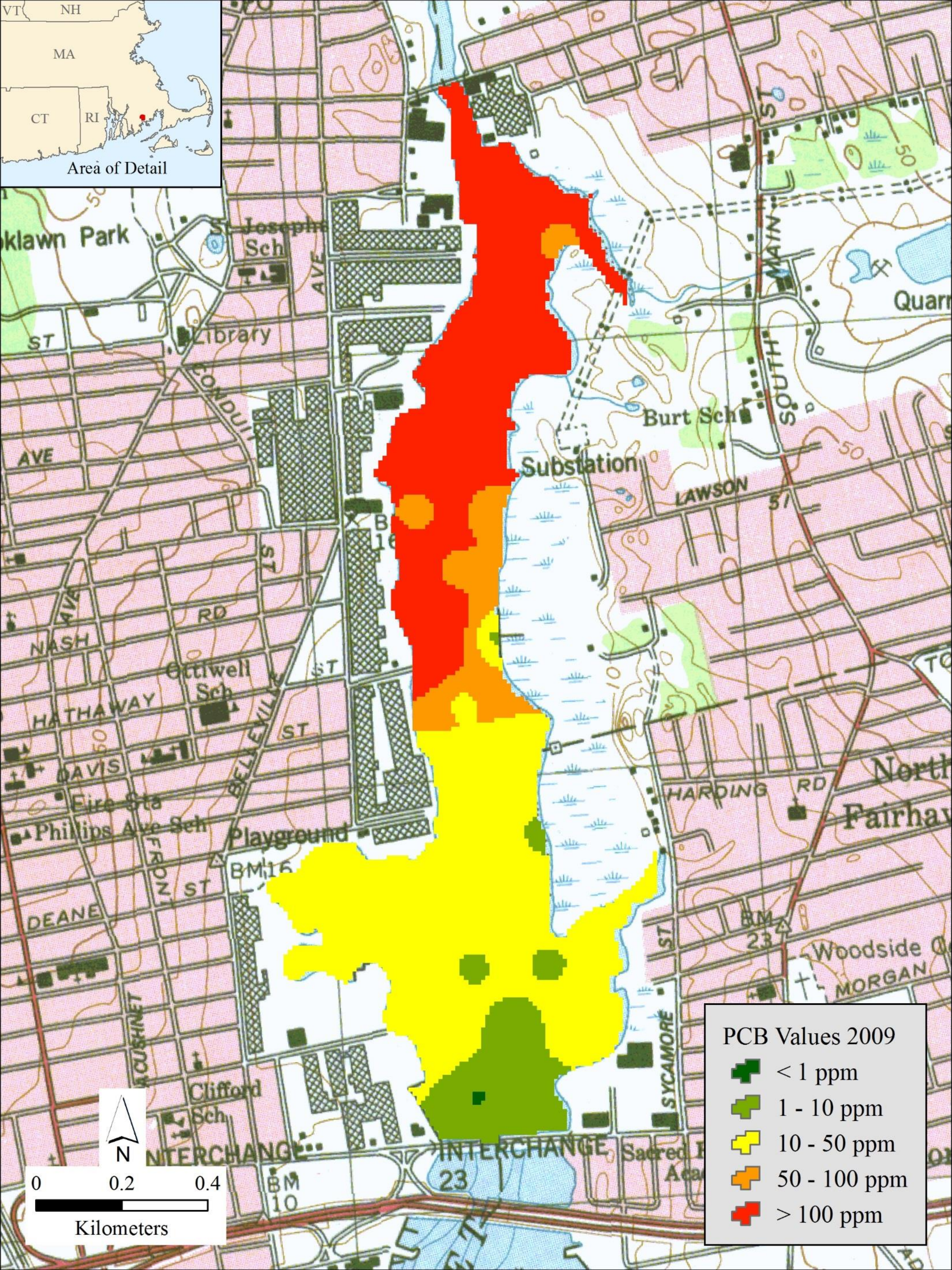


Total PCB (ppm)
0
2
4
6
8
10
12
14
16
18
930709
931201
940523
940629
940808
940916
941019
941122
941220
950117
950221
950323
950518
950614
950713
950925
951025
960524
961026
970602
971104
980604
981022
990525
991103
000605
001003
010711
011021
020617
021210
030701
031210
040706
041123
050713
051201
061201
070710
071121
080608
090709
091125
100602
110803
111122
120611
121026
130705
140707
141015

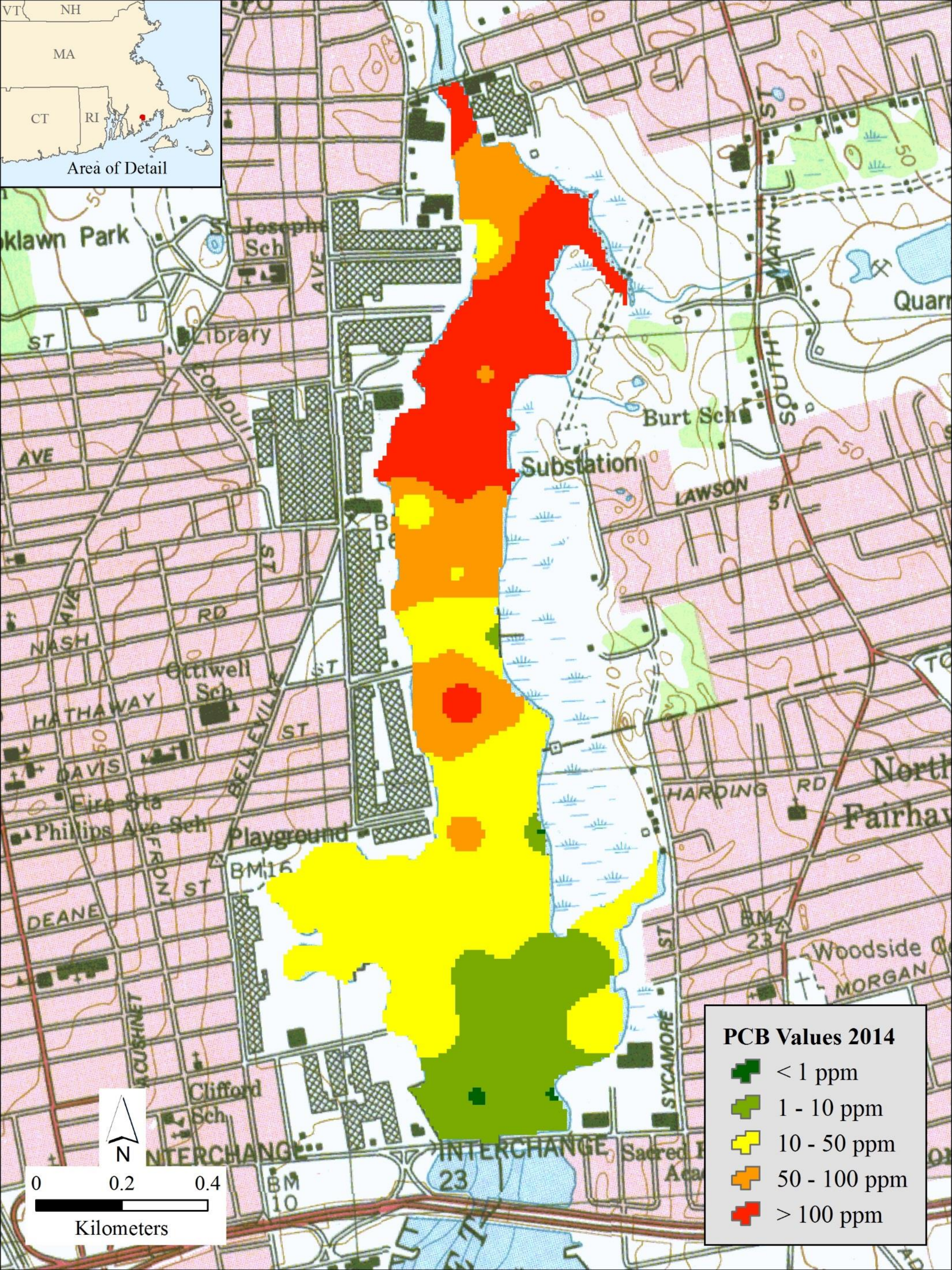

NBH-5
Total PCB (ppm)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
930709
931201
940523
940629
940808
940916
941019
941115
941220
950117
950221
950323
950518
950614
950713
950907
951005
960524
961026
970602
971104
980604
981022
990525
991103
000605
001003
010711
011021
020617
021210
030701
031210
040706
051201
061201
070710
071121
080608
090709
091125
100602
110803
111122
120611
121026
130705
140707
141015

8 - LTM DATA

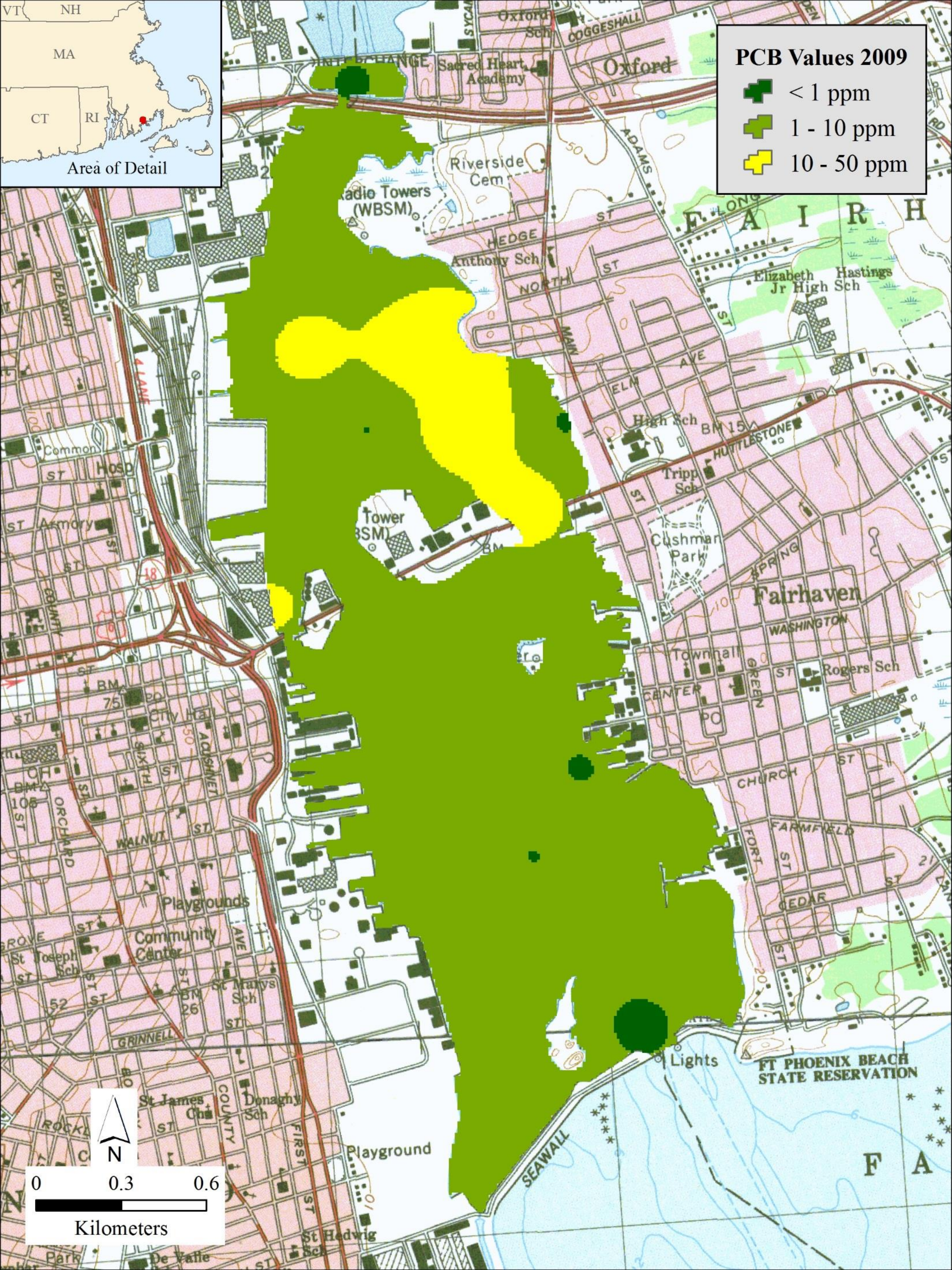
- PCB LEVELS IN TOP 2 CM OF SEDIMENT OVER TIME
- BENTHIC COMMUNITY INDICES OVER TIME



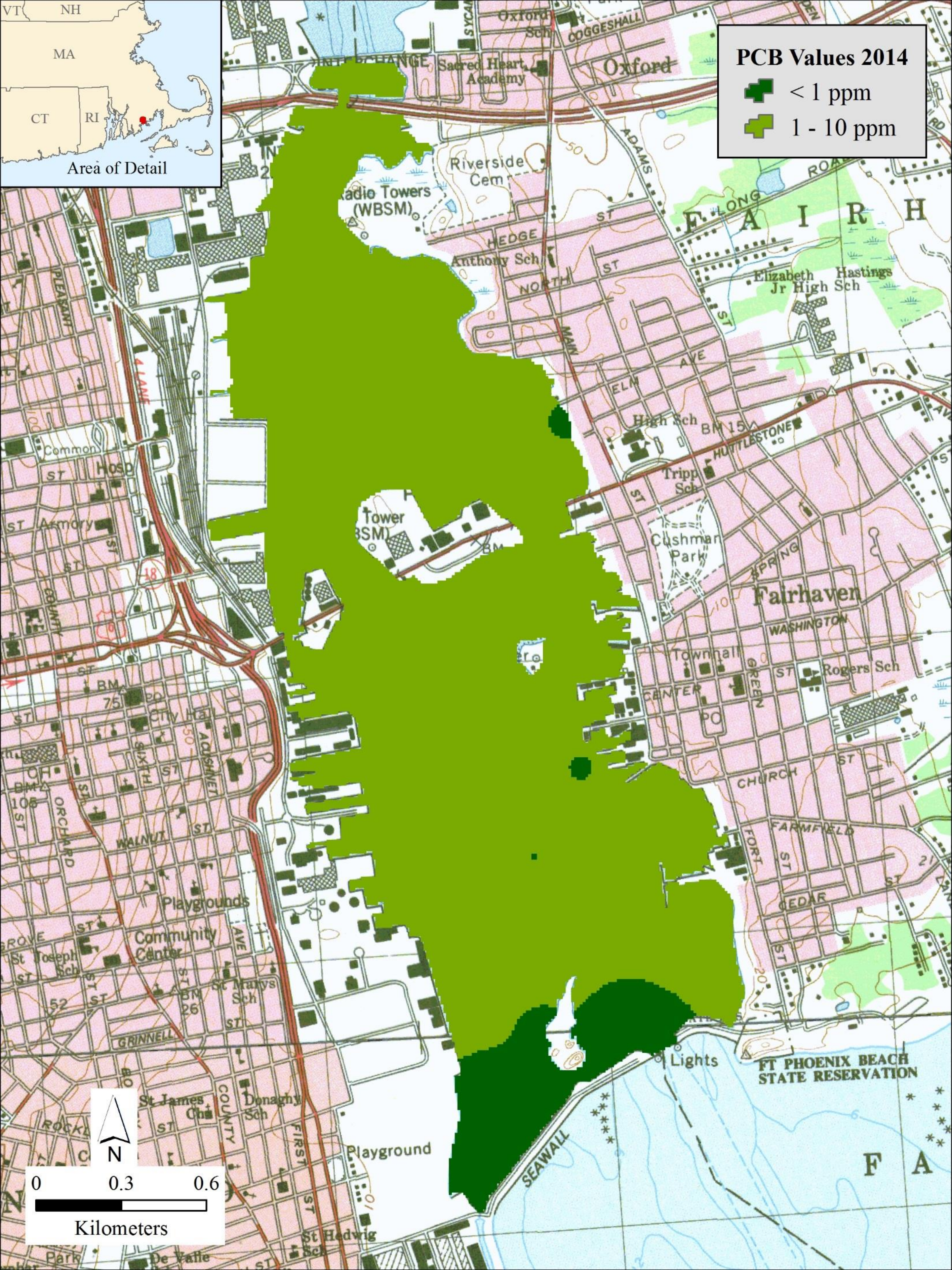
VT
NH
MA
CT
RI
Area of Detail
PCB Values 2009
< 1 ppm
1 - 10 ppm
10 - 50 ppm
50 - 100 ppm
> 100 ppm
N
0
0.2
0.4
Kilometers
Brooklawn Park
St Josephs Sch
Library
Substation
Burt Sch
Lawson
South Main St
Nash Rd
Ottiwell Sch
Hathaway St
Davis
Fire Sta
Phillips Ave Sch
Playground
Deane
Harding Rd
North Fairhaven
Woodside
Morgan
Sycamore
Clifford Sch
Interchange 23
Sacred

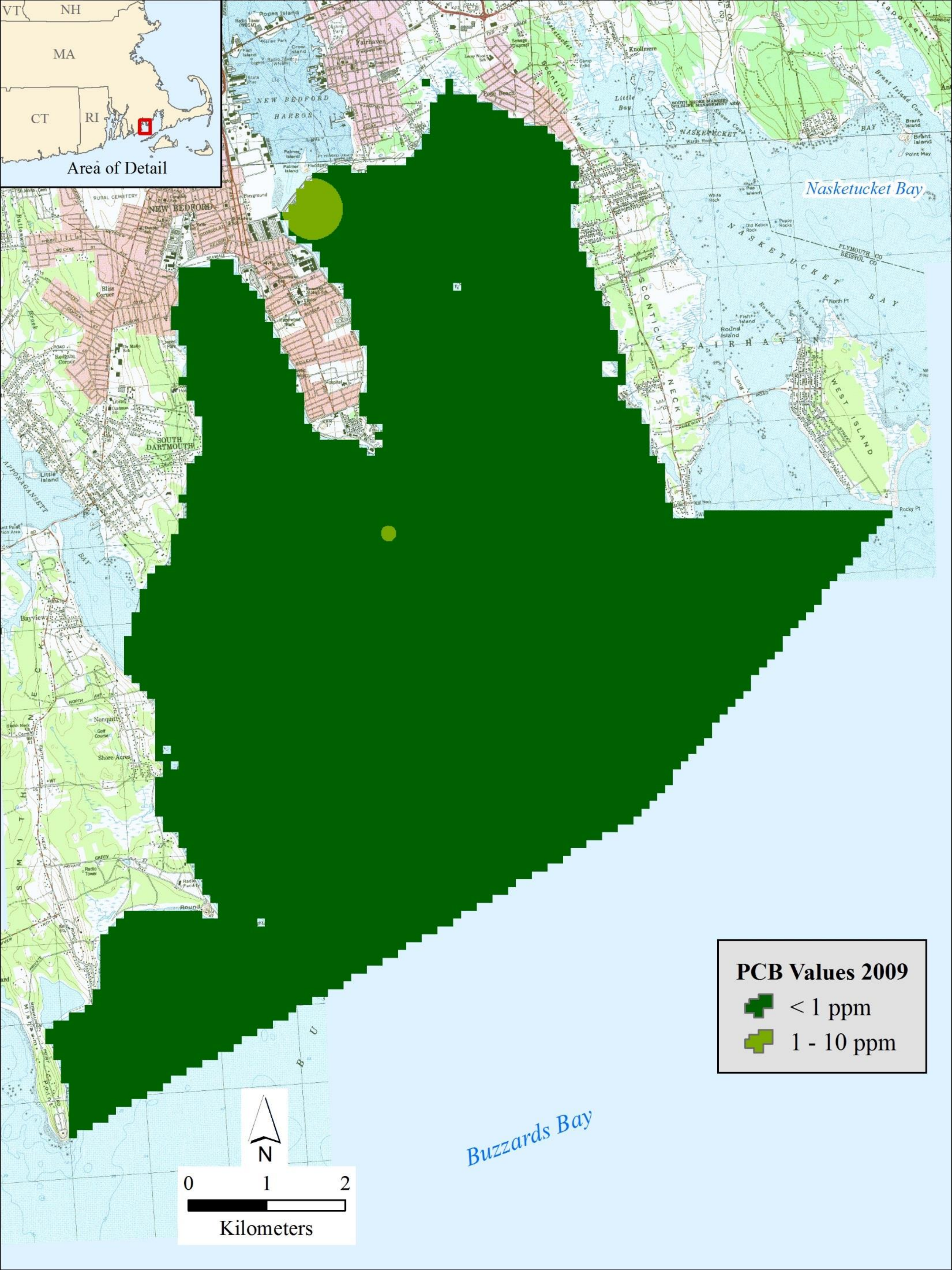


VT
NH
MA
CT
RI
Area of Detail
PCB Values 2014
< 1 ppm
1 - 10 ppm
10 - 50 ppm
50 - 100 ppm
> 100 ppm
N
0
0.2
0.4
Kilometers
Library
Substation
Burt Sch
Playground
Fire Sta
Phillips Ave Sch
Clifford Sch
INTERCHANGE 23
Woodside
North Fairhaven

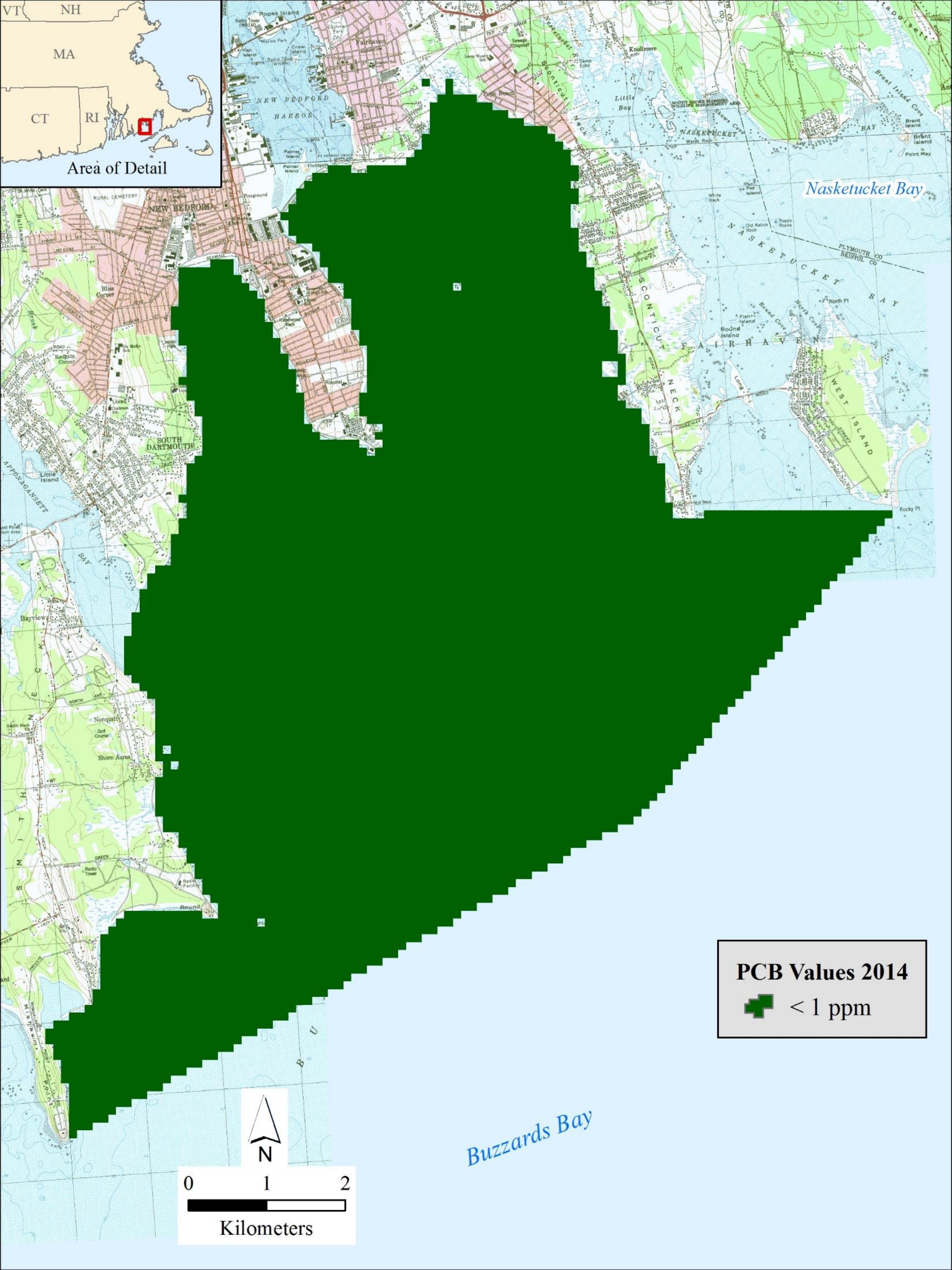


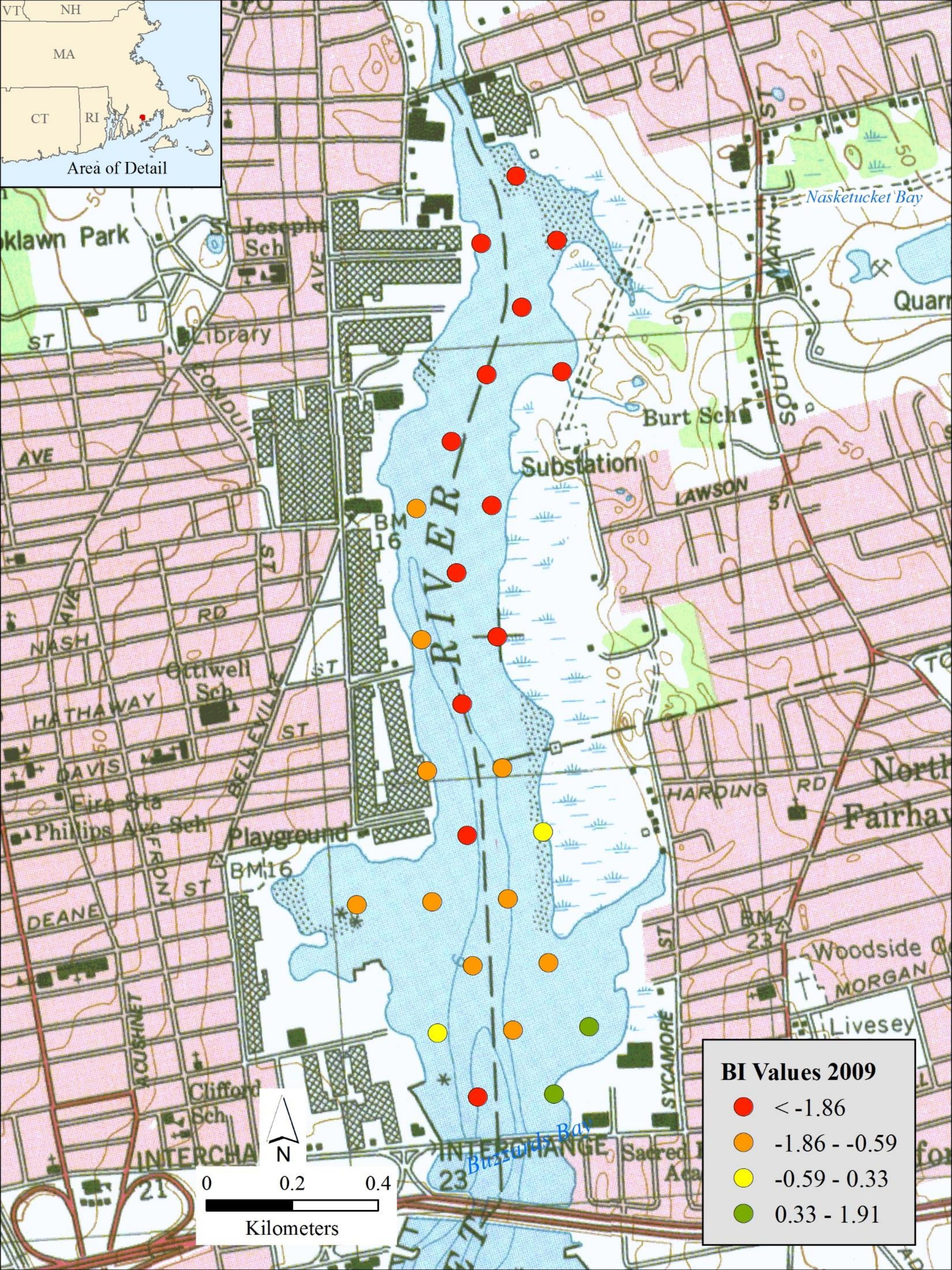
PCB Values 2009
< 1 ppm
1 - 10 ppm
10 - 50 ppm
VT
NH
MA
CT
RI
Area of Detail
N
0
0.3
0.6
Kilometers
Fairhaven
FT PHOENIX BEACH STATE RESERVATION

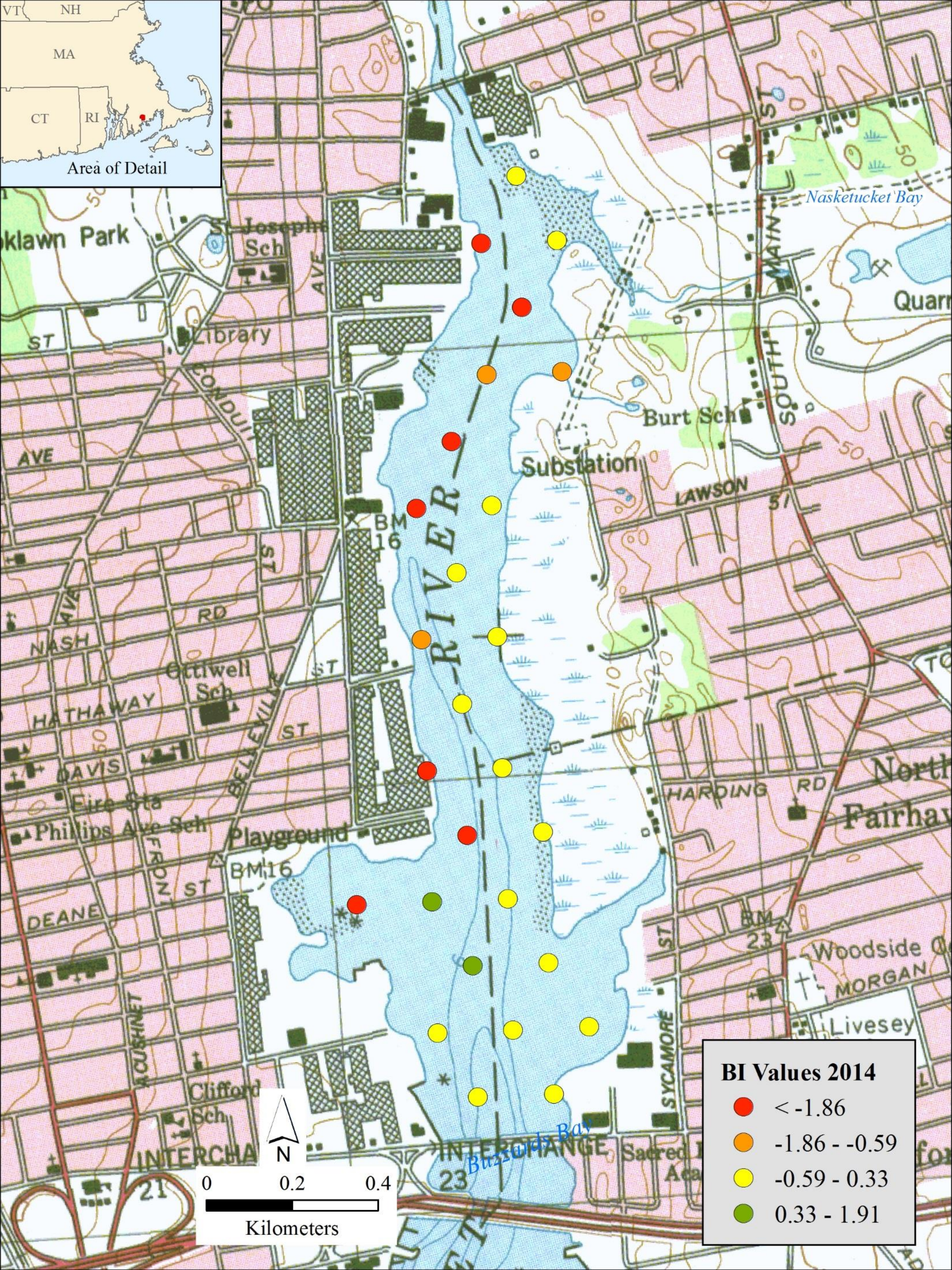

PCB Values 2014
< 1 ppm
1 - 10 ppm
VT
NH
MA
CT
RI
Area of Detail
N
0
0.3
0.6
Kilometers
Oxford
Sacred Heart Academy
Riverside Cem
Radio Towers (WBSM)
Anthony Sch
Elizabeth Hastings Jr High Sch
High Sch
Tripp Sch
Cushman Park
Fairhaven
Townhall
Rogers Sch
City Hall
Playgrounds
Community Center
St Joseph Sch
St Marys Sch
St James Ch
Donaghy Sch
Playground
St Hedwig Sch
Lights
FT PHOENIX BEACH STATE RESERVATION
SEAWALL

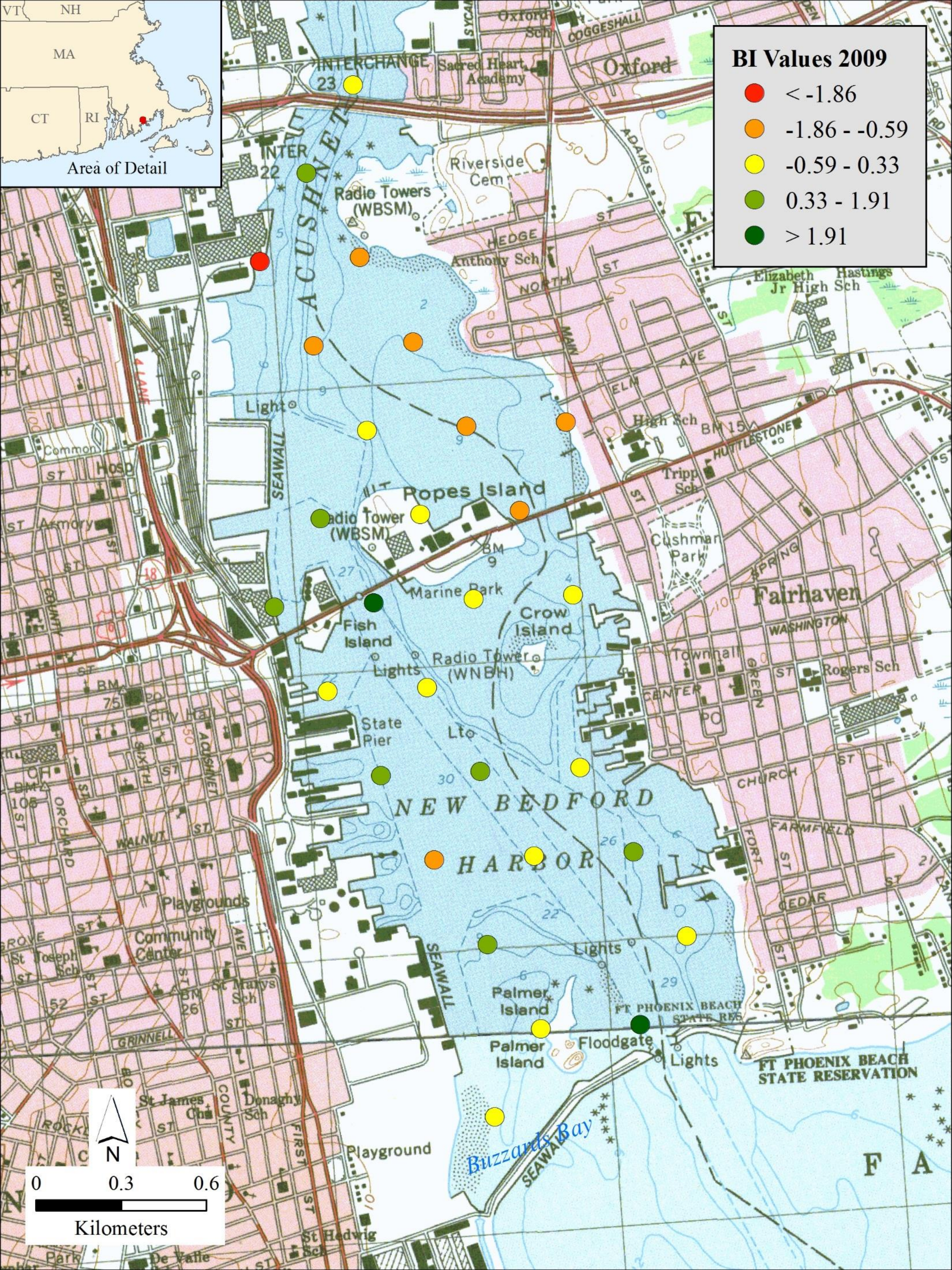


VT
NH
MA
CT
RI
Area of Detail
Nasketucket Bay
Buzzards Bay
PCB Values 2009
< 1 ppm
1 - 10 ppm
N
0
1
2
Kilometers

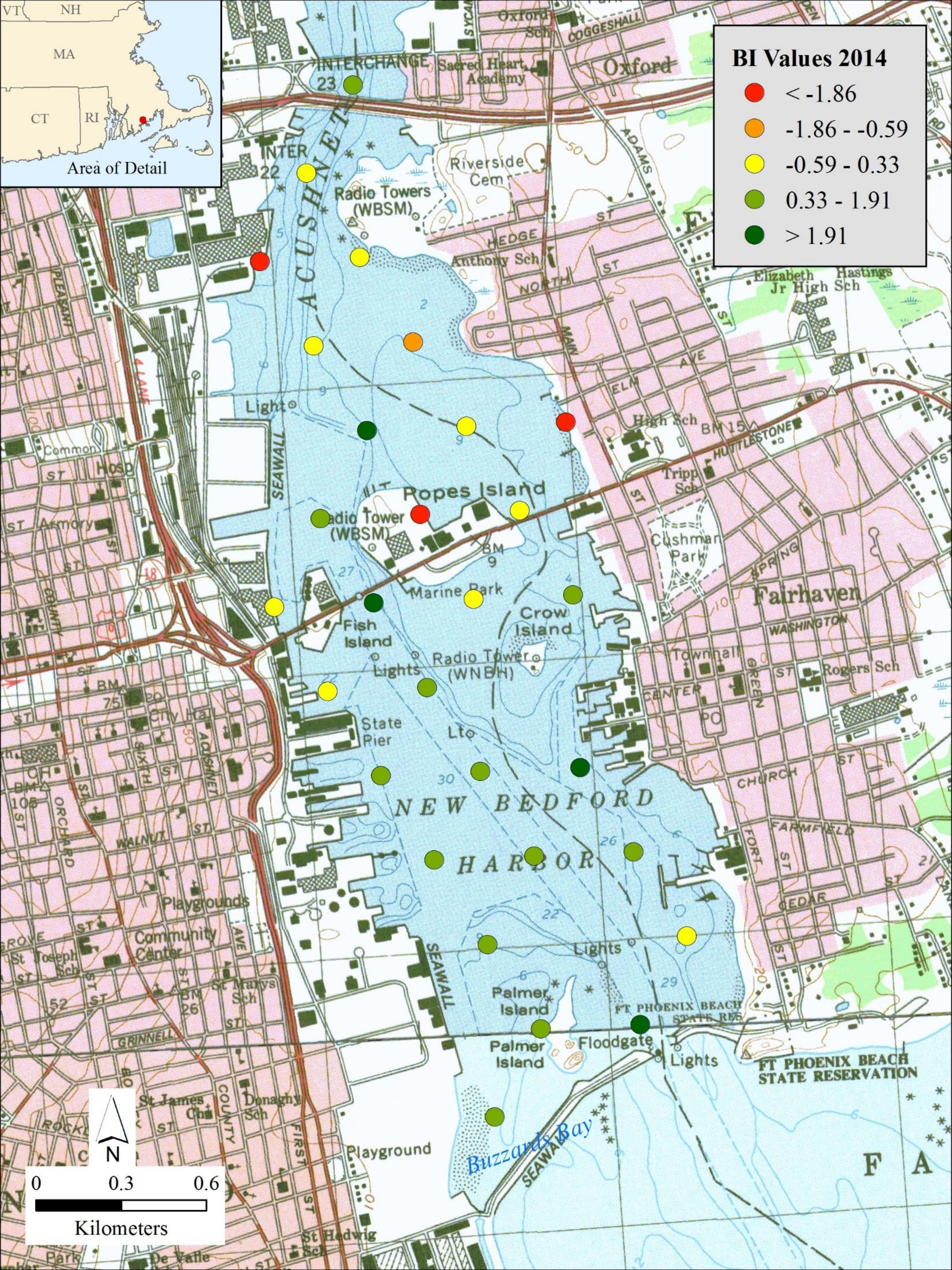

VT
NH
MA
CT
RI
Area of Detail
NEW BEDFORD
SOUTH DARTMOUTH
FAIRHAVEN
Nasketucket Bay
Buzzards Bay
PCB Values 2014
< 1 ppm
N
0
1
2
Kilometers


VT
NH
MA
CT
RI
Area of Detail
Nasketucket Bay
RIVER
Buzzards Bay
BI Values 2009
< -1.86
-1.86 - -0.59
-0.59 - 0.33
0.33 - 1.91
N
0
0.2
0.4
Kilometers
St Joseph Sch
Library
Substation
Burt Sch
Ottiwell Sch
Fire Sta
Phillips Ave Sch
Playground
Clifford Sch
Woodside
Livesey
North Fairhav

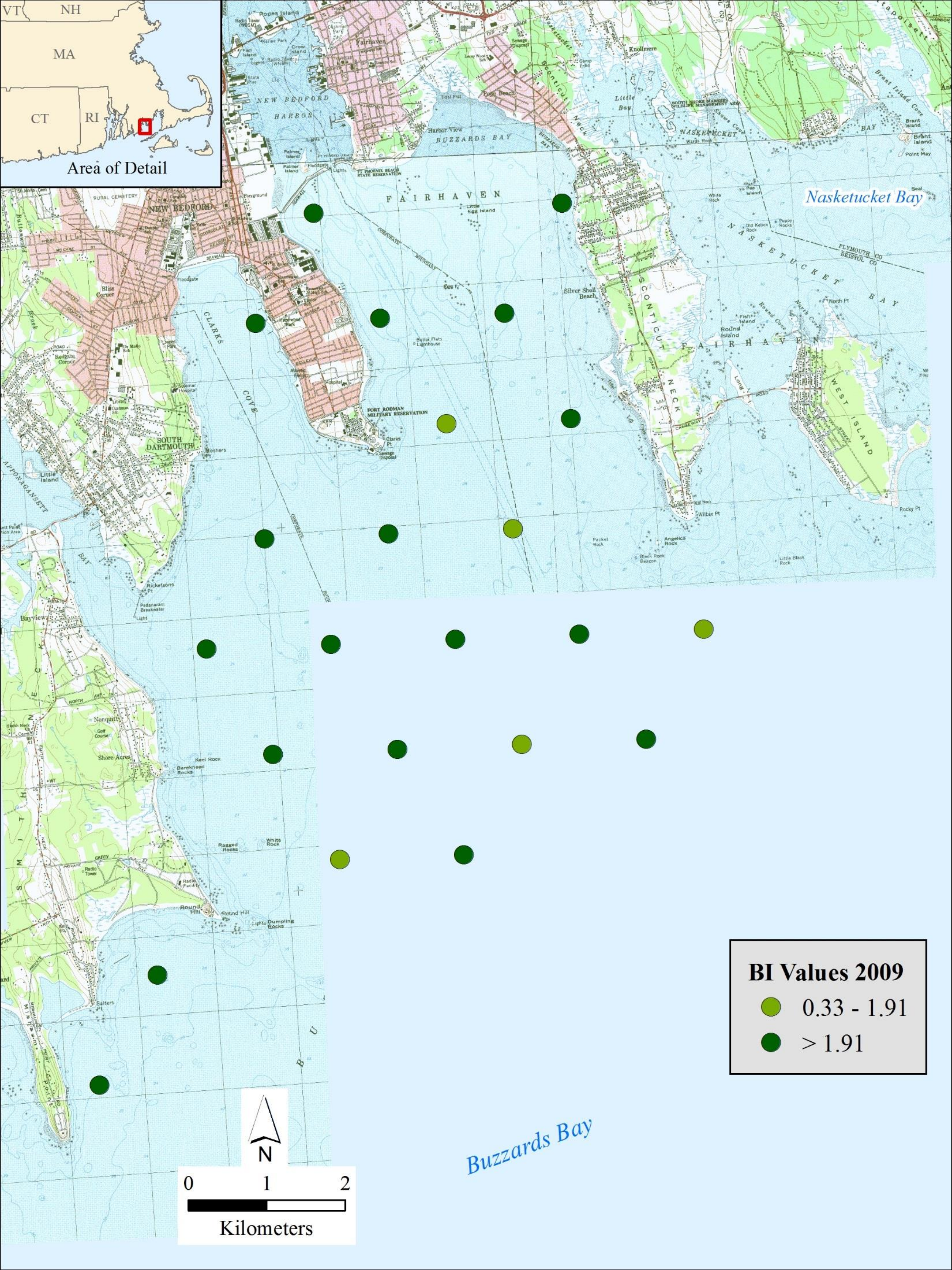

VT
NH
MA
CT
RI
Area of Detail
Nasketucket Bay
Buzzards Bay
BI Values 2014
< -1.86
-1.86 - -0.59
-0.59 - 0.33
0.33 - 1.91
N
0
0.2
0.4
Kilometers
RIVER
Library
Substation
Burt Sch
LAWSON ST
HARDING RD
Playground
Fire Sta
Phillips Ave Sch
Ottiwell Sch
Clifford Sch
Woodside
MORGAN
Livesey
INTERCHANGE 23
INTERCHANGE 21



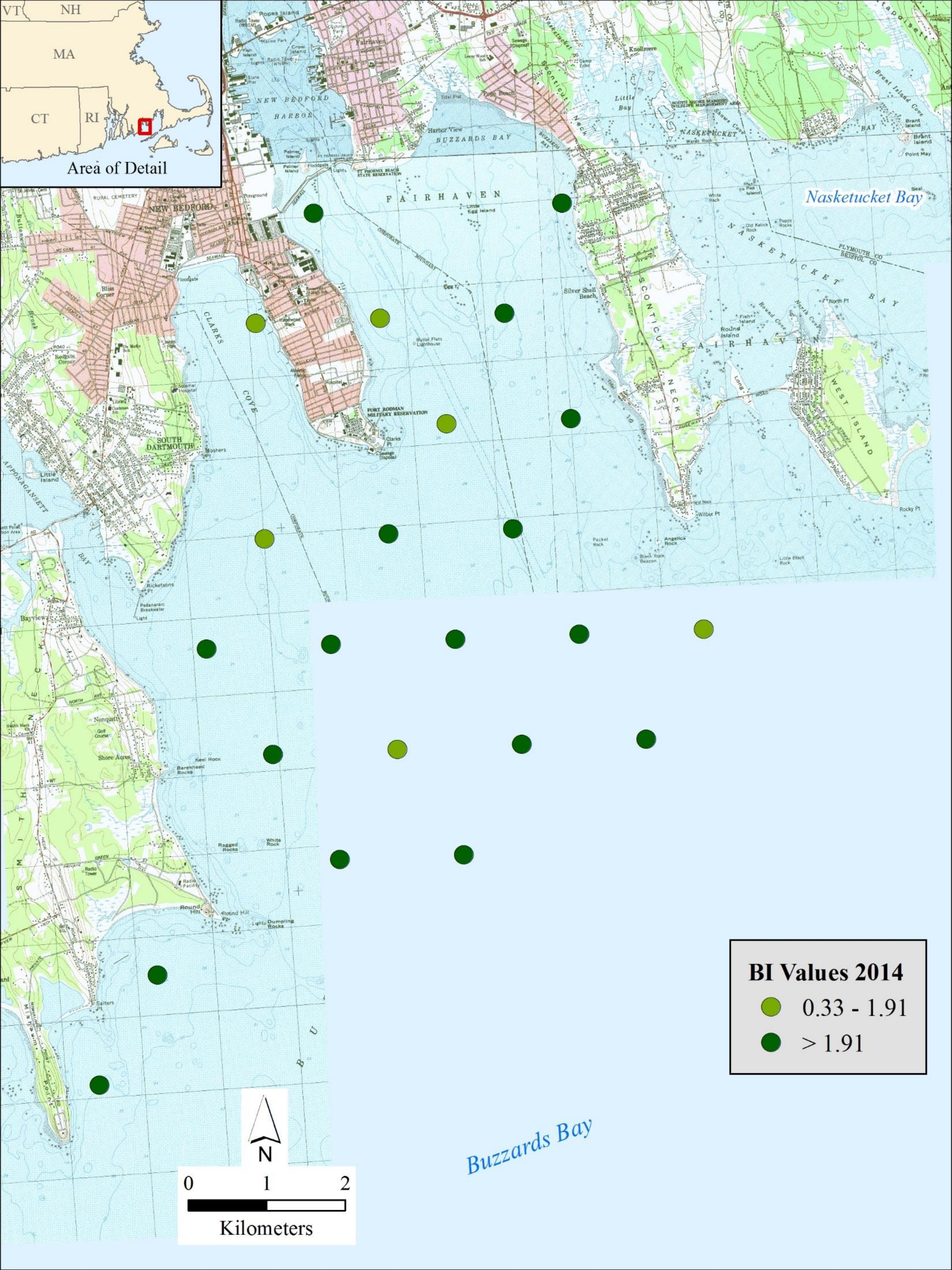
BI Values 2009
< -1.86
-1.86 - -0.59
-0.59 - 0.33
0.33 - 1.91
> 1.91
VT
NH
MA
CT
RI
Area of Detail
0
0.3
0.6
Kilometers
N
ACUSHNET
NEW BEDFORD
HARBOR
Popes Island
Fish Island
Crow Island
Palmer Island
State Pier
Marine Park
Fairhaven
Oxford
Buzzards Bay
Floodgate
FT PHOENIX BEACH STATE RESERVATION
Riverside Cem
Radio Towers (WBSM)
Radio Tower (WBSM)
Radio Tower (WNBH)
Cushman Park
SEAWALL



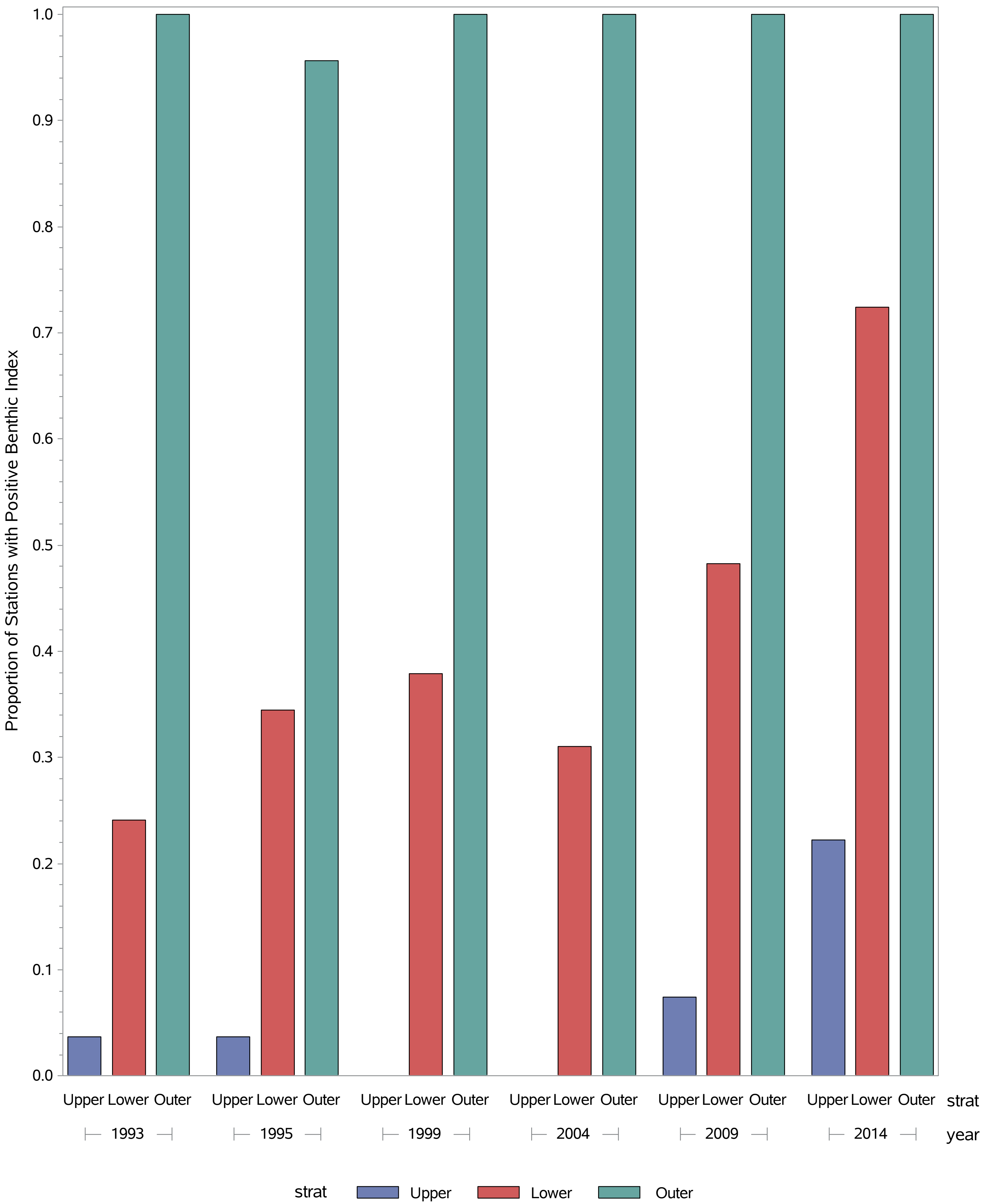
BI Values 2014
< -1.86
-1.86 - -0.59
-0.59 - 0.33
0.33 - 1.91
> 1.91
VT
NH
MA
CT
RI
Area of Detail
0
0.3
0.6
Kilometers
N
ACUSHNET
Popes Island
Fish Island
Crow Island
NEW BEDFORD
HARBOR
Palmer Island
Fairhaven
Oxford
Buzzards Bay
FT PHOENIX BEACH STATE RESERVATION
Floodgate
SEAWALL
Marine Park
State Pier
Radio Tower (WNBH)
Radio Towers (WBSM)
Riverside Cem
Cushman Park



VT
NH
MA
CT
RI
Area of Detail
Nasketucket Bay
Buzzards Bay
BI Values 2009
0.33 - 1.91
> 1.91
N
0
1
2
Kilometers



VT
NH
MA
CT
RI
Area of Detail
NEW BEDFORD HARBOR
FAIRHAVEN
NEW BEDFORD
SOUTH DARTMOUTH
CLARKS COVE
Nasketucket Bay
NASKETUCKET BAY
SCONTICUT NECK
WEST ISLAND
FORT RODMAN MILITARY RESERVATION
Buzzards Bay
BI Values 2014
0.33 - 1.91
> 1.91
N
0
1
2
Kilometers


Proportion of Stations with Positive Benthic Index
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Upper Lower Outer
1993
1995
1999
2004
2009
2014
strat
year
strat Upper Lower Outer

9 - Maps of Signage Locations for Upper, Lower and Outer Harbor

Signage
New Bedford Harbor
-Upper Harbor-

Sign Type

- No Fishing
- Proposed New No-Fishing Sign Locations
- Catch & Release
- PCB Contaminated Sediment
- Kiosk Location

N
W E
S

0 0.1 0.2 0.3 0.4 0.5 Miles

EPA

Signage
New Bedford Harbor
-Lower Harbor-

Sign Type

- No Fishing
- Proposed New No-Fishing Sign Locations
- Catch & Release
- PCB Contaminated Sediment
- Kiosk Location

N
W E
S

0 0.1 0.2 0.3 0.4 0.5 Miles

EPA

Signage
New Bedford Harbor
-Outer Harbor-

Sign Type

- No Fishing
- Proposed New No-Fishing Sign Locations
- Catch & Release
- PCB Contaminated Sediment
- Kiosk Location

N
W E
S

0 0.1 0.2 0.3 0.4 0.5 Miles

EPA

New Bedford Harbor
Sign Locations

LOCATION	SIGN TYPE	CONDITION	INSPECTION DATE	ACTION	DATE
1	No Fishing	Bad	May 26,2015	Replaced	June 17,2015
2	No Fishing	Bad	May 26,2015	Replaced	June 17,2015
3	No Fishing	Good	May 26,2015		
4	No Fishing	Good	May 26,2015		
5	No Fishing	Good	May 26,2015		
6	No Fishing	Need Pole & Sign	May 26,2015	Replaced	June 17,2015
7	No Fishing	Good	May 26,2015		
8	No Fishing	Good	May 26,2015		
9	No Fishing	Missing	May 26,2015	Replaced	June 17,2015
10	PCB Contaminant Beyond Point	Good	May 26,2015		
11	No Fishing	Good	May 26,2015		
12	PCB Sediment Beyond Fence	Good	May 26,2015		
13	PCB Sediment Beyond Fence	Good	May 26,2015		
14	No Trespassing	Good	May 26,2015		
15	No Fishing/ PCB	Good	May 26,2015		
16	PCB Contaminant	Good	May 26,2015		
17	No Fishing and PCB Beyond Fence	Good	May 26,2015		
18	No Fishing	Needs New Post & Sign	May 26,2015	Replaced Post	June 17,2015
21	No Fishing	Bad	May 26,2015	Replaced	June 17,2015
22	No Fishing	Bad	May 26,2015	Replaced	June 17,2015
23	No Fishing	Bad	May 26,2015	Replaced	June 17,2015
24	No Fishing	Bad	May 26,2015	Replaced	June 17,2015
26	No Fishing	Good	May 26,2015		

New Bedford Harbor
Sign Locations

LOCATION	SIGN TYPE	CONDITION	INSPECTION DATE	ACTION	DATE
27	Warning PCB Sediment	Good	May 26,2015		
28	No Fishing	Good	May 26,2015		
29	No Fishing	Missing	May 26,2015	Bridge Construction can not replace	June 17,2015
30	No Fishing	Missing	May 26,2015	Same as 29	June 17,2015
31	No Fishing	Construction	May 26,2015	Same as 29	June 17,2015
32	No Fishing	Construction	May 26,2015	Same as 29	June 17,2015
33	No Fishing	Missing	May 26,2015	Replaced	June 17,2015
34	Catch and Release	Good	May 26,2015		
35	Catch and Release	Good	May 26,2015		
36	No Fishing	Good	May 26,2015		
37	No Fishing	Good	May 26,2015		
38	No Fishing	Good	May 26,2015		
39	No Fishing	Good	May 26,2015		
40	No Fishing	Good	May 26,2015		
42	No Fishing	Good	May 26,2015		
43	No Fishing	Good	May 26,2015		
44	Catch and Release	Good	May 26,2015		
45	Missing	Missing	May 26,2015	Replaced	June 17,2015
46	Catch and Release	Good	May 26,2015		
47	Catch and Release	Missing	May 26,2015	Replaced	June 17,2015
48	Catch and Release	Good	May 26,2015		
49	Catch and Release	Missing	May 26,2015	Replaced	June 17,2015
50	Catch and Release	Good	May 26,2015		
51	Catch and Release	Bad	May 26,2015	Replaced	June 17,2015
52	Catch and Release	Good	May 26,2015		

New Bedford Harbor
Sign Locations

LOCATION	SIGN TYPE	CONDITION	INSPECTION DATE	ACTION	DATE
53	Catch and Release	Good	May 26,2015		
54	Catch and Release	Missing	May 26,2015	Replaced	June 17,2015
55	Catch and Release	Good	May 26,2015		
56	Catch and Release	Good	May 26,2015		
57	Catch and Release	Good	May 26,2015		
58	Catch and Release	Bad	May 26,2015		
59	Catch and Release	Good	May 26,2015		
60	Catch and Release	Good	May 26,2015		
61	Catch and Release	Good	May 26,2015		
62	Catch and Release	Bad	May 26,2015		
63	Catch and Release	Missing	May 26,2015		

11 - OU3 Pilot Cap and State's Mitigation Cap Expansion Area

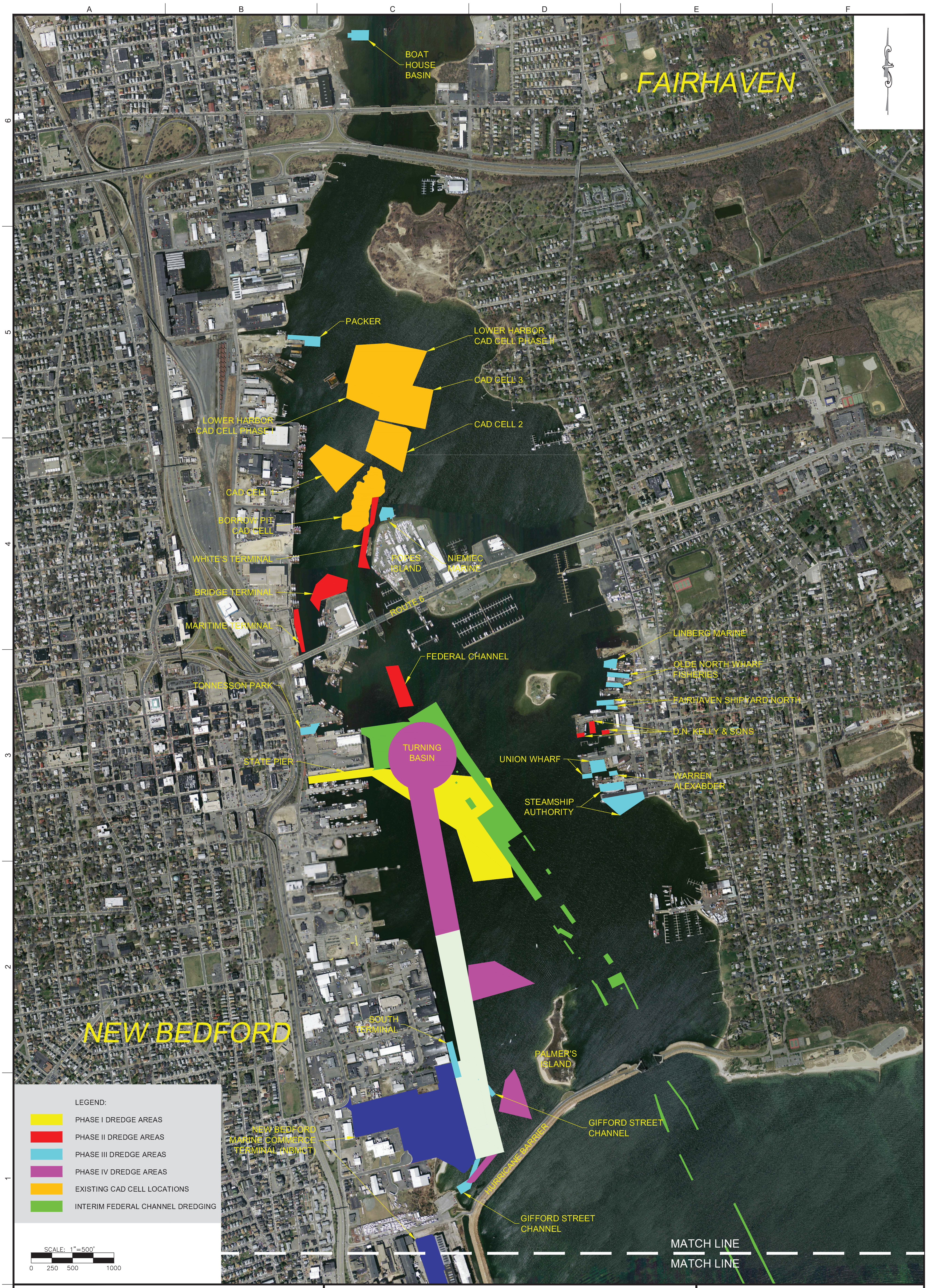
APPENDIX B.11
OU3 PILOT CAP AND STATE'S MITIGATION CAP EXPANSION AREA

12 - SUMMARY OF PLANNED AND/OR IMPLEMENTED ICS

Summary of Planned and/or Implemented ICs

Objective of IC	Form of IC	Status of IC
Prevent consumption of PCB-contaminated seafood above risk-based levels	MassDPH fishing restriction regulations.	Promulgated in 1979
	Establish site-specific seafood consumption advisories.	Completed
	Education and outreach	Ongoing
	Signage	Installed/Ongoing
Prevent dermal contact/incidental ingestion of PCB-contaminated sediments	Fencing	Installed/Ongoing
	Signage	Installed/Ongoing
	Land use controls on properties not remediated to unrestricted use.	Planned following completion of intertidal/shoreline remediation.
Maintain the protectiveness of the Pilot CDF cap (following cap construction)	Land use controls on the Pilot CDF property to restrict reuse of the area to passive recreational use and ensure that the integrity of the cap and the Pilot CDF's sidewalls are maintained for long term protectiveness.	Planned following completion of remedial dredging activities and construction of Pilot CDF cap.
Maintain the protectiveness of the OU3 Pilot Cap	Coordinate with the U.S. Coast Guard and the National Oceanic and Atmospheric Administration (NOAA) to establish a regulated navigation area that will prohibit activities that could disturb the seabed within the OU3 Cap area and also delineate the OU3 Cap footprint on marine navigational charts for the New Bedford Harbor area. These charts will note the anchorage restrictions for mariners in the harbor.	Completed
Maintain the protectiveness of the LHCC Cap (following cap installation)	Work with harbor stakeholders to develop guidelines for mooring and anchor designs that will ensure that the integrity of the cap is not damaged by moorings and anchors. Assist these stakeholders in developing and implementing regulations requiring that such mooring and anchor designs are used within the cap area.	Planned following completion of remedial dredging activities for the filling of the LHCC and construction/installation of the LHCC cap
	Coordinate with the U.S. Coast Guard and the National Oceanic and Atmospheric Administration (NOAA) to establish a regulated navigation area that will prohibit activities that could disturb the seabed within the LHCC and also delineate the LHCC footprint on marine navigational charts for the NBH area. These charts will note the anchorage restrictions for mariners in the harbor.	Planned following completion of remedial dredging activities for the filling of the LHCC and construction/installation of the LHCC cap

13 - Lower Harbor CAD Cells and SER Navigational Dredging



APEX

125 BROAD STREET, 5TH FLOOR
BOSTON, MASSACHUSETTS

OFFICES NATIONWIDE

NEW BEDFORD HARBOR

DREDGE AREAS TO DATE

CONTACT INFORMATION:

JAY BORKLAND

JOHN CROWTHER

(P) 617 728-0070

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APEX

125 BROAD STREET, 5TH FLOOR
BOSTON, MASSACHUSETTS

OFFICES NATIONWIDE

NEW BEDFORD HARBOR

DREDGE AREAS TO DATE

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APPENDIX C – PUBLIC NOTICE/OUTREACH AND FYR INTERVIEWS

PUBLIC NOTIFICATION

INTERVIEWS/QUESTIONNAIRES

SEPTEMBER 2015 UPDATED SEAFOOD CONSUMPTION ADVISORY

EPA New England News Release
Protecting Human Health and the Environment
www.epa.gov/region1/news

News Release

U.S. Environmental Protection Agency
New England Regional Office
January 5, 2015

Contact: Emily Bender, 617-918-1037

EPA Will Review 24 Hazardous Site Cleanups during 2015

Boston, Mass.– EPA will review site clean ups and remedies at 20 Superfund Sites and oversee reviews at 4 Federal Facilities across New England this year by doing scheduled Five-Year Reviews at each site.

EPA conducts evaluations every five years on previously-completed clean up and remediation work performed at Superfund sites and Federal Facilities listed on the "National Priorities List" (aka Superfund sites) to determine whether the implemented remedies at the sites continue to be protective of human health and the environment. Further, five year review evaluations identify any deficiencies to the previous work and, if called for, recommend action(s) necessary to address them.

The Superfund Sites where EPA will begin Five Year Reviews in FY' 2015 (October 1, 2014 through September 30, 2015) are below. Please note, the Web link provided after each site provides detailed information on the site status and past assessment and cleanup activity. The web link also provides contact information for the EPA Project Manager and Community Involvement Coordinator at each site. Community members and local officials are invited to contact EPA with any comments or current concerns about a Superfund Site or about the conclusions of the previous Five Year Review.

The Superfund Sites at which EPA is performing Five Year Reviews over the following several months include the following sites.

Connecticut
Durham Meadows, Durham
http://www.epa.gov/region1/superfund/sites/durham

Old Southington Landfill, Southington
http://www.epa.gov/region1/superfund/sites/oldsouthington

Raymark Industries, Stratford
http://www.epa.gov/region1/superfund/sites/raymark

Solvents Recovery Services of New England, Southington
http://www.epa.gov/region1/superfund/sites/srs

Maine

Brunswick Naval Air Station (Federal Facility), Brunswick
http://www.epa.gov/region1/superfund/sites/brunswick

Callahan Mining Corp., Brooksville
http://www.epa.gov/region1/superfund/sites/callahan

Eastland Woolen Mill, Corinna
http://www.epa.gov/region1/superfund/sites/eastland

Loring Air Force Base (Federal Facility), Limestone
http://www.epa.gov/region1/superfund/sites/loring

Pinette's Salvage Yard, Washburn
http://www.epa.gov/region1/superfund/sites/pinette

Saco Municipal Landfill, Saco
http://www.epa.gov/region1/superfund/sites/sacolandfill

Massachusetts

Atlas Tack Corp., Fairhaven
http://www.epa.gov/region1/superfund/sites/atlas

Cannon Engineering Corp., Bridgewater
http://www.epa.gov/region1/superfund/sites/cannon

Charles-George Reclamation Trust Landfill, Tyngsborough
http://www.epa.gov/region1/superfund/sites/charlesgeorge

Fort Devens (Federal Facility), Ayer, Harvard, Lancaster & Shirley
http://www.epa.gov/region1/superfund/sites/devens

Groveland Wells No. 1 & 2 Site, Groveland
http://www.epa.gov/region1/superfund/sites/groveland

Materials Technology Laboratory (US ARMY, Federal Facility), Watertown
http://www.epa.gov/region1/superfund/sites/amtl

New Bedford Harbor, New Bedford
www.epa.gov/nbh

PSC Resources, Palmer
http://www.epa.gov/region1/superfund/sites/psc

New Hampshire

Somersworth Sanitary Landfill, Somersworth
http://www.epa.gov/region1/superfund/sites/somersworth

South Municipal Water Supply Well (Five Year Review Addendum), Peterborough
http://www.epa.gov/region1/superfund/sites/southmuni

Troy Mills Landfill, Troy
http://www.epa.gov/region1/superfund/sites/troymills

Rhode Island

Stamina Mills Inc., North Smithfield
http://www.epa.gov/region1/superfund/sites/stamina

West Kingston Town Dump/URI Disposal Area, South Kingstown
http://www.epa.gov/region1/superfund/sites/wkingston

Vermont

Burgess Brothers Landfill, Woodford and Bennington
http://www.epa.gov/region1/superfund/sites/burgess

Learn More about the Latest EPA News & Events in New England
(http://www.epa.gov/region1/newsevents/index.html)

Follow EPA New England on Twitter (http://twitter.com/epanewengland)

Connect with EPA New England on Facebook (https://www.facebook.com/EPARegion1)

INTERVIEW RECORD

Site Name: New Bedford Harbor		**EPA ID No.:** MAD980731335	
Subject: 2015 Five Year Review - State and Local Considerations		**Time:** 1030	**Date:** 6/2/15
Type: ☐ Telephone ☒ E-mail ☐ Other ☐ Visit **Location of Visit:**		☐ Incoming ☐ Outgoing	

Contact Made By:

Name:	**Title:**	**Organization:** EPA

Individual Contacted:

Name: Joseph Coyne	**Title:** Environmental Engineer	**Organization:** MassDEP

Telephone No: 617-348-4066 **Fax No:** 617-292-5530	**Street Address:** 1 Winter Street **City, State, Zip:** Boston, Ma 02108
E-Mail Address: Joseph.Coyne@state.ma.us	

Summary of Conversation

1. What is your overall impression of the project? (general sentiment)

Overall I am satisfied with how the project is progressing and how EPA, the Corps and the private contractor have been able to solve the unique and difficult problems that have arisen in a site as large and complicated as this.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

MassDEP is a partner with EPA in the cleanup of the harbor and therefore our office remains in close contact with EPA regarding the site and we participate in site visits, inspections and other reporting activities.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

Yes there have been various complaints regarding the use of CAD Cells, the timing of the clean-up, the amount of PCBs that will remain at the site, the frequency and extent of sampling, and the total amount from AVX settlement.

4. Do you feel well informed about the site's activities and progress?

For the most part, yes.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

The site management and operations are being done at a very high level.

INTERVIEW RECORD

Site Name: New Bedford Harbor	**EPA ID No.:** MAD980731335
Subject: 2015 Five Year Review - State and Local Considerations	**Time:** 7/17/15 **Date:**
Type: ☐ Telephone ☒ E-mail ☐ Other ☐ Visit **Location of Visit:**	☐ Incoming ☐ Outgoing

Contact Made By:

Name:	**Title:**	**Organization:** EPA

Individual Contacted:

Name: Michele Paul	**Title:** Director, Env. Stewardship	**Organization:** City of New Bedford

Telephone No: 508-979-1487	**Street Address:** 133 William Street, Rm 304
Fax No:	**City, State, Zip:** New Bedford, MA 02740
E-Mail Address: michele.paul@newbedford.ma-gov	

Summary of Conversation

1. What is your overall impression of the project? (general sentiment)

Until the AVX settlement greatly compressed the project timeframe, I sincerely doubted that the overall condition of the harbor could be positively affected at the former pace of cleanup. The EPA has responded to the opportunity provided by the settlement with a comensurate increase in resources. Ginny Lombardo's work as the harbor program team leader has greatly enhanced coordination and communication and Ginny has informed the City about funding opportunities enabling the City to carry out associated work at a local level. The City has numerous projects in the planning stages for the future of the harbor which rely on close coordination with Ginny and her Harbor Team.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

Our office does not perform inspections or reporting activities, but we do keep up to date so that we can inform the public when we are asked. We participate in EPA-facilitated public outreach events to demonstrate the partnership between the City and EPA.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

There have not been any complaints or violations. When we have received questions from the public that we were not able to answer, we have passed those questions along to Ginny and the team. The Harbor Team is extremely responsive - making site visits immediately if that is what is required to address and issues.

4. Do you feel well informed about the site's activities and progress?

Absolutely - Ginny keep our department informed of site progress and schedule on regular basis and calls, emails, or sets up meetings with any significant items of note as they occur.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

From my perspective, I could not be more pleased with the coordination and cooperation of the Harbor Team. When I speak to the public about EPA's efforts, I do so with full confidence in the quality of the work, and the dedication of the Harbor Team.

INTERVIEW RECORD

Site Name: New Bedford Harbor		**EPA ID No.:** MAD980731335	
Subject: 2015 Five Year Review - State and Local Considerations		**Time:**	**Date:** 7/31/15
Type: ☐ Telephone ☒ E-mail ☐ Other ☐ Visit **Location of Visit:**		☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Kelsey O'Neil	**Title:** Community Involvement Coordinator	**Organization:** EPA

Individual Contacted:

Name: Edward Anthes-Washburn	**Title:** Acting Port Director	**Organization:** New Bedford Harbor Development Commission

Telephone No: 508-961-3000	**Street Address:** 52 Fishermans Wharf
Fax No:	**City, State, Zip:** New Bedford, MA 02740
E-Mail Address:	

Summary of Conversation

1. What is your overall impression of the project? (general sentiment)

The AVX settlement has provided a needed funding source and a welcome increase in the pace of the harbor clean up. The HDC appreciates the cooperation and collaboration of the EPA team with respect to all aspects of the project. As the clean up moves forward, one of the HDC's primary concerns is to continue to make effective use of the State Enhanced Remedy (SER) Process to increase port activity and provide for additional dredging while removing additional PCBs from the environment. Without the SER process, the port would not be able to maintain and deepen vital channels and berths. In the months and years ahead, we look forward to further use of the SER process for federal channel maintenance dredging, Phase V berth dredging, the design of additional bulkheads in the North terminal and construction of a new Route 6 bridge. As the Superfund clean up progresses, we look forward to EPA's cooperation in working with the HDC and City to develop a mechanism for the SER, or a similarly efficient process, to be available once the EPA harbor clean up is completed.

2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results.

HDC staff meets weekly with the EPA and Army Corps project team to review the progress of construction on the Lower Harbor CAD cell. These weekly meeting provide an excellent method to coordinate federal, state and city interests in the timely completion of CAD cell construction and other issues related to the harbor clean up. We appreciate the project teams' responsiveness to our requests for information and updates.

3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses.

Complaints and concerns regarding EPA operations have been expeditiously addressed by the EPA/Army Corps project team.

4. Do you feel well informed about the site's activities and progress?

Yes.

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

Public outreach efforts are well planned and executed - particularly the public meeting held in the Fairhaven Town Hall. One recommendation is to develop data and graphic handouts for the public as take aways from public meetings. Handouts could show work areas, pollution concentrations, etc. Handouts with key data and mapping would be welcomed by community members rather than a reference to a web page and could be used to inform and educate others.

Fish Consumption Regulations and Recommendations

Massachusetts Regulations / U.S. EPA Recommendations for Eating Fish, Shellfish and Lobster Caught in Three Fish Closure Areas Around New Bedford Harbor

UPDATED SEPTEMBER 2015

Closure Area 1

Inner Harbor: North of the hurricane barrier and Ft. Phoenix Beach State Reservation – Includes Palmer Island

If you catch…	Then…
Any shellfish, lobster, or fish, including bottom feeders	Do not eat it

Closure Area 2

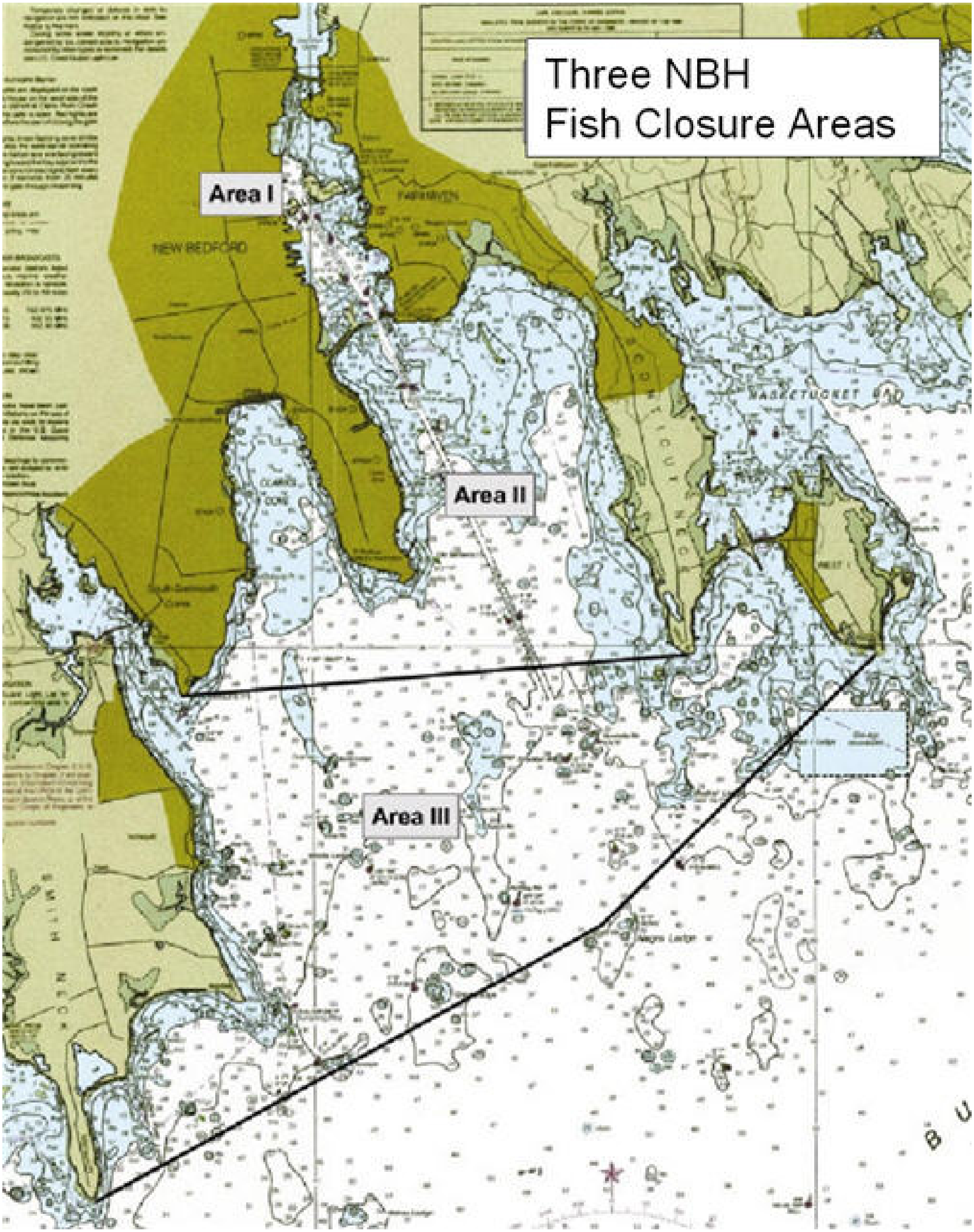
Outer Harbor: South of the hurricane barrier to Ricketsons Point and tip of Sconticut Neck (Wilbur Point) – Includes Clarks Cove

If you catch…	Then…
Fish:	
Black Sea Bass 	Eat no more than one meal per month
All bottom-feeding fish including:	
Eel 	Do not eat it
Flounder 	
Scup 	
Tautog 	
All other fish	U.S. EPA does not have adequate data so cannot make a recommendation
Lobster 	Do not eat it
Shellfish (clams, quahogs, mussels, conch, etc.)	Eat no more than one meal per month. Exception: Shellfish caught in Clarks Cove: East no more than one meal per week
Note: Pregnant women, nursing mothers, children under age 12, and women who may become pregnant should not eat fish, shellfish or lobster caught in Closure Area 2, except they can safely eat one, and only one, meal per month of shellfish caught in Clarks Cove.	

Closure Area 3

Buzzards Bay: South of Ricketsons Point and tip of Sconticut Neck (Wilbur Point) to Mishaum Point in Dartmouth and West Island South Point in Fairhaven – Includes area south of the West Island Causeway

If you catch…	Then…
Fish:	
Black Sea Bass 	Eat no more than one meal per month
All bottom-feeding fish including:	
Eel 	U.S. EPA does not have adequate data so cannot make a recommendation
Flounder 	U.S. EPA does not have adequate data so cannot make a recommendation
Scup 	Do not eat it
Tautog 	Eat no more than one meal per month
All other fish	U.S. EPA does not have adequate data so cannot make a recommendation
Lobster 	Do not eat it
Shellfish (clams, quahogs, mussels, conch, etc.)	There are no eating restrictions
Note: Pregnant women, nursing mothers, children under age 12, and women who may become pregnant should not eat fish or lobster caught in Closure Area 3. They can safely eat one, and only one, meal per month of shellfish caught in Area 3.	



Three NBH
Fish Closure Areas
Area I
NEW BEDFORD
Area II
Area III

APPENDIX D – RISK ASSESSMENT UPDATES

Dermal/Incidental Contact Risk Update Memo

Seafood Tissue Risk Update Memo

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

TECHNICAL MEMORANDUM

To: Ginny Lombardo
From: Richard Sugatt
Date: September 15, 2015
Subject: Updated risk evaluation of sediment cleanup goals for PCBs from the 1998 Record of Decision (ROD) for the New Bedford harbor Superfund Site, New Bedford, Massachusetts

The purpose of this technical memorandum is to evaluate whether the 1998 ROD cleanup goals for PCBs in shoreline sediments at the New Bedford Superfund Site remain protective. Shoreline sediment cleanup levels were calculated in Appendix B of the 1998 "Declaration for the Record of Decision New Bedford Harbor Superfund Site Upper and Lower Harbor Operable Unit New Bedford, Massachusetts".

The exposure assumptions for these calculations are presented in Table 1. The exposure equations are provided in a copy of Appendix B attached. The cleanup levels were calculated for non-cancer risk using the oral Reference Dose (RfD) for Aroclor 1254, which has not changed. In order to evaluate whether these cleanup levels remain protective for non-cancer effects, as well as cancer effects, the EPA Regional Screening Level (RSL) calculator (http://www.epa.gov/region9/superfund/prg/) was used to calculate concentrations of Aroclor 1254 for a Hazard Quotient (HQ) of 1 and an Incremental Lifetime Cancer Risk (ILCR) of 1×10^{-6} to 1×10^{-4} (also expressed as 1E-06 to 1E-04). The RSL calculator uses current (June, 2015) recommended exposure and toxicity factors.

The 1998 ROD derived cleanup levels for five shoreline areas (see Table 1). As detailed in Table 1, the receptor for three primarily non-residential areas was an older child age 7-18 years who contacted sediment for 20 or 32 days/year for 12 years, with a sediment ingestion rate of 100 mg/day. The fraction ingested from the site was assumed to be 0.5, and the oral absorption was assumed to be 100%. The fraction ingested is the fraction of total daily sediment ingestion that is from the Site as opposed to other areas. Dermal contact was assumed to occur over a skin surface area of 4380 cm^2, with a skin adherence factor of 0.61 mg/cm^2 and an oral to dermal absorption factor of 0.14. The PCB cleanup level for an HQ =1 was 25 mg/kg for the receptors with 32 day/year exposure frequency and 40 mg/kg for the receptors with 20 day/year exposure frequency.

Also as shown in Table 1, the receptor for two primarily residential areas was a young child age 0-6 years who contacted sediment for 150 days/year for 6 years, with a sediment ingestion rate of 200 mg/day. The fraction ingested from the site was assumed to be 1, and the oral absorption was assumed to be 100%. Dermal contact was assumed to occur over a skin surface area of 2900 cm^2, with a skin adherence factor of 1 mg/cm^2

and an oral to dermal absorption factor of 0.14. The PCB cleanup level for an HQ =1 was 1 mg/kg.

The risk-based concentrations (RBCs) calculated using the EPA RSL calculator are presented in Table 2 for comparable receptors. A copy of the calculator printout is attached. The printout contains all of the exposure factors used in the calculation. For the older child receptor with an exposure frequency of 20 days/year (with a 1998 cleanup level of 40 mg/kg), the 2015 RBC was 184 mg/kg for HQ = 1 and 159 mg/kg for ILCR = 1E-05. Since both 2015 RBCs are higher than the 1998 cleanup level, it is concluded that the 1998 ROD cleanup level remains protective for both non-cancer and cancer risk.

For the older child receptor with an exposure frequency of 32 days/year (with a 1998 cleanup level of 25 mg/kg), the 2015 RBC was 115 mg/kg for HQ =1 and 27 mg/kg for ILCR = 1E-05. Since both 2015 RBCs are higher than the 1998 cleanup level, it is concluded that the 1998 ROD cleanup level remains protective for both non-cancer and cancer risk.

For the young child receptor with an exposure frequency of 150 days (with a 1998 cleanup level of 1 mg/kg), the 2015 RBC was 2.7 mg/kg for HQ = 1 and 5.8 mg/kg for ILCR = 1E-05. Since both 2015 RBCs are higher than the 1998 cleanup level, it is concluded that the 1998 ROD cleanup level remains protective.

As shown in Table 2, the 2015 non-cancer RBCs are higher (less stringent) than the 1998 cleanup levels for comparable receptors. The major differences in exposure factors between 1998 and 2015 are in the fraction ingested, skin adherence factor, and skin surface area. For the older child receptors, the 2015 non-cancer RBCs are about 5 times higher (less stringent) than the 1998 cleanup levels primarily because the skin adherence factor is now about ten times lower (0.07 mg/cm^2 in 2015 *vs* 0.61 mg/cm^2 in 1998), combined with a doubling of the fraction ingested from 0.5 in 1998 to 1 in 2015, and a slight decrease in skin surface area (2900 cm^2 in 1998 *vs* 2373 cm^2 in 2015). For the young child receptor, the 2015 non-cancer RBC is about 3 times higher (less stringent) than the 1998 cleanup level primarily because the skin adherence factor is now about five times lower (0.2 mg/cm^2 in 2015 *vs* 1 mg/cm^2 in 1998), combined with an increase in skin surface area (2900 cm^2 in 1998 *vs* 6032 cm^2 in 2015).

Table 1. Exposure and toxicity factors for sediment cleanup levels from 1998 Record of Decision

Exposure Scenario	Receptor Age (yr)	Oral Reference Dose (mg/kg-day)	Body Weight (kg)	Exposure Frequency (days/yr)	Exposure Duration (yr)	Non-Cancer Averaging Time (days)	Sediment Ingestion Rate (mg/day)	Fraction Ingested from Site (unitless)	Skin Surface Area (cm^2)	Skin Adherence Factor (mg/cm^2)	Oral to Dermal Absorption Factor (unitless)	Cleanup Level (for HQ =1) (mg/kg)
1	7-18	2.0E-05	47	32	12	4380	100	0.5	4380	0.61	0.14	25
2	7-18	2.0E-05	47	20	12	4380	100	0.5	4380	0.61	0.14	40
3	0-6	2.0E-05	15	150	6	2900	200	1	2900	1	0.14	1
4	7-18	2.0E-05	47	20	12	4380	100	0.5	4380	0.61	0.14	40
5	0-6	2.0E-05	15	150	6	2900	200	1	2900	1	0.14	1

Information from Appendix B "Record of Decision for the Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site, New Bedford, MA" EPA (1998)

HQ = Hazard Quotient

1 = Coffin St. cove, New Bedford, including Coffin St. playground, vacant waterfront property, hot spot CDF

2 = Industrial area north of Coffin St. playground continuing to Wood St. Bridge

3 = Houses just north of Wood St. Bridge, New Bedford

4 = South of Wood St. Bridge (Acushnet Side)

5 = Veranda St. inlet (Fairhaven)

Table 2. Comparison of 1998 ROD PCB Sediment Cleanup Levels with Updated 2015 PCB Risk-Based Concentrations (RBCs)

1998 ROD				2015 RBCs (mg/kg) for Aroclor 1254					
Exposure Scenario	Receptor Age (yr)	Exposure Frequency (days/yr)	Cleanup Level (mg/kg)	Receptor Age (yr)	Cancer			Non-Cancer	
					ILCR=			Child	Adult
					1E-06	1E-05	1E-04	HQ = 1	HQ = 1
1	7-18	32	25	6-16 & 16-30	2.71	27.1	271	NA	115
2	7-18	20	40	6-16 & 16-30	15.9	159	1590	NA	184
3	0-6	150	1	0-6	0.578	5.8	58	2.7	24.5
4	7-18	20	40	6-16 & 16-30	4.34	43.4	434	NA	184
5	0-6	150	1	0-6	0.578	5.8	58	2.7	24.5

NA = Not Applicable, because young child was not a receptor in 1998 ROD

The Child HQ represents the HQ for a child age 0-6 years without adjustment for other age groups

ILCR = Incremental Lifetime Cancer Risk

HQ = Hazard Quotient

Screening Levels calculated with EPA Regional Screening Level calculator (http://www.epa.gov/region9/superfund/prg/)

1 = Coffin St. cove, New Bedford, including Coffin St. playground, vacant waterfront property, hot spot CDF

2 = Industrial area north of Coffin St. playground continuing to Wood St. Bridge

3 = Houses just north of Wood St. Bridge, New Bedford

4 = South of Wood St. Bridge (Acushnet Side)

5 = Veranda St. inlet (Fairhaven)

APPENDIX B

CALCULATIONS SUPPORTING UPDATED SHORELINE CLEANUP LEVELS

NEW BEDFORD HARBOR SUPERFUND SITE - ROD 2

1. **Coffin Street cove, New Bedford:** This area contains three subareas; the Coffin Street playground area, a recently cleared waterfront property and the hot spot CDF area.

a. Coffin Street playground: This is a well established playground with swings, a playset, ballfield, hockey court and an old outdoor shower. Adjacent and very close to this area is the shoreline bordered by a narrow strip of saltmarsh. There is currently a fence between the playground and shoreline although there is evidence that individuals can trespass over the fence. In addition, well worn paths are present within the fenced area to the shoreline. The playground is surrounded by homes. It is reasonable to assume that an older child aged seven to eighteen could access the shoreline and saltmarshes two times per week during the summer months of June, July and August and one time per week during May and September.

b. Vacant waterfront property: This area was cleared of an old (Pierce) mill complex in 1997. The City of New Bedford has proposed use of at least part of this area as a "Riverside" park. Since the fringe saltmarsh conditions are very similar to those bordering the Coffin Street playground, the potential exposures and receptor are assumed to be the same as for the playground area.

c. CDF: It is reasonable to assume that the hot spot CDF could be converted into a recreational or park area in the future to match the land use of the other properties bordering the cove. As with the playground and vacant waterfront property, it is likely that the fringe saltmarsh in this area would remain and act as a buffer limiting complete access to the shoreline. Based on this future scenario, a future exposure scenario and receptor could be the same as for these other waterfront properties bordering the cove.

d. Proposed cleanup level: All three areas of the Cove have the same receptor and exposure pathways, thus the same cleanup level should be attained in all three areas. The 95% Upper Confidence Level on the arithmetic mean of exposed sediments in these areas should meet the cleanup goal derived below since this is the statistic utilized in assessing exposure in risk assessments.

CLEANUP LEVEL FOR PCBS IN SEDIMENTS IN AREAS OF BEACHCOMBING ACTIVITIES

$$C_s\ (mg/kg) = \frac{THQ \times BW_c \times AT_{nc}}{FxD\ [(\frac{1}{RfD_o} \times \frac{IR_c}{10^6 mg/kg}) + (\frac{1}{RfD_o} \times \frac{SA_c \times AF \times RAF_d}{10^6 mg/kg})}$$

C_s = PCB concentration in soil = soil cleanup level
THQ = target hazard quotient = 1
BW = average body weight of child 7-18 years of age = 47 kg
AT_{nc} = averaging time, noncarcinogen = (12yrs x 365dys/yr) = 4,380 days
F = exposure frequency = 2dys/wk x 4wks/mo x 3mos/yr + 1dy/wk x 2 mos/yr = 32 days per year
D = duration = 12 years
RfD = reference dose for PCBs = $2x10^{-5}$ mg/kg-dy (IRIS, 10/1/96)
IR = sediment ingestion rate = [100mg/dy (soil ingestion rate for older child) x 0.5 (fraction of total soil/sediment from source)] = 50 mg/day
SA = surface area of an older child exposed (head, hands, lower arms and lower legs) = 4,380 cm^2
AF = skin adherence factor = 0.61 mg/cm^2; derived by averaging adherence factor of 1 mg/cm^2 for age groups 7 - 12 exposed to wet sediment (Kissel et al., 1996) with adherence factor of 0.23 mg/cm^2 for age groups 13 - 18 exposed to wet sediments (Kissel et al., 1996)
RAF_{dermal} = dermal relative absorption factor = 14% = amount absorbed in the blood via the dermal route from the site divided by the amount absorbed in the blood from the toxicity study which is the basis of the RfD or CDF (From Wester et al., 1993)

Substituting the above values into the equation:

$$C\ (mg/kg) = \frac{(1)(47)(4380)}{32 \times 12\ [\frac{(1)}{2x10^{-5}} \times \frac{(50)}{10^6} + \frac{1 \times 4380 \times 0.6 \times 0.14]}{2x10^{-5}\quad 10^6}}$$

$$= \frac{(205,860)}{384(\frac{50}{20} + \frac{374)}{20}}$$

= 205,860/8141.8 = 25.2 or 25 ppm

2. Industrial area north of Coffin Street playground continuing to Wood Street Bridge: A heavily industrialized area extends north from the Coffin Street playground to the Wood Street Bridge. This area is unlikely to be visited on a regular basis by children or adults since it is on private property, not very accessible and not very attractive. It is assumed that an older child, aged 7-18, might visit this area one time per week for five months per year (about 20 days per year).

Proposed Cleanup Goal

$$C_s\ (\text{mg/kg}) = \frac{THQ \times BW_c \times AT_{nc}}{FxD\left[\left(\frac{1}{RfD_o} \times \frac{IR_c}{10^6\ \text{mg/kg}}\right) + \left(\frac{1}{RfD_o} \times \frac{SA_c \times AF \times RAF_d}{10^6\ \text{mg/kg}}\right)\right]}$$

C_s = PCB concentration in soil = soil cleanup level
THQ = target hazard quotient = 1
BW = average body weight of child 7-18 years of age = 47 kg
AT_{nc} = averaging time, noncarcinogen = (12 yrs x 365 dys/yr) = 4,380 days
F = exposure frequency = 20 days per year
D = duration = 12 years
RfD = reference dose for PCBs = 2×10^{-5}mg/kg-dy (IRIS, 10/1/96)
IR = sediment ingestion rate = [100mg/dy (soil ingestion rate for older child) x 0.5 (fraction of total soil/sediment from source)] = 50 mg/day
SA = surface area of an older child exposed (head, hands, lower arms and lower legs) = 4,380 cm^2
AF = skin adherence factor = 0.61 mg/cm^2; derived by averaging adherence factor of 1 mg/cm^2 for age groups 7 - 12 exposed to wet sediment (Kissel et al., 1996) with adherence factor of 0.23 mg/cm^2 for age groups 13 - 18 exposed to wet sediments (Kissel et al., 1996)
RAF_{dermal} = dermal relative absorption factor = 14% = amount absorbed in the blood via the dermal route from the site divided by the amount absorbed in the blood from the toxicity study which is the basis of the RfD or CDF (From Wester et al., 1993)

Substituting the above values into the equation:

$$C\ (\text{mg/kg}) = \frac{(1)(47)(4380)}{20 \times 12\left[\frac{(1)}{2\times10^{-5}} \times \frac{(50)}{10^6} + \frac{1}{2\times10^{-5}} \times \frac{4380 \times 0.6 \times 0.14}{10^6}\right]}$$

$$= \frac{205{,}860}{240\left(\frac{50}{20} + \frac{374}{20}\right)}$$

= 205,860/5088 = 40.4 or 40 ppm

3. **Houses just north of Wood Street Bridge (New Bedford):** There are three houses just north of the Wood Street bridge which abut the west shore of the Acushnet River. Paths lead from each home through a thin band of saltmarsh to the river. Due to the close proximity of the river and the easy access to the river and sediment, the cleanup goal for all sediment areas adjacent to these homes should be consistent with a "residential cleanup goal" (see below).

SEDIMENT CLEANUP LEVEL FOR RESIDENTIAL EXPOSURES

The following cleanup level applies to residential properties which abut areas of the harbor with exposed sediments. This cleanup level is protective of a young child (ages 0-6) who would access these sediments as if they were an extension of their backyard. This cleanup level should be attained in surface soils, (i.e., 0-1ft). The following calculation assumes two potential exposure pathways from soil; accidental ingestion of soil and dermal absorption of soils. The inhalation pathway is not expected to contribute significantly to the total risk from contaminated soils.

$$C_s\ (\text{mg/kg}) = \frac{THQ \times BW_c \times AT_{nc}}{FxD\ [(\frac{1}{RfD_o} \times \frac{IR_c}{10^6\ \text{mg/kg}}) + (\frac{1}{RfD_o} \times \frac{SA_c \times AF \times RAF_d}{10^6\ \text{mg/kg}})}$$

C_s = PCB concentration in soil = soil cleanup level
THQ = target hazard quotient = 1
BW = average body weight of child 0-6 years of age = 15 kg
AT_{nc} = averaging time, noncarcinogen = (6 yrs x 365dys/yr) = 2,190 days
F = exposure frequency = 150 days per year (amount of time that ground is not frozen or covered with snow)
D = duration = 6 years
RfD = reference dose for PCBs = 2×10^{-5} mg/kg-dy (IRIS, 10/1/96)
IR = sediment ingestion rate = 200 mg/day (soil ingestion rate for young child)
SA = surface area of a young child exposed (head, hands, lower arms and lower legs) = 2,900 cm^2
AF = skin adherence factor = 1 mg/cm^2 (Kissel et al., 1996, for young children)
RAF_{dermal} = dermal relative absorption factor = 14% = amount absorbed in the blood via the dermal route from the site divided by the amount absorbed in the blood from the toxicity study which is the basis of te RfD or CPF (from Wester et al., 1993)

Substituting the above values into the equation:

$$C\ (\text{mg/kg}) = \frac{(1)(15)(2190)}{150 \times 6\ [\frac{(1)}{2\times10^{-5}} \times \frac{(200)}{10^6} + \frac{1 \times 2900}{2\times10^{-5}} \frac{\times 1 \times 0.14]}{10^6}}$$

$$= \frac{(32,850)}{900\left(\frac{200}{20} + \frac{406}{20}\right)}$$

= (32850)/27,270 = 1.2 or 1 ppm

4. **South of the Wood Street Bridge (Acushnet Side):** Just south of the Wood Street bridge on the Acushnet and Fairhaven shore of the Acushnet River is a small industrial area bordered to the south by a continuous and extensive saltmarsh system. These saltmarshes extend inland quite a bit before meeting houses or roads and are difficult to get to. It is likely that only an older child or adult would access these marshes on a regular basis. Thus the most reasonable exposure pathway is for an older child (7-18 years of age) who would visit this area one time per week for five months per year. The cleanup level would be the same for #2 above; the industrial area north of the Coffin St. playground (i.e., 40 ppm).

5. Veranda Street inlet (Fairhaven)

This area contains many homes whose lawns extend right down to the river. There is very little slope and the river is essentially at the level of the lawn. Thus the river can be considered an extension of the backyards of these residences. The cleanup goal for exposed sediments adjacent to and extending into residential backyards in this area should attain the residential cleanup level of 1 ppm (as derived in #3 above).

Site-specific

Recreator Equation Inputs for Soil

Variable	Value
TR (target cancer risk) unitless	1.0E-6
SA_{recsc} (skin surface area - child) cm^2/day	2373
SA_{recsa} (skin surface area - adult) cm^2/day	6032
SA_{0-2} (skin surface area - mutagenic) cm^2/day	2373
SA_{2-6} (skin surface area - mutagenic) cm^2/day	2373
SA_{6-16} (skin surface area - mutagenic) cm^2/day	6032
SA_{16-30} (skin surface area - mutagenic) cm^2/day	6032
SA_{recsa} (skin surface area - adult) cm^2/day	6032
THQ (target hazard quotient) unitless	1
LT (lifetime - recreator) year	70
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	2100
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	5908
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	9533.333
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	24472 *
EF_{0-2} (exposure frequency) day/year	20
EF_{2-6} (exposure frequency) day/year	20
EF_{6-16} (exposure frequency) day/year	20
EF_{16-30} (exposure frequency) day/year	20
EF_{recsc} (exposure frequency - child) day/year	20
EF_{recsa} (exposure frequency - adult) day/year	20
EF_{recsa} (exposure frequency - adult) day/year	20
EF_{recs} (exposure frequency - recreator) day/year	20
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-30} (soil intake rate) mg/day	100
IRS_{recsc} (soil intake rate - child) mg/day	200
IRS_{recsa} (soil intake rate - adult) mg/day	100

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Site-specific

Recreator Equation Inputs for Soil

Variable	Value
IRS_{recsa} (soil intake rate - adult) mg/day	100
ED_{0-2} (exposure duration) year	2
ED_{2-6} (exposure duration) year	4
ED_{6-16} (exposure duration) year	10
ED_{16-30} (exposure duration) year	10
ED_{recsc} (exposure duration - child) year	6
ED_{recsa} (exposure duration - adult) year	20
ED_{recsa} (exposure duration - adult) year	20
ED_{recs} (exposure duration - recreator) year	26
ET_{0-2} (exposure time) hr/day	4
ET_{2-6} (exposure time) hr/day	4
ET_{6-16} (exposure time) hr/day	2
ET_{16-30} (exposure time) hr/day	2
ET_{recsc} (exposure time - child) hr/day	4
ET_{recsa} (exposure time - adult) hr/day	2
ET_{recsa} (exposure time - adult) hr/day	2
ET_{recs} (exposure time - recreator) hr/day	2.462
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-30} (body weight) kg	80
BW_{recsc} (body weight - child) kg	15
BW_{recsa} (body weight - adult) kg	80
BW_{recsa} (body weight - adult) kg	80
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07
AF_{recsc} (skin adherence factor - child) mg/cm^2	0.2

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Site-specific

Recreator Equation Inputs for Soil

Variable	Value
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
City (Climate Zone) PEF Selection	Hartford, CT (8
A_s (acres)	.5
Q/C_{wp} (g/m^2-s per kg/m^3)	73.950449528400
PEF (particulate emission factor) m^3/kg	10982401741.557
A (PEF Dispersion Constant)	12.5907
B (PEF Dispersion Constant)	18.8368
C (PEF Dispersion Constant)	215.4377
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	3.84
U_t (equivalent threshold value)	11.32
F(x) (function dependant on U_m/U_t) unitless	0.0345
City (Climate Zone) VF Selection	Hartford, CT (8
A_s (acres)	.5
Q/C_{vol} (g/m^2-s per kg/m^3)	73.950449528400
foc (fraction organic carbon in soil) g/g	0.006
ρ$_b$ (dry soil bulk density) g/cm^3	1.5
ρ$_s$ (soil particle density) g/cm^3	2.65
θ$_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	12.5907
B (VF Dispersion Constant)	18.8368
C (VF Dispersion Constant)	215.4377
City (Climate Zone) VF_{ml} Selection	Default
VF_s (volitization factor) m^3/kg	.

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Site-specific
Recreator Equation Inputs for Soil

Variable	Value
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18365
A_s (acres)	.5
T (exposure interval) yr	26
d_s (depth of source) m	.
ρ$_b$ (dry soil bulk density) g/cm^3	1.5
A (VF Dispersion Constant - Mass Limit)	11.911
B (VF Dispersion Constant - Mass Limit)	18.4385
C (VF Dispersion Constant - Mass Limit)	209.7845

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Site-specific

Recreator Screening Levels (RSL) for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,
Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),
Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	GIABS	ABS	RBA
Aroclor 1254	11097-69-1	No	Yes	2.00E+00	S	5.71E-04	S	2.00E-05	I	-		1	0.14	1

Chemical	Volatilization Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	Particulate Emission Factor (m^3/kg)	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL Child HQ=1 (mg/kg)	Dermal SL Child HQ=1 (mg/kg)	Inhalation SL Child HQ=1 (mg/kg)
Aroclor 1254	9.14E+05	-	1.10E+10	6.08E+00	1.54E+01	7.66E+02	4.34E+00	2.74E+01	8.24E+01	-

Chemical	Noncarcinogenic SL Child HI=1 (mg/kg)	Ingestion SL Adult HQ=1 (mg/kg)	Dermal SL Adult HQ=1 (mg/kg)	Inhalation SL Adult HQ=1 (mg/kg)	Noncarcinogenic SL Adult HI=1 (mg/kg)	Screening Level (mg/kg)
Aroclor 1254	2.05E+01	2.92E+02	4.94E+02	-	1.84E+02	4.34E+00 ca**

Output generated 25AUG2015:09:46:02

Site-specific

Recreator Equation Inputs for Soil

Variable	Value
TR (target cancer risk) unitless	1.0E-6
SA_{recsc} (skin surface area - child) cm^2/day	2373
SA_{recsa} (skin surface area - adult) cm^2/day	6032
SA_{0-2} (skin surface area - mutagenic) cm^2/day	2373
SA_{2-6} (skin surface area - mutagenic) cm^2/day	2373
SA_{6-16} (skin surface area - mutagenic) cm^2/day	6032
SA_{16-30} (skin surface area - mutagenic) cm^2/day	6032
SA_{recsa} (skin surface area - adult) cm^2/day	6032
THQ (target hazard quotient) unitless	1
LT (lifetime - recreator) year	70
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	3360
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	9452.8
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	15253.333
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	39155.2
EF_{0-2} (exposure frequency) day/year	32
EF_{2-6} (exposure frequency) day/year	32
EF_{6-16} (exposure frequency) day/year	32
EF_{16-30} (exposure frequency) day/year	32
EF_{recsc} (exposure frequency - child) day/year	32
EF_{recsa} (exposure frequency - adult) day/year	32
EF_{recsa} (exposure frequency - adult) day/year	32
EF_{recs} (exposure frequency - recreator) day/year	32
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-30} (soil intake rate) mg/day	100
IRS_{recsc} (soil intake rate - child) mg/day	200
IRS_{recsa} (soil intake rate - adult) mg/day	100

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Site-specific
Recreator Equation Inputs for Soil

Variable	Value
IRS_{recsa} (soil intake rate - adult) mg/day	100
ED_{0-2} (exposure duration) year	2
ED_{2-6} (exposure duration) year	4
ED_{6-16} (exposure duration) year	10
ED_{16-30} (exposure duration) year	10
ED_{recsc} (exposure duration - child) year	6
ED_{recsa} (exposure duration - adult) year	20
ED_{recsa} (exposure duration - adult) year	20
ED_{recs} (exposure duration - recreator) year	26
ET_{0-2} (exposure time) hr/day	4
ET_{2-6} (exposure time) hr/day	4
ET_{6-16} (exposure time) hr/day	2
ET_{16-30} (exposure time) hr/day	2
ET_{recsc} (exposure time - child) hr/day	4
ET_{recsa} (exposure time - adult) hr/day	2
ET_{recsa} (exposure time - adult) hr/day	2
ET_{recs} (exposure time - recreator) hr/day	2.462
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15
BW_{6-16} (body weight) kg	80
BW_{16-30} (body weight) kg	80
BW_{recsc} (body weight - child) kg	15
BW_{recsa} (body weight - adult) kg	80
BW_{recsa} (body weight - adult) kg	80
AF_{0-2} (skin adherence factor) mg/cm^2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07
AF_{recsc} (skin adherence factor - child) mg/cm^2	0.2

Output generated 25AUG2015:09:52:02

Site-specific
Recreator Equation Inputs for Soil

Variable	Value
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
AF_{recsa} (skin adherence factor - adult) mg/cm^2	0.07
City (Climate Zone) PEF Selection	Hartford, CT (8
A_s (acres)	.5
Q/C_{wp} (g/m^2-s per kg/m^3)	93.77
PEF (particulate emission factor) m^3/kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependant on U_m/U_t) unitless	0.194
City (Climate Zone) VF Selection	Hartford, CT (8
A_s (acres)	.5
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ$_b$ (dry soil bulk density) g/cm^3	1.5
ρ$_s$ (soil particle density) g/cm^3	2.65
θ$_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
City (Climate Zone) VF_{ml} Selection	Default
VF_s (volitization factor) m^3/kg	.

Output generated 25AUG2015:09:52:02

Site-specific
Recreator Equation Inputs for Soil

Variable	Value
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18365
A_s (acres)	.5
T (exposure interval) yr	26
d_s (depth of source) m	.
ρ$_b$ (dry soil bulk density) g/cm^3	1.5
A (VF Dispersion Constant - Mass Limit)	11.911
B (VF Dispersion Constant - Mass Limit)	18.4385
C (VF Dispersion Constant - Mass Limit)	209.7845

Output generated 25AUG2015:09:52:02

Site-specific

Recreator Screening Levels (RSL) for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,
Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),
Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	GIABS	ABS	RBA
Aroclor 1254	11097-69-1	No	Yes	2.00E+00	S	5.71E-04	S	2.00E-05	I	-		1	0.14	1

Chemical	Volatilization Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	Particulate Emission Factor (m^3/kg)	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL Child HQ=1 (mg/kg)	Dermal SL Child HQ=1 (mg/kg)	Inhalation SL Child HQ=1 (mg/kg)
Aroclor 1254	8.43E+05	-	1.36E+09	3.80E+00	9.65E+00	4.41E+02	2.71E+00	1.71E+01	5.15E+01	-

Chemical	Noncarcinogenic SL Child HI=1 (mg/kg)	Ingestion SL Adult HQ=1 (mg/kg)	Dermal SL Adult HQ=1 (mg/kg)	Inhalation SL Adult HQ=1 (mg/kg)	Noncarcinogenic SL Adult HI=1 (mg/kg)	Screening Level (mg/kg)
Aroclor 1254	1.28E+01	1.83E+02	3.09E+02	-	1.15E+02	2.71E+00 ca**

Output generated 25AUG2015:09:52:02

Site-Specific
Recreator Equation Inputs for Soil/Sediment

Variable	Value
TR (target cancer risk) unitless	1.0E-6
ED_r (exposure duration - recreator) years	26
ET_r (exposure time - recreator) hours	2.5
ED_c (exposure duration - child) years	6
BW_a (body weight - adult) kg	80
BW_c (body weight - child) kg	15
SA_a (skin surface area - adult) cm^2/day	6032
SA_c (skin surface area - child) cm^2/day	2373
THQ (target hazard quotient) unitless	1
LT (lifetime - recreator) yr	70
EF_r (exposure frequency) d/yr	150 *
IRS_a (soil intake rate - adult) mg/day	100
IRS_c (soil intake rate - child) mg/day	200
AF_a (skin adherence factor - adult) mg/cm^2	0.07
AF_c (skin adherence factor - child) mg/cm^2	0.2
IFS_{adj} (age-adjusted soil ingestion factor) mg/kg	15750
DFS_{adj} (age-adjusted soil dermal factor) mg/kg	44310
$IFSM_{adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	71500
$DFSM_{adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	183540
AF_{0-2} (skin adherence factor) mg/cm^2	.2
AF_{2-6} (skin adherence factor) mg/cm^2	.2
AF_{6-16} (skin adherence factor) mg/cm^2	.07
AF_{16-30} (skin adherence factor) mg/cm^2	.07
BW_{0-2} (body weight) kg	15
BW_{2-6} (body weight) kg	15

Output generated 24AUG2015:14:45:00

Site-Specific
Recreator Equation Inputs for Soil/Sediment

Variable	Value
BW_{6-16} (body weight) kg	80
BW_{16-30} (body weight) kg	80
ED_{0-2} (exposure duration) year	2
ED_{2-6} (exposure duration) year	4
ED_{6-16} (exposure duration) year	10
ED_{16-30} (exposure duration) year	10
EF_{0-2} (exposure frequency) day/year	150
EF_{2-6} (exposure frequency) day/year	150
EF_{6-16} (exposure frequency) day/year	150
EF_{16-30} (exposure frequency) day/year	150
ET_{0-2} (exposure time) hour/day	4
ET_{2-6} (exposure time) hour/day	4
ET_{6-16} (exposure time) hour/day	2
ET_{16-30} (exposure time) hour/day	2
IRS_{0-2} (soil intake rate) mg/day	200
IRS_{2-6} (soil intake rate) mg/day	200
IRS_{6-16} (soil intake rate) mg/day	100
IRS_{16-30} (soil intake rate) mg/day	100
SA_{0-2} (skin surface area) cm^2/day	2373
SA_{2-6} (skin surface area) cm^2/day	2373
SA_{6-16} (skin surface area) cm^2/day	6032
SA_{16-30} (skin surface area) cm^2/day	6032
City (Climate Zone) PEF Selection	Hartford, CT (8
A_s (acres) PEF Selection	0.5
Q/C_{wp} (g/m^2-s per kg/m^3) PEF Selection	93.77
PEF (particulate emission factor) m^3/kg	1359344438

Output generated 24AUG2015:14:45:00

Site-Specific
Recreator Equation Inputs for Soil/Sediment

Variable	Value
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U_m (mean annual wind speed) m/s	4.69
U_t (equivalent threshold value)	11.32
F(x) (function dependant on U_m/U_t) unitless	0.194
City (Climate Zone) VF Selection	Hartford, CT (8
A_s (acres) VF Selection	0.5
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
Q/C_{wp} (g/m^2-s per kg/m^3) VF Selection	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ$_b$ (dry soil bulk density) g/cm^3	1.5
ρ$_s$ (soil particle density) g/cm^3	2.65
θ$_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15
T (exposure interval) s	819936000

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Site-Specific
Recreator PRG for Soil/Sediment

Chemical	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Reference	Chronic RfC (mg/m^3)	RfC Reference	Ingestion SF (mg/kg-day)$^{-1}$	SFO Reference	Inhalation Unit Risk (ug/m^3)$^{-1}$	IUR Reference	ABS_{derm}	ABS_{gi}
Aroclor 1254	No	Yes	2.00E-05	IRIS	-		2.00E+00	SURROGA	5.71E-04	SURROGA	0.14	1

Volatilization Factor (m^3/kg)	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	Ingestion PRG TR=1.0E-6 (mg/kg)	Inhalation PRG TR=1.0E-6 (mg/kg)	Dermal PRG TR=1.0E-6 (mg/kg)	* Carcinogenic PRG TR=1.0E-6 (mg/kg)	Child Ingestion PRG HQ=1 (mg/kg)	Child Inhalation PRG HQ=1 (mg/kg)	Child Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Child PRG HI=1 (mg/kg)
8.43E+05	1.36E+09	-	1	8.11E-01	9.27E+01	2.06E+00	5.78E-01	3.65E+00	-	1.10E+01	2.74E+00

Adult Ingestion PRG HQ=1 (mg/kg)	Adult Inhalation PRG HQ=1 (mg/kg)	Adult Dermal PRG HQ=1 (mg/kg)	* Noncarcinogenic Adult PRG HI=1 (mg/kg)	Adjusted Ingestion PRG HQ=1 (mg/kg)	Adjusted Inhalation PRG HQ=1 (mg/kg)	Adjusted Dermal PRG HQ=1 (mg/kg)	Noncarcinogenic Adjusted PRG HI=1 (mg/kg)
3.89E+01	-	6.59E+01	2.45E+01	1.21E+01	-	3.06E+01	8.65E+00

Output generated 24AUG2015:14:45:00

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

TECHNICAL MEMORANDUM

To: Ginny Lombardo
From: Richard Sugatt
Date: September 29, 2015
RE: Evaluation of protectiveness of risk-based target levels in seafood and EPA seafood consumption advisories for the New Bedford Harbor Superfund site

One purpose of this memorandum is to evaluate the human health risk-based target level (RBTL) for finfish and shellfish for the New Bedford Harbor Superfund site to ensure that the target level is still protective. Additional purposes are to evaluate the cancer and non-cancer risks of specific species of finfish and shellfish based on the tissue contaminant data available up to 2014 and use that risk information to confirm whether the EPA seafood consumption advisories remain protective.

Risk-based Target Level for total PCBs

The current risk-based target level for the ROD for seafood is 0.02 mg/kg. To evaluate the protectiveness of this level, cancer and non-cancer risks of total PCBs were calculated using current exposure assumptions and toxicity values for one meal per month and 4 meals per month for adult, older child, younger child and lifelong resident receptors. The risks were calculated for each receptor for total PCB concentrations of 0.02 mg/kg, 0.03 mg/kg, and 0.04 mg/kg.

The exposure and toxicity assumptions are presented in Table 1, along with the equations for cancer risk and non-cancer risk. Cancer risk, expressed as the Elevated Lifetime Cancer Risk (ELCR), is the probability of getting cancer (e.g. 1×10^{-6}, or 1 in 1 million, or 1E-06) due to exposure related to the site. Non-cancer risk (i.e. for health effects other than cancer) is expressed as a Hazard Quotient (HQ) which is the number obtained by dividing the site-related dose by the safe Reference Dose (RfD). EPA's acceptable risk levels at Superfund sites are ELCR within a range of 1×10^{-6} to 1×10^{-4}, and a HQ of 1 or less.

The fraction ingested (FI) was conservatively assumed to be 1, meaning that 100 % of the total seafood consumption of the specified seafood species was assumed to be from the specified area of New Bedford Harbor. The Exposure Frequency (EF) was assumed to be either 12 events per year (i.e. once per month) or 52 events/year (once per week, or about 4 times per month). The EF of 12 events/yr was designated as the Central Tendency Exposure (CTE), and the EF of 52 events/yr was designated as the Reasonable Maximum Exposure (RME). The exposure duration (ED) was assumed to be 55 years for the adult (age 16 to 70 years), 10 years for the older child (age 6 to 15 years), and 5 years for the young child (age 1-6 years). The exposure duration of the lifelong resident was assumed to be 70 years. The body weight (BW) was assumed to be 70 kg for the adult, 40 kg for the older child, and 15 kg for the young child. The averaging time for cancer risk was 25,550 days (70 years x 365 days/yr) for each receptor. The averaging time for non-cancer risk was 20,075 days (55 yr x 365 days/yr) for the adult, 3650 days (10 yr x 365 days/yr) for the older child, and 1825 days (5 yr x 365 days/yr) for the young child. Meal size was assumed to be 0.227 kg for the adult and older child and half of that (0.114 kg) for the young child. The larger meal size was designated as the CTE and RME for adults and older child. The smaller meal size was designated as the CTE and RME for the young child.

The toxicity factors for total PCBs were those for "high-risk" PCBs as designated in EPA's Integrated Risk Information System (IRIS). These toxicity factors are the same as those recommended for Aroclor 1254. The oral cancer slope factor (SF) was 2.0 per mg/kg/day. The oral Reference Dose (RfD) was 2.0 x 10^{-5} mg/kg/day for chronic exposure (adults and older child) and 5.0 x 10^{-5} mg/kg/day for subchronic exposure (young child). These values are current as of 2015.

Table 1. Exposure and toxicity assumptions

Receptor	Age (yrs)	Exposure Condition	IR	FI	EF	ED	BW	AT-c	AT-nc	RfD	SF
Adult	16-70	CTE	0.227	1	12	55	70	25550	20075	2.0E-05	2.0E+00
		RME	0.227	1	52	55	70	25550	20075	2.0E-05	2.0E+00
Older Child	6-15	CTE	0.227	1	12	10	40	25550	3650	2.0E-05	2.0E+00
		RME	0.227	1	52	10	40	25550	3650	2.0E-05	2.0E+00
Young Child	1-6	CTE	0.114	1	12	5	15	25550	1825	2.0E-05	2.0E+00
		RME	0.114	1	52	5	15	25550	1825	5.0E-05	2.0E+00

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested from site (unitless)
EF = meal/yr
ED = Exposure Duration (yr)
BW = Body Weight (kg)
AT-c = Averaging Time-cancer (days)
AT-nc = Averaging Time-non-cancer (days)
RfD = Reference Dose (mg/kg/day)
SF = Slope Factor $(mg/kg/day)^{-1}$
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

The calculated cancer and non-cancer risks for seafood total PCB concentrations of 0.02 mg/kg, 0.03 mg/kg, and 0.04 mg/kg are presented in Table 2 and summarized below:

Total PCB (mg/kg)	Maximum HQ		ELCR	
	CTE	RME	CTE	RME
0.02	0.2	0.8	1E-05	2E-05
0.03	0.3	1.2	8E-06	3E-05
0.04	0.4	**1.6**	1E-05	4E-05

CTE = Central Tendency Exposure (one meal per month)
RME = Reasonable Maximum Exposure (4 meals per month)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk
The number in bold exceeds EPA's risk limit for non-cancer (HQ ≤ 1)

Based on uncertainty inherent in the risk assessment process, HQ and ELCR values should be rounded to the nearest whole number; therefore, the above HQ values of 1.2 should be rounded to 1, and an HQ of 1.6 would be rounded to 2. The results indicate that the cancer and non-cancer risks of PCB concentrations of 0.02 mg/kg and 0.03 mg/kg are within EPA's risk limits for both cancer and non-cancer effects, but that the PCB concentration of 0.04 mg/kg exceeds the non-cancer risk limit, based on a rounded HQ of 2 for the RME condition of 4 meals per month. The PCB concentration of 0.04 mg/kg would have acceptable non-cancer risk for 1 meal per month. Since a PCB concentration of 0.03 mg/kg is acceptable for both cancer and non-cancer risk for both 1 meal per month and 4 meals per month, it is concluded that the ROD risk target of 0.02 mg/kg in seafood is protective.

Risks of Seafood and Comparison to EPA Consumption Advisories

The 1979 Massachusetts Department of Public Health (MassDPH) and 2010 EPA seafood consumption advisories for New Bedford Harbor are summarized in Table 3. The advisories categorize receptors as either "sensitive receptors" or "other" receptors. Sensitive receptors include pregnant women, nursing mothers, children under age 12, and women who may become pregnant. Massachusetts Division of Marine Fisheries (MassDMF) and Massachusetts Department of Environmental Protection (MassDEP) have collected and analyzed seafood for total PCB congeners and dioxin-like PCB congeners on an annual basis since 2003. Seafood was collected from Area 1 of Operable Unit 1 (OU1), Area 2 and 3 of OU3, and a Reference Area (Sippican Harbor) and analyzed for PCB congeners. The available data (from 2003 to 2013, assuming zero concentration for non-detected congeners) were used in the 2014 draft risk assessment for OU 3 (AMEC, 2014) to calculate Exposure Point Concentrations (EPCs) for those species which had sufficient data to calculate an Upper Confidence Level (UCL) of the arithmetic mean. These included: Lobster meat (Area 2, Area 3, Reference); Lobster meat and tomalley (Area 2, Area 3, Reference); Quahogs (Area 2, Clark's Cove, Area 3, Reference); Scup (Area 2, Area 3, Reference); and Black Sea Bass (Area 2, Area 3).

These EPCs are summarized in Table 4. The EPC tables from the draft risk assessment are provided in the attachment to this memorandum. The UCLs in the draft risk assessment were calculated and selected using EPA's ProUCL software. The selected UCL is often the 95% UCL of the arithmetic mean, but the software selects the most statistically appropriate UCL type. The statistical basis for each UCL is identified in the EPC tables from the draft risk assessment in the attachment to this memorandum. Although these EPCs were calculated before 2014 data were available, the 2014 data are consistent with past years so the EPCs will not change significantly.

There were insufficient data to calculate a UCL for three additional species (eel, flounder, and tautog) that have MassDPH and EPA consumption advisories. The individual data, and mean and maximum concentrations of available data from 2003 to 2014 for these species from designated areas are provided in Table 5. The EPC for EPA risk assessments is usually the UCL or maximum, whichever is lower. Since there were insufficient data to calculate a statistical UCL EPC for eel, flounder, and tautog, the maximum concentration would normally be used for risk assessment purposes; however, both the maximum and mean concentrations for these three species are evaluated for risk to understand the level of uncertainty given that there were so few samples. The maximum and mean concentrations for these species are summarized in Table 4 along with the EPCs for the other species.

The cancer and non-cancer risks of the EPCs for lobster, quahog, scup, black sea bass, and the maximum and mean concentrations for eel, flounder, and tautog, were calculated for the adult, young child, older child, and lifelong receptor using the toxicity factors and exposure assumptions for PCBs previously described in Table 1. In addition, for lobster, quahog, and black sea bass, the risks of dioxin-like PCBs were calculated using the same exposure assumptions and dioxin Toxicity Equivalence values (TEQ) for the dioxin-like PCB congeners. The TEQ value for a particular dioxin-like PCB congener is expressed as a proportion of the toxicity of the most toxic dioxin, 2, 3, 7, 8-Tetrachlorodibenzodioxin (2, 3, 7, 8-TCDD). The non-cancer toxicity factor for 2, 3, 7, 8-TCDD is an oral Reference Dose of 7.0×10^{-10} mg/kg from the EPA Integrated Risk Information System (IRIS). There is no cancer toxicity value for 2, 3, 7, 8-TCDD on IRIS; however, the EPA Regional Screening Level database (http://www3.epa.gov/region09/superfund/prg/) recommends the use of the California EPA cancer oral slope factor of 1.6×10^{5} per mg/kg., which was used here. The risks of dioxin-like PCBs for eel, flounder, and tautog were not calculated due to lack of data on dioxin-like PCBs.

The risks are summarized in Table 6 (Area 2), Table 7 (Clark's Cove), Table 8 (Area 3) and Table 9 (Reference area). The consumption advisory information from Table 3 has been added to these risk tables to facilitate comparison of the risks with the advisory recommendation for that species or type of seafood. Since both the young child receptor (age 1-6 years) and older child receptor (age 6-15 years) include ages below 12 years, both types of child receptors are considered to be "sensitive" receptors for comparison of risks with advisories. The "other" receptor advisory category therefore includes adults but not children. The lifelong receptor risks include both childhood and adult exposure, but are not compared with advisories because there is no separate advisory category for "lifelong" receptors.

Although there are no advisories associated with the Reference Area, the risks of seafood from the Reference Area have been calculated to evaluate risks from a New England coastal area unaffected by contamination from New Bedford Harbor. The risk values in the tables are colored green if they are acceptable (HQ $\leq$ 1; ELCR $\leq 1 \times 10^{-4}$) or bolded red if they are unacceptable (HQ > 1; ELCR > 1×10^{-4}). These risk management criteria are used by EPA at Superfund sites. The individual risk calculations are documented in un-numbered tables in the attachment to this memorandum.

The protectiveness of current advisories and recommendations for Area 2 and Area 3 of OU3 are described below. Area 1 was not further evaluated because the existing advisory is to not eat any seafood from Area 1, and the available data indicate that PCB concentrations in seafood from this area remain above acceptable risk levels for all receptors.

Area 2

The advisory for Area 2 recommends that sensitive receptors should not eat fish, shellfish or lobster caught in Area 2 (except for shellfish from Clark's Cove in Area 2, see below) . As shown in table 6 (Area 2), the advisory for Area 2 is still protective for sensitive receptors (0 meals/month) because the risks at both the RME (4 meals/month) and the CTE (1 meal/month) are still unacceptable for children for each species at the UCL EPC or maximum concentration. The advisory of no consumption of any fish species in Area 2 for sensitive receptors ensures protectiveness for children.

The advisory for "non-sensitive" receptors (adults) is to eat no bottom-feeding fish or lobster from Area 2 and no more than one meal per month of black sea bass or shellfish (clams, quahog, mussels, etc.) and no recommendation for all other fish due to lack of data. This advisory is still protective because the CTE risks (1 meal/month) for black sea bass and quahog are acceptable. [Note that quahog data have been used to establish the advisory for all shellfish, including clams, quahog, mussels, etc.]

Clark's Cove

The advisory related to Clark's Cove recommends that sensitive receptors can safely eat one, and only one, meal per month of shellfish caught in Clark's Cove. Other receptors can safely eat no more than one meal per week (e.g. 4 meals/month) of shellfish. For this advisory, shellfish are considered to be "clams, quahogs, mussels, etc." but not lobster. As shown in Table 7 (Clark's Cove), there is acceptable risk for both 1 meal per month (CTE) and 4 meals per month (RME) of quahogs for non-sensitive (adult) receptors; therefore, the advisory of 4 meals per month for non-sensitive receptors is still protective. Although the CTE and RME for the child receptor is acceptable, the RME (4 meals per month) risk for the older child (which is included in the 'sensitive' receptor group) is unacceptable. The CTE (1 meal/month) risk for the older child is acceptable; therefore the advisory of no more than 1 meal/month remains protective for sensitive receptors. Advisories for species other than quahog are not shown in Table 7 because the advisories for Area 2 apply to these species.

Area 3

The advisories related to Area 3 for non-sensitive receptors recommend no more than 1 meal/month for black sea bass, no consumption of lobster or scup, no restrictions for eel, flounder, tautog, and no recommendation for all other fish due to lack of data. Also, sensitive receptors should not eat lobster or fish but can eat one, and only one, meal per month of shellfish (clams, quahog, mussels, etc.) caught in Area 3.

As shown in Table 8, the advisories are still protective for sensitive receptors for shellfish. Although the CTE and RME for the child receptor is acceptable, the RME (4 meals/month) risk for the older child (which is included in the 'sensitive' receptor group) is unacceptable. The CTE (1 meal/month) risk for the older child is acceptable; therefore the advisory of no more than 1 meal per month for shellfish remains protective for sensitive receptors.

As shown in Table 8, the advisory of no more than one meal per month for black sea bass is still protective because the CTE risks are acceptable whereas the RME risks are unacceptable. The advisory of no consumption for scup and lobster meat & tomalley is still protective because both the RME and CTE risks are unacceptable.

The advisory for non-sensitive receptors is "There are no eating restrictions" (NR in table 8) for eel, flounder and tautog. There are no contaminant data for eels in Area 3 so a protectiveness conclusion concerning the non-restricted consumption of eel from Area 3 by sensitive or non-sensitive receptors cannot be made. It is recommended that the advisory for eel of "no restriction" (NR) be changed to "EPA has insufficient data so cannot make a recommendation" (i.e., ND). The limited data for flounder (2 fish from 2003) indicate that the risk may be unacceptable for both the RME and CTE at the mean and maximum PCB concentration; therefore, the advisory of no restriction (NR) may be of concern. Since the flounder data from Area 3 are limited and more than 10 years old, it is recommended that the advisory for flounder be changed from "no restriction (NR) to "EPA has insufficient data so cannot make a recommendation" (i.e., ND).

These recommended changes for eel and flounder will be protective because the MassDMF indicated that it is unlikely that there is any significant consumption of these species from Area 3 (Vincent Malkoski, personal communication-see attachments) because eel do not aggregate enough to catch them easily, and the flounder fishery is in serious decline.

The data for tautog (8 fish) indicate that the risk is acceptable for the CTE (1 meal/ month), for both mean and maximum PCB concentrations, but not acceptable for the RME (4 meals/month) at mean and maximum PCB concentrations; therefore, the advisory of unrestricted consumption should be changed to no more than one meal per month for tautog.

<u>Reference Area</u>

Although there are no known seafood consumption advisories for seafood from the Reference Area, the risks of total PCB congeners and dioxin-like PCBs were calculated for lobster meat, lobster meat & tomalley, scup, and quahog to evaluate risks of seafood from a New England coastal area unaffected by contamination from New Bedford Harbor. As shown in Table 9, the risks were acceptable for lobster meat (but not lobster meat & tomalley) and quahog for both CTE and RME consumption rates by children and adults. Risks of scup were unacceptable for both CTE and RME consumption rates by children and for the RME consumption rate by adults. Although the concentrations of total PCBs and dioxin-like PCBs were lower than in the same biota from Area 2 and Area 3 at New Bedford Harbor, it should be noted that the total PCB EPCs in lobster and scup (but not quahog) from the Reference Area were higher than the 0.02 mg/kg biota target concentration in the ROD for New Bedford Harbor, suggesting that the ROD target tissue concentration may be lower than background for some types of seafood.

Conclusions

1. It is concluded that the ROD target biota concentration of 0.02 mg/kg total PCBs is still protective. It is also concluded that the current seafood consumption advisories are still protective, although the following changes should be made:

2. The current "no restriction" advisory for eel and flounder in Area 3 for non-sensitive receptors should be changed to "insufficient data for EPA to make a recommendation" because there are no eel data and only two samples of flounder from Area 3 from 2003. The current "no restriction" advisory has probably been protective because these fish are unlikely to be caught by recreational fishers in Area 3 due to scarcity. For the same reason, the change to "insufficient data for EPA to make a recommendation" will be protective. There is also a "do not eat" advisory for sensitive receptors for all fish from Area 3.

3. The current "no restriction" advisory for tautog in Area 3 for non-sensitive receptors should be changed from "no restriction" to "no more than 1 meal per month". This new recommendation is based on data collected in 2013 and 2014. Data for this species was not available prior to 2013. The change will be protective because the mean and maximum concentration in tautog (8 samples) has acceptable risk for adults at a CTE consumption rate of 1 meal per month.

References

AMEC Environmental & Infrastructure, Inc. 2014. 2014 Revised Draft Baseline Human Health Risk Assessment Operable Unit #3 New Bedford Harbor Superfund Site New Bedford, Massachusetts. Prepared for Army Corps of Engineers, New England District. March 26, 2014.

Personal Communication. Email dated September 28, 2015 from Vincent Malkoski (MassDMF) to Ginny Lombardo (EPA).

Table 2. EPA calculation of risk-based target levels for total PCBs in seafood- New Bedford Harbor

0.02 mg/kg Total PCB Congeners

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.02	2.13E-06	1.7E-06	2.0E-05	2.0E+00	1E-01	3E-06
	2	RME	0.227	1	52	55	70	25550	20075	0.02	9.24E-06	7.3E-06	2.0E-05	2.0E+00	5E-01	1E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.02	3.73E-06	5.3E-07	2.0E-05	2.0E+00	2E-01	1E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.02	1.62E-05	2.3E-06	2.0E-05	2.0E+00	8E-01	5E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.02	5.00E-06	3.6E-07	2.0E-05	2.0E+00	2E-01	7E-07
	2	RME	0.114	1	52	5	15	25550	1825	0.02	2.17E-05	1.5E-06	5.0E-05	2.0E+00	4E-01	3E-06
Total	2	CTE														5E-06
	2	RME														2E-05

0.03 mg/kg Total PCB Congeners

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.03	3.20E-06	2.5E-06	2.0E-05	2.0E+00	2E-01	5E-06
	2	RME	0.227	1	52	55	70	25550	20075	0.03	1.39E-05	1.1E-05	2.0E-05	2.0E+00	7E-01	2E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.03	5.60E-06	8.0E-07	2.0E-05	2.0E+00	3E-01	2E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.03	2.43E-05	3.5E-06	2.0E-05	2.0E+00	1.2E+00	7E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.03	7.50E-06	5.4E-07	2.0E-05	2.0E+00	4E-01	1E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.03	3.25E-05	2.3E-06	5.0E-05	2.0E+00	6E-01	5E-06
Total	2	CTE														8E-06
	2	RME														3E-05

0.04 mg/kg Total PCB Congeners

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.04	4.26E-06	3.4E-06	2.0E-05	2.0E+00	2E-01	7E-06
	2	RME	0.227	1	52	55	70	25550	20075	0.04	1.85E-05	1.5E-05	2.0E-05	2.0E+00	9E-01	3E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.04	7.46E-06	1.1E-06	2.0E-05	2.0E+00	4E-01	2E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.04	3.23E-05	4.6E-06	2.0E-05	2.0E+00	**1.6E+00**	9E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.04	9.99E-06	7.1E-07	2.0E-05	2.0E+00	5E-01	1E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.04	4.33E-05	3.1E-06	5.0E-05	2.0E+00	9E-01	6E-06
Total	2	CTE														1E-05
	2	RME														4E-05

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested from site (unitless)
EF = meal/yr
ED = Exposure Duration (yr)
BW = Body Weight (kg)
AT-c = Averaging Time-cancer (days)
AT-nc = Averaging Time-non-cancer (days)
CF = Concentration in Seafood (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)

RfD = Reference Dose (mg/kg/day)
SF = Slope Factor $(mg/kg/day)^{-1}$
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk
CTE = Central Tendency Exposure
RME = Reasonable Maximum Exposure

ADD = CF * IR * FI * EF * ED * 1/BW * 1/AT-nc
LADD = CF * IR * FI *EF * ED * 1/BW * 1/AT-c
HQ = ADD/RfD
ELCR = LADD * SF

Table 3. EPA Seafood Advisories

Seafood Type	Maximum Meals/Month							
	Area 1		Area 2				Area 3	
			Other Area 2		Clark's Cove			
	Receptors		Receptors		Receptors		Receptors	
	Sensitive	Others	Sensitive	Others	Sensitive	Others	Sensitive	Others
Any fish, lobster, shellfish	0	0	0	0	0	0	0	NR
Any bottom feeding fish	0	0	0	0	0	0	0	ND
Black Sea Bass	0	0	0	1	0	1	0	1
Scup	0	0	0	ND	0	ND	0	0
Lobster	0	0	0	0	0	0	0	0
Shellfish other than lobster	0	0	0	1	1	4	1	NR
Eel	0	0	0	0	0	0	0	NR
Flounder	0	0	0	0	0	0	0	NR
Tautog	0	0	0	0	0	ND	0	NR
All other fish	0	0	0	ND	0	ND	0	ND

Sensitive receptors: pregnant women, nursing mothers, children under age 12, women who may become pregnant
ND = No Data (therefore EPA cannot make a recommendation)
NR = No Restrictions
A value of 0 meals/month means "do not eat"
A value of 4 meals/month is equivalent to "no more than one meal/week"

Table 4. Seafood Exposure Point Concentrations-New Bedford Harbor

Seafood Type	EPC Type	Exposure Point Concentration (mg/kg)								Data Source
		Area 2				Area 3		Reference		
				Clark's Cove						
		TEQ	tPCB	TEQ	tPCB	TEQ	tPCB	TEQ	tPCB	
Lobster meat	UCL	7.9E-06	0.149	NA	NA	5.8E-06	0.0982	1.3E-07	0.0133	Table 3-1 draft HHRA
Lobster meat & tomalley	UCL	1.6E-04	2.7	NA	NA	1.0E-04	1.5	4.3E-05	0.596	Table 3-2 draft HHRA
Quahog	UCL	3.89E-07	0.223	1.87E-07	0.0623	6.92E-07	0.0525	9.72E-08	0.0122	Table 3-3 draft HHRA
Scup	UCL	5.0E-05	2.37	NA	NA	4.8E-05	1.33	6.5E-07	0.14	Table 3-4 draft HHRA
Black Sea Bass	UCL	1.1E-06	0.246	NA	NA	5.5E-06	0.15	NA	NA	Table 3-5 draft HHRA
Eel	Max		83	NA	NA	NA	NA	NA	NA	Table 5, this memo
(n= 4 in Area 2)	Mean		40.2	NA	NA	NA	NA	NA	NA	Table 5, this memo
Tautog	Max		1.9	NA	NA	NA	0.11	NA	NA	Table 5, this memo
(n= 7 in Area 2, 4 in Area 3)	Mean		0.15	NA	NA	NA	0.08	NA	NA	Table 5, this memo
Flounder	Max		2	NA	NA	NA	0.62	NA	NA	Table 5, this memo
(n= 4 in Area 2, 2 in Area 3)	Mean		0.72	NA	NA	NA	0.37	NA	NA	Table 5, this memo

NA = Not Available

tPCB = total PCB congeners

TEQ = dioxin Toxicity Equivalents, dioxin-like PCB congeners

HHRA = Human Health Risk Assessment, for Operable Unit 3, 2014 draft

UCL = Upper Confidence Level

Table 5. Total PCBs in flounders, eel, and tautog, New Bedford Harbor

				Total PCB	Area I				Area II				Area III			
Year	Species	Area	Station	(mg/kg)	min	max	mean	n	min	max	mean	n	min	max	Mean	n
2004	Summer Flounder	II	A	0.11												
2005	Winter Flounder	II	C	2												
2006	Winter Flounder	II	C	0.055												
2004	Summer & Winter Flounder	II	E	0.82												
2003	Winter Flounder	III	A	0.62												
2003	Summer Flounder	III	A	0.11												
all	All Flounders								0.055	2	0.72	4	0.11	0.62	0.37	2
2004	Eel	I	A	28												
2004	Eel	I	B	32												
2004	Eel	I	C	22												
2004	Eel	I	D	133												
2004	Eel	I	E	68												
2005	Eel	I	A	16												
2005	Eel	I	B	15												
2005	Eel	I	C	29												
2005	Eel	I	D	35												
2005	Eel	I	E	28												
2006	Eel	I	A	81												
2006	Eel	I	B	69												
2006	Eel	I	C	37												
2006	Eel	I	D	70												
2006	Eel	I	E	55												
2007	Eel	I	A	47												
2007	Eel	I	B	22												
2007	Eel	I	C	66												
2007	Eel	I	D	102												
2007	Eel	I	E	59												
2012	Eel	I	A	53.3												
2012	Eel	I	B	20.3												
2012	Eel	I	D	36.8												
2004	Eel	II	C	40												
2005	Eel	II	C	6.9												
2006	Eel	II	C	31												
2007	Eel	II	C	83												
All	All Eel				15	133	48.9	22	6.9	83	40.2	4				
2012	Tautog	II	B	0.5												
2012	Tautog	II	C	1.9												
2013	Tautog	II	A	0.42												
2013	Tautog	II	B	0.15												
2013	Tautog	II	C	1.22												
2013	Tautog	II	D	0.20												
2013	Tautog	II	E	0.87												
2014			2A	0.16												
2014			2B	0.14												
2014			2C	0.97												
2014			2D	0.83												
2014			2E	0.12												
2013	Tautog	III	A	0.08												
2013	Tautog	III	B	0.14												
2013	Tautog	III	C	0.09												
2013	Tautog	III	D	0.11												
			3A	0.019												
			3C	0.072												
			3D	0.074												
			3E	0.042												
All	All Tautog								0.14	1.9	0.62	12	0.02	0.14	0.08	8

Table 6. Risk summary Area 2

Seafood Type	EPC (mg/kg)			Young Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.149	7.9E-06	UCL	3	2	10	3	2E-05	5E-06	1E-04	2E-05	1E-04	3E-05	0		Yes
Lobster meat & tomalley	2.7	1.6E-04	UCL	60	30	200	60	4E-04	1E-04	2E-03	5E-04	2E-03	6E-04	0		Yes
Black Sea Bass	0.246	1.1E-06	UCL	5	3	2	0.4	4E-05	9E-06	1E-05	3E-06	4E-04	9E-05	0		Yes
Scup	0.69	6.6E-06	UCL	10	9	10	2	1E-04	2E-05	8E-05	2E-05	2E-04	4E-05	0		Yes
Quahog	0.223	3.89E-07	UCL	5	3	0.6	0.1	3E-05	8E-06	5E-06	1E-06	4E-05	9E-06	0		Yes
Eel (n=4)	83.0	NA	Max	2000	1000	NA	NA	1E-02	3E-03	NA	NA	NA	NA	0		Yes
Eel (n=4)	40.2	NA	Mean	900	500	NA	NA	6E-03	1E-03	NA	NA	NA	NA	0		Yes
Flounder (n=2)	2.0	NA	Max	40	20	NA	NA	3E-04	7E-05	NA	NA	NA	NA	0		Yes
Flounder (n=2)	0.72	NA	Mean	20	9	NA	NA	1E-04	3E-05	NA	NA	NA	NA	0		Yes
Tautog (n=12)	1.9	NA	Max	40	20	NA	NA	3E-04	7E-05	NA	NA	NA	NA	0		Yes
Tautog (n=12)	0.62	NA	Mean	10	8	NA	NA	1E-04	2E-05	NA	NA	NA	NA	0		Yes

Seafood Type	EPC (mg/kg)			Older Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.149	7.9E-06	UCL	6	1	9	2	3E-05	8E-06	1E-04	3E-05	2E-04	4E-05	0		Yes
Lobster meat & tomalley	2.7	1.6E-04	UCL	100	30	200	40	6E-04	1E-04	3E-03	7E-04	4E-03	8E-04	0		Yes
Black Sea Bass	0.246	1.1E-06	UCL	10	2	1	0.3	6E-05	1E-05	2E-05	5E-06	8E-05	2E-05	0		Yes
Scup	0.69	6.6E-06	UCL	30	6	8	2	2E-04	4E-05	1E-04	3E-05	3E-04	6E-05	0		Yes
Quahog	0.223	3.89E-07	UCL	9	2	0.4	0.1	5E-05	1E-05	7E-06	2E-06	6E-05	1E-05	0		Yes
Eel (n=4)	83.0	NA	Max	3000	800	NA	NA	2E-02	4E-03	NA	NA	NA	NA	0		Yes
Eel (n=4)	40.2	NA	Mean	2000	400	NA	NA	9E-03	2E-03	NA	NA	NA	NA	0		Yes
Flounder (n=2)	2.0	NA	Max	80	20	NA	NA	5E-04	1E-04	NA	NA	NA	NA	0		Yes
Flounder (n=2)	0.72	NA	Mean	30	7	NA	NA	2E-04	4E-05	NA	NA	NA	NA	0		Yes
Tautog (n=12)	1.9	NA	Max	80	20	NA	NA	4E-04	1E-04	NA	NA	NA	NA	0		Yes
Tautog (n=12)	0.62	NA	Mean	30	6	NA	NA	1E-04	3E-05	NA	NA	NA	NA	0		Yes

Seafood Type	EPC (mg/kg)			Adult										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.149	7.9E-06	UCL	3	0.8	5	1	1E-04	2E-05	5E-04	1E-04	6E-04	1E-04	0	0	Yes
Lobster meat & tomalley	2.7	1.6E-04	UCL	60	10	100	20	2E-03	5E-04	9E-03	2E-03	1E-02	3E-03	0	0	Yes
Black Sea Bass	0.246	1.1E-06	UCL	6	1	0.7	0.2	2E-04	4E-05	6E-05	1E-05	2E-04	6E-05	0	1	Yes
Scup	0.69	6.6E-06	UCL	20	4	4	1	5E-04	1E-04	4E-04	9E-05	9E-04	2E-04	0	ND	No?
Quahog	0.223	3.89E-07	UCL	5	1	0.3	0.06	2E-04	4E-05	2E-05	5E-06	2E-04	4E-05	0	1	Yes
Eel (n=4)	83.0	NA	Max	2000	400	NA	NA	6E-02	1E-02	NA	NA	NA	NA	0	0	Yes
Eel (n=4)	40.2	NA	Mean	900	200	NA	NA	3E-02	7E-03	NA	NA	NA	NA	0	0	Yes
Flounder (n=2)	2.0	NA	Max	50	10	NA	NA	1E-03	3E-04	NA	NA	NA	NA	0	0	Yes
Flounder (n=2)	0.72	NA	Mean	20	4	NA	NA	5E-04	1E-04	NA	NA	NA	NA	0	0	Yes
Tautog (n=12)	1.9	NA	Max	40	10	NA	NA	1E-03	3E-04	NA	NA	NA	NA	0	0	Yes
Tautog (n=12)	0.62	NA	Mean	10	3	NA	NA	5E-04	1E-04	NA	NA	NA	NA	0	0	Yes

Seafood Type	EPC (mg/kg)			Lifelong										Seafood Advisory		
				HQ				ELCR						(meals/mo.)		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.149	7.9E-06	UCL	NA	NA	NA	NA	2E-04	4E-05	7E-04	2E-04	9E-04	2E-04	No advisory for lifelong receptor		
Lobster meat & tomalley	2.7	1.6E-04	UCL	NA	NA	NA	NA	3E-03	7E-04	1E-02	3E-03	2E-02	4E-03	No advisory for lifelong receptor		
Black Sea Bass	0.246	1.1E-06	UCL	NA	NA	NA	NA	3E-04	6E-05	1E-04	2E-05	4E-04	9E-05	No advisory for lifelong receptor		
Scup	0.69	6.6E-06	UCL	NA	NA	NA	NA	8E-04	2E-04	6E-04	1E-04	1E-03	3E-04	No advisory for lifelong receptor		
Quahog	0.223	3.89E-07	UCL	NA	NA	NA	NA	2E-04	6E-05	3E-05	8E-06	3E-04	7E-05	No advisory for lifelong receptor		
Eel (n=4)	83.0	NA	Max	NA	NA	NA	NA	9E-02	2E-02	NA	NA	NA	NA	No advisory for lifelong receptor		
Eel (n=4)	40.2	NA	Mean	NA	NA	NA	NA	4E-02	1E-02	NA	NA	NA	NA	No advisory for lifelong receptor		
Flounder (n=2)	2.0	NA	Max	NA	NA	NA	NA	2E-03	5E-04	NA	NA	NA	NA	No advisory for lifelong receptor		
Flounder (n=2)	0.72	NA	Mean	NA	NA	NA	NA	8E-04	2E-04	NA	NA	NA	NA	No advisory for lifelong receptor		
Tautog (n=12)	1.9	NA	Max	NA	NA	NA	NA	2E-03	5E-04	NA	NA	NA	NA	No advisory for lifelong receptor		
Tautog (n=12)	0.62	NA	Mean	NA	NA	NA	NA	2E-04	4E-05	NA	NA	NA	NA	No advisory for lifelong receptor		

NA = Not Available
ND = No EPA advisory was issued due to lack of data.
n = number of samples
tPCB = total PCBs
TEQ = dioxin Toxicity Equivalent for dioxin-like PCBs
UCL = Upper Confidence Level
Max = Maximum concentration

HQ = Hazard Quotient
CTE = Central Tendency Exposure (1 meal/month)
RME = Reasonable Maximum Exposure (4 meals/month)
ELCR = Elevated Lifetime Cancer Risk
EPC = Exposure Point Concentration
Numbers in red are unacceptable (HQ > 1; ELCR > 1E-04)
Numbers in green are acceptable (HQ ≤ 1; ELCR ≤ 1E-04)

Sensitive receptors include pregnant women, nursing mothers, children under age 12, women who may become pregnant
ND = No EPA advisory was issued due to lack of data.

Table 7. Risk summary Area 2 Clark's Cove

Seafood Type	EPC (mg/kg)			Young Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Quahog	0.0623	1.87E-07	UCL	1	0.8	0.3	0.07	1E-05	2E-06	2E-06	5E-07	1E-05	3E-06	1		Yes

Seafood Type	EPC (mg/kg)			Older Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Quahog	0.0623	1.87E-07	UCL	3	0.6	0.2	0.05	1E-05	3E-06	3E-06	8E-07	2E-05	4E-06	1		Yes

Seafood Type	EPC (mg/kg)			Adult										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Quahog	0.0623	1.87E-07	UCL	1	0.3	0.1	0.03	5E-05	1E-05	1E-05	3E-06	6E-05	1E-05	1	4	Yes

Seafood Type	EPC (mg/kg)			Lifelong										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Quahog	0.0623	1.87E-07	UCL	NA	NA	NA	NA	7E-05	2E-05	2E-05	4E-06	9E-05	2E-05	No advisory for lifelong receptor		

NA = Not Available
n = number of samples
tPCB = total PCBs
TEQ = dioxin Toxicity Equivalent for dioxin-like PCBs
UCL = Upper Confidence Level
Max = Maximum concentration

HQ = Hazard Quotient
CTE = Central Tendency Exposure (1 meal/month)
RME = Reasonable Maximum Exposure (4 meals/month)
ELCR = Elevated Lifetime Cancer Risk
EPC = Exposure Point Concentration
Numbers in red are unacceptable (HQ > 1; ELCR > 1E-04)
Numbers in green are acceptable (HQ ≤ 1; ELCR ≤ 1E-04)

Sensitive receptors include pregnant women, nursing mothers, children under age 12, women who may become pregnant.

Note: The HQ for the older child is acceptable for 1 meal/month, but not for 4 meals/month; however the advisory recommends no more than 1 meal/month for children under age 12, which is included in the older child receptor; therefore, the advisory is protective for the CTE condition, which has acceptable risk.

Table 8. Risk summary Area 3

Seafood Type	EPC (mg/kg)			Young Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0982	5.8E-06	UCL	2	1	9	2	2E-05	4E-06	7E-05	2E-05	9E-05	2E-05	0		Yes
Lobster meat & tomalley	1.5	1.0E-04	UCL	30	20	200	40	2E-04	5E-05	1E-03	3E-04	1E-03	3E-04	0		Yes
Black Sea Bass	0.15	5.5E-06	UCL	3	0.7	9	2	2E-05	5E-06	7E-05	2E-05	9E-05	2E-05	0		Yes
Scup	0.3	6.2E-06	UCL	6	4	10	2	5E-05	1E-05	8E-05	2E-05	1E-04	3E-05	0		Yes
Quahog	0.0525	6.92E-07	UCL	1	0.7	1	0.2	8E-06	2E-06	9E-06	2E-06	2E-05	4E-06	1		Yes
Flounder (n=2)	0.62	NA	Max	10	8	NA	NA	1E-04	2E-05	NA	NA	NA	NA	0		Yes
Flounder (n=2)	0.37	NA	Mean	8	5	NA	NA	6E-05	1E-05	NA	NA	NA	NA	0		Yes
Tautog (n=8)	0.14	NA	Max	3	2	NA	NA	2E-05	5E-06	NA	NA	NA	NA	0		Yes
Tautog (n=8)	0.08	NA	Mean	2	1	NA	NA	1E-05	3E-06	NA	NA	NA	NA	0		Yes

Seafood Type	EPC (mg/kg)			Older Child										Seafood Advisory		
				HQ				ELCR						(meals/mo.)		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0982	5.8E-06	UCL	4	0.9	7	2	2E-05	5E-06	1E-04	2E-05	1E-04	3E-05	0		Yes
Lobster meat & tomalley	1.5	1.0E-04	UCL	60	10	100	30	3E-04	8E-05	2E-03	4E-04	2E-03	5E-04	0		Yes
Black Sea Bass	0.15	5.5E-06	UCL	6	1	6	1	3E-05	8E-06	1E-04	2E-05	1E-04	3E-05	0		Yes
Scup	0.3	6.2E-06	UCL	10	3	7	2	7E-05	2E-05	1E-04	3E-05	2E-04	4E-05	0		Yes
Quahog	0.0525	6.92E-07	UCL	2	0.5	0.8	0.2	1E-05	3E-06	1E-05	3E-06	2E-05	6E-06	1		Yes
Flounder (n=2)	0.62	NA	Max	30	6	NA	NA	1E-04	3E-05	NA	NA	NA	NA	0		Yes
Flounder (n=2)	0.37	NA	Mean	10	3	NA	NA	9E-05	2E-05	NA	NA	NA	NA	0		Yes
Tautog (n=8)	0.14	NA	Max	6	1	NA	NA	3E-05	7E-06	NA	NA	NA	NA	0		Yes
Tautog (n=8)	0.08	NA	Mean	3	0.7	NA	NA	2E-05	4E-06	NA	NA	NA	NA	0		Yes

Seafood Type	EPC (mg/kg)			Adult										Seafood Advisory		
				HQ				ELCR						(meals/mo.)		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0982	5.8E-06	UCL	2	0.5	4	0.9	7E-05	2E-05	3E-04	8E-05	4E-04	9E-05	0	0	Yes
Lobster meat & tomalley	1.5	1.0E-04	UCL	30	8	70	20	1E-03	3E-04	6E-03	1E-03	7E-03	2E-03	0	0	Yes
Black Sea Bass	0.15	5.5E-06	UCL	3	0.8	4	0.8	1E-04	3E-05	3E-04	7E-05	4E-04	1E-04	0	1	Yes
Scup	0.3	6.2E-06	UCL	7	2	4	0.9	2E-04	5E-05	4E-04	8E-05	6E-04	1E-04	0	0	Yes
Quahog	0.0525	6.92E-07	UCL	1	0.3	0.5	0.1	4E-05	9E-06	4E-05	9E-06	8E-05	2E-05	1	NR	Yes
Flounder (n=2)	0.62	NA	Max	10	3	NA	NA	5E-04	1E-04	NA	NA	NA	NA	0	ND	?
Flounder (n=2)	0.37	NA	Mean	9	2	NA	NA	3E-04	6E-05	NA	NA	NA	NA	0	ND	?
Tautog (n=8)	0.14	NA	Max	3	0.7	NA	NA	1E-04	2E-05	NA	NA	NA	NA	0	NR	?
Tautog (n=8)	0.08	NA	Mean	2	0.4	NA	NA	6E-05	1E-05	NA	NA	NA	NA	0	NR	?

Seafood Type	EPC (mg/kg)			Lifelong										Seafood Advisory		
				HQ				ELCR						(meals/mo.)		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0982	5.8E-06	UCL	NA	NA	NA	NA	1E-04	3E-05	5E-04	1E-04	6E-04	1E-04	No advisory for lifelong receptor		
Lobster meat & tomalley	1.5	1.0E-04	UCL	NN	NA	NA	NA	2E-03	4E-04	9E-03	2E-03	1E-02	2E-03	No advisory for lifelong receptor		
Black Sea Bass	0.15	5.5E-06	UCL	NA	NA	NA	NA	2E-04	4E-05	5E-04	1E-04	7E-04	2E-04	No advisory for lifelong receptor		
Scup	0.3	6.2E-06	UCL	NA	NA	NA	NA	3E-04	8E-05	6E-04	1E-04	9E-04	2E-04	No advisory for lifelong receptor		
Quahog	0.0525	6.92E-07	UCL	NA	NA	NA	NA	6E-05	1E-05	6E-05	1E-05	1E-04	3E-05	No advisory for lifelong receptor		
Flounder (n=2)	0.62	NA	Max	NA	NA	NA	NA	7E-04	2E-04	NA	NA	NA	NA	No advisory for lifelong receptor		
Flounder (n=2)	0.37	NA	Mean	NA	NA	NA	NA	4E-04	9E-05	NA	NA	NA	NA	No advisory for lifelong receptor		
Tautog (n=8)	0.14	NA	Max	NA	NA	NA	NA	2E-04	4E-05	NA	NA	NA	NA	No advisory for lifelong receptor		
Tautog (n=8)	0.08	NA	Mean	NA	NA	NA	NA	9E-05	2E-05	NA	NA	NA	NA	No advisory for lifelong receptor		

NA = Not Available
ND = No Data, therefore EPA cannot make a recommendation
NR = No Restrictions
n = number of samples
tPCB = total PCBs
TEQ = dioxin Toxicity Equivalent for dioxin-like PCBs
UCL = Upper Confidence Level
Max = Maximum concentration

HQ = Hazard Quotient
CTE = Central Tendency Exposure (1 meal/month)
RME = Reasonable Maximum Exposure (4 meals/month)
ELCR = Elevated Lifetime Cancer Risk
EPC = Exposure Point Concentration
Numbers in red are unacceptable (HQ > 1; ELCR > 1E-04)
Numbers in green are acceptable (HQ ≤ 1; ELCR ≤ 1E-04)

Sensitive receptors include pregnant women, nursing mothers, children under age 12, women who may become pregnant.

Table 9. Risk summary Reference Area

Seafood Type	EPC (mg/kg)			Young Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0133	1.3E-07	UCL	0.3	0.2	0.2	0.05	2E-06	5E-07	2E-06	4E-07	4E-06	8E-07	no advisory		
Lobster meat & tomalley	0.596	4.3E-05	UCL	10	7	70	20	9E-05	2E-05	5E-04	1E-04	6E-04	1E-04	no advisory		
Scup	0.14	6.5E-07	UCL	3	2	1	0.2	2E-05	5E-06	8E-06	2E-06	3E-05	7E-06	no advisory		
Quahog	0.012	9.72E-08	UCL	0.3	0.2	0.2	0.03	2E-06	4E-07	1E-06	3E-07	3E-06	7E-07	no advisory		

Seafood Type	EPC (mg/kg)			Older Child										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0133	1.3E-07	UCL	0.5	0.1	0.2	0.03	3E-06	7E-07	2E-06	6E-07	5E-06	1E-06	no advisory		
Lobster meat & tomalley	0.596	4.3E-05	UCL	20	6	50	10	1E-04	3E-05	8E-04	2E-04	9E-04	2E-04	no advisory		
Scup	0.14	6.5E-07	UCL	6	1	0.8	0.2	3E-05	7E-06	1E-05	3E-06	4E-05	1E-05	no advisory		
Quahog	0.012	9.72E-08	UCL	0.5	0.1	0.1	0.03	3E-06	7E-07	2E-06	4E-07	5E-06	1E-06	no advisory		

Seafood Type	EPC (mg/kg)			Adult										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0133	1.3E-07	UCL	0.3	0.07	0.09	0.02	1E-05	2E-06	8E-06	2E-06	2E-05	4E-06	no advisory		
Lobster meat & tomalley	0.596	4.3E-05	UCL	10	3	30	7	4E-04	1E-04	2E-03	6E-04	3E-03	7E-04	no advisory		
Scup	0.14	6.5E-07	UCL	3	0.7	0.4	0.1	1E-04	2E-05	4E-05	9E-06	1E-04	3E-05	no advisory		
Quahog	0.012	9.72E-08	UCL	0.3	0.07	0.06	0.01	9E-06	2E-06	6E-06	1E-06	1E-05	3E-06	no advisory		

Seafood Type	EPC (mg/kg)			Lifelong										Seafood Advisory		
				HQ				ELCR						Maximum meals/month		Still Protective?
	tPCB	TEQ		tPCB		TEQ		tPCB		TEQ		tPCB & TEQ				
				RME	CTE	RME	CTE	RME	CTE	RME	CTE	RME	CTE	Sensitive	Others	
Lobster meat	0.0133	1.3E-07	UCL	NA	NA	NA	NA	1E-05	3E-06	1E-05	3E-06	3E-05	6E-06	no advisory		
Lobster meat & tomalley	0.596	4.3E-05	UCL	NA	NA	NA	NA	7E-04	2E-04	4E-03	9E-04	4E-03	1E-03	no advisory		
Scup	0.14	6.5E-07	UCL	NA	NA	NA	NA	2E-04	4E-05	6E-05	1E-05	2E-04	5E-05	no advisory		
Quahog	0.012	9.72E-08	UCL	NA	NA	NA	NA	1E-05	3E-06	2E-06	9E-06	2E-05	5E-06	no advisory		

NA = Not Available
n = number of samples
tPCB = total PCBs
TEQ = dioxin Toxicity Equivalent for dioxin-like PCBs
UCL = Upper Confidence Level
Max = Maximum concentration

HQ = Hazard Quotient
CTE = Central Tendency Exposure (1 meal/month)
RME = Reasonable Maximum Exposure (4 meals/month)
ELCR = Elevated Lifetime Cancer Risk
EPC = Exposure Point Concentration
Numbers in red are unacceptable (HQ > 1; ELCR > 1E-04)
Numbers in green are acceptable (HQ ≤ 1; ELCR ≤ 1E-04)

Sensitive receptors include pregnant women, nursing mothers, children under age 12, women who may become pregnant.

ATTACHMENTS

Table 3-1
Exposure Point Concentrations - Lobster (Meat)
Remedial Investigation Report
New Bedford Harbor - OU3
New Bedford, Massachusetts

Exposure Point	Chemical of Potential Concern (3)	Units	Arithmetic Mean	95% UCL (4) (calculation)		Maximum Detected Concentration (qualifier)	Exposure Point Concentration			
							EPC	Units	Statistic	Rationale
Area 2	Dioxin-Like PCB Congener TEQ (1)	mg/kg	2.5E-06	7.9E-06	NP [a]	3.6E-05	7.9E-06	mg/kg	UCL - NP [a]	(5)
	Total PCB Congeners (2)	mg/kg	0.129	0.149	N [b]	0.314	0.149	mg/kg	UCL - N [b]	(5)
Area 3	Dioxin-Like PCB Congener TEQ (1)	mg/kg	1.8E-06	5.80E-06	NP [a]	2.6E-05	5.8E-06	mg/kg	UCL - NP [a]	(5)
	Total PCB Congeners (2)	mg/kg	0.0802	0.0982	G [c]	0.308	0.0982	mg/kg	UCL - G [c]	(5)
Reference	Dioxin-Like PCB Congener TEQ (1)	mg/kg	6.1E-08	1.31E-07	N [b]	1.5E-07	1.3E-07	mg/kg	UCL - N [b]	(5)
	Total PCB Congeners (2)	mg/kg	0.0067	0.0133	N [b]	0.0150	0.0133	mg/kg	UCL - N [b]	(5)

Notes:

Prepared by / Date: KJC 01/08/14
Checked by / Date: MJM 01/22/14

(1) TEQ - Toxicity equivalence for dioxin-like PCB congeners. Toxic equivalence factors (TEFs) from the *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* EPA/100/R 10/005 USEPA, 2010. Dioxin-like congeners that were not detected in a given sample were assigned a concentration of zero for calculation of TEQ.
(2) Sum of all detected PCB congeners. Congeners that were not detected in a given sample were assigned a concentration of zero for calculation of total PCB congeners.
(3) Chemicals of potential concern (COPCs) are identified in Table 2-1, Table 2-7, and Table 2-12.
(4) 95% UCL is calculated using ProUCL software (V. 5.0); calculations presented in Appendix D.

NP - Non-Parametric Distribution
[a] 95% Chebyshev (Mean, Sd)

G - Gamma Distribution
[c] 95% Adjusted Gamma UCL

N - Normal Distribution
[b] 95% Students-t UCL

(5) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.

EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
mg/kg = milligrams per kilogram

Table 3-2
Exposure Point Concentrations - Lobster (Meat and Tomalley)
Remedial Investigation Report
New Bedford Harbor - OU3
New Bedford, Massachusetts

Exposure Point	Chemical of Potential Concern (3)	Units	Arithmetic Mean	95% UCL (4) (calculation)		Maximum Detected Concentration (qualifier)	Exposure Point Concentration			
							EPC	Units	Statistic	Rationale
Area 2	Dioxin-Like PCB Congener TEQ (1)	mg/kg	1.3E-04	1.6E-04	N [a]	3.5E-04	1.6E-04	mg/kg	UCL - N [a]	(5)
	Total PCB Congeners (2)	mg/kg	2.1	2.7	G [b]	6.5	2.7	mg/kg	UCL - G [b]	(5)
Area 3	Dioxin-Like PCB Congener TEQ (1)	mg/kg	8.4E-05	1.0E-04	N [a]	2.7E-04	1.0E-04	mg/kg	UCL - N [a]	(5)
	Total PCB Congeners (2)	mg/kg	1.3	1.5	LN [c]	3.4	1.5	mg/kg	UCL - LN [c]	(5)
Reference	Dioxin-Like PCB Congener TEQ (1)	mg/kg	1.4E-05	4.3E-05	N [a]	5.1E-05	4.3E-05	mg/kg	UCL - N [a]	(5)
	Total PCB Congeners (2)	mg/kg	0.4	0.60	N [a]	0.60	0.596	mg/kg	UCL - N [a]	(5)

Prepared by / Date: KJC 03/10/14
Checked by / Date: MJM 3/11/14

Notes:
(1) TEQ - Toxicity equivalence for dioxin-like PCB congeners. Toxic equivalence factors (TEFs) from the *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* EPA/100/R 10/005 USEPA, 2010. Dioxin-like congeners that were not detected in a given sample were assigned a concentration of zero for calculation of TEQ.
(2) Sum of all detected PCB congeners. Congeners that were not detected in a given sample were assigned a concentration of zero for calculation of total PCB congeners.
(3) Chemicals of potential concern (COPCs) are identified in Table 2-2, Table 2-8, and Table 2-15.
(4) 95% UCL is calculated using ProUCL software (V. 5.0); calculations presented in Appendix D.

N - Normal distribution
[a] 95% Student's-t UCL

LN - Log Normal Distribution
[c] 95% H-UCL

G - Gamma Distribution
[b] 95% Adjusted Gamma

(5) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.
(6) The maximum detected concentration is used as the EPC because it is lower than the calculated 95% UCL, or no 95% UCL is calculated.

EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
mg/kg = milligrams per kilogram

Table 3-3
Exposure Point Concentrations - Quahogs
Remedial Investigation Report
New Bedford Harbor - OU3
New Bedford, Massachusetts

Exposure Point	Chemical of Potential Concern (3)	Units	Arithmetic Mean	95% UCL (4) (calculation)		Maximum Detected Concentration (qualifier)	Exposure Point Concentration			
							EPC	Units	Statistic	Rationale
Clark's Cove	Dioxin-Like PCB Congener TEQ (1)	mg/kg	1.6E-07	1.87E-07	G [a]	3.8E-07	1.87E-07	mg/kg	UCL - G [a]	(5)
	Total PCB Congeners (2)	mg/kg	0.0532	0.0623	G [a]	0.133	0.0623	mg/kg	UCL - G [a]	(5)
Area 2	Dioxin-Like PCB Congener TEQ (1)	mg/kg	3.3E-07	3.89E-07	LN [b]	1.9E-06	3.89E-07	mg/kg	UCL - LN [b]	(5)
	Total PCB Congeners (2)	mg/kg	0.155	0.223	NP [c]	0.881	0.223	mg/kg	UCL - NP [c]	(5)
Area 3	Dioxin-Like PCB Congener TEQ (1)	mg/kg	1.8E-07	6.92E-07	NP [c]	9.1E-06	6.92E-07	mg/kg	UCL - NP [c]	(5)
	Total PCB Congeners (2)	mg/kg	0.0349	0.0525	NP [c]	0.193	0.0525	mg/kg	UCL - NP [c]	(5)
Reference	Dioxin-Like PCB Congener TEQ (1)	mg/kg	2.2E-08	9.72E-08	N [d]	1.1E-07	9.72E-08	mg/kg	UCL - N [d]	(5)
	Total PCB Congeners (2)	mg/kg	0.00253	0.0122	G [a]	0.015	0.0122	mg/kg	UCL - G [a]	(5)

Notes:

Prepared by / Date: KJC 03/10/14
Checked by / Date: MJM 3/11/14

(1) TEQ - Toxicity equivalence for dioxin-like PCB congeners. Toxic equivalence factors (TEFs) from the *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* EPA/100/R 10/005 USEPA, 2010. Dioxin-like congeners that were not detected in a given sample were assigned a concentration of zero for calculation of TEQ.
(2) Sum of all detected PCB congeners. Congeners that were not detected in a given sample were assigned a concentration of zero for calculation of total PCB congeners.
(3) Chemicals of potential concern (COPCs) are identified in Tables 2-3, 2-4, 2-9, and 2-13.
(4) 95% UCL is calculated using ProUCL software (V. 5.0); calculations presented in Appendix D.

G - Gamma Distribution
[a] 95% Adjusted Gamma UCL

LN - Log Normal Distribution
[b] 95% H-UCL

NP - Non-Parametric Distribution
[c] 95% Chebyshev (Mean, Sd)

N - Normal Distribution
[d] 95% Student's-t UCL

(5) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.

EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
mg/kg = milligrams per kilogram

Table 3-4
Exposure Point Concentrations - Scup
Remedial Investigation Report
New Bedford Harbor - OU3
New Bedford, Massachusetts

Exposure Point	Chemical of Potential Concern (3)	Units	Arithmetic Mean	95% UCL (4) (calculation)		Maximum Detected Concentration (qualifier)	Exposure Point Concentration			
							EPC	Units	Statistic	Rationale
Area 2	Dioxin-Like PCB Congener TEQ (1)	mg/kg	5.2E-06	6.6E-06	LN [a]	5.0E-05	6.6E-06	mg/kg	UCL - LN [a]	(5)
	Total PCB Congeners (2)	mg/kg	0.58	0.69	G [b]	2.37	0.69	mg/kg	UCL - G [b]	(5)
Area 3	Dioxin-Like PCB Congener TEQ (1)	mg/kg	2.3E-06	6.2E-06	NP [c]	4.8E-05	6.2E-06	mg/kg	UCL - NP [c]	(5)
	Total PCB Congeners (2)	mg/kg	0.26	0.3	G [b]	1.33	0.30	mg/kg	UCL - G [b]	(5)
Reference	Dioxin-Like PCB Congener TEQ (1)	mg/kg	4.8E-07	7.81E-07	N [d]	6.5E-07	6.5E-07	mg/kg	Maximum	(6)
	Total PCB Congeners (2)	mg/kg	0.10	0.174	N [d]	0.14	0.14	mg/kg	Maximum	(6)

Notes:

Prepared by / Date: KJC 03/10/14
Checked by / Date: MJM 3/11/14
Revised by/Date MJM 7/28/15
Checked by/Date LCG 7/28/15

(1) TEQ - Toxicity equivalence for dioxin-like PCB congeners. Toxic equivalence factors (TEFs) from the *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* EPA/100/R 10/005 USEPA, 2010. Dioxin-like congeners that were not detected in a given sample were assigned a concentration of zero for calculation of TEQ.
(2) Sum of all detected PCB congeners. Congeners that were not detected in a given sample were assigned a concentration of zero for calculation of total PCB congeners.
(3) Chemicals of potential concern (COPCs) are identified in Table 2-5, Table 2-10 and Table 2-14.
(4) 95% UCL is calculated using ProUCL software (V. 5.0); calculations presented in Appendix D.

LN - Log Normal Distribution
[a] 95% H-UCL

G - Gamma Distribution
[b] 95% Approximate Gamma

NP - Non-Parametric distribution
[c] 95% Chebyshev (Mean, Sd)

N - Normal Distribution
[d] 95% Student's-t UCL

(5) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.
(6) The maximum detected concentration is used as the EPC because it is lower than the calculated 95% UCL, or no 95% UCL is calculated.

EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
mg/kg = milligrams per kilogram

Table 3-5
Exposure Point Concentrations - Sea Bass
Remedial Investigation Report
New Bedford Harbor - OU3
New Bedford, Massachusetts

Exposure Point	Chemical of Potential Concern (3)	Units	Arithmetic Mean	95% UCL (4) (calculation)		Maximum Detected Concentration (qualifier)	Exposure Point Concentration			
							EPC	Units	Statistic	Rationale
Area 2	Dioxin-Like PCB Congener TEQ (1)	mg/kg	8.0E-07	1.1E-06	LN [a]	7.5E-06	1.1E-06	mg/kg	UCL - LN [a]	(5)
	Total PCB Congeners (2)	mg/kg	0.1792	0.246	LN [a]	1.9331	0.246	mg/kg	UCL - LN [a]	(5)
Area 3	Dioxin-Like PCB Congener TEQ (1)	mg/kg	1.5E-06	5.5E-06	NP [b]	4.5E-05	5.5E-06	mg/kg	UCL - NP [b]	(5)
	Total PCB Congeners (2)	mg/kg	0.119	0.15	G [c]	0.593	0.15	mg/kg	UCL - G [c]	(5)

Notes:

Prepared by / Date: KJC 01/09/14
Checked by / Date: MJM 01/22/14

(1) TEQ - Toxicity equivalence for dioxin-like PCB congeners. Toxic equivalence factors (TEFs) from the *Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds* EPA/100/R 10/005 USEPA, 2010. Dioxin-like congeners that were not detected in a given sample were assigned a concentration of zero for calculation of TEQ.
(2) Sum of all detected PCB congeners. Congeners that were not detected in a given sample were assigned a concentration of zero for calculation of total PCB congeners.
(3) Chemicals of potential concern (COPCs) are identified in Table 2-6 and Table 2-11.
(4) 95% UCL is calculated using ProUCL software (V. 5.0); calculations presented in Appendix D.

LN - Log Normal Distribution
[a] 95% H-UCL

G - Gamma Distribution
[c] 95% Adjusted Gamma

NP - Non-Parametric Distribution
[b] 95% Chebyshev (Mean, Sd)

(5) The 95% UCL is used as the EPC because the calculated 95% UCL is less than the maximum detected concentration.

EPC = Exposure Point Concentration
UCL = Upper Confidence Limit on the arithmetic mean
mg/kg = milligrams per kilogram

EPA 2014 draft RI Calculation of Risks of Black Sea Bass in Area 2, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.246	2.62E-05	2.1E-05	2.0E-05	2.0E+00	1E+00	4E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.246	1.14E-04	8.9E-05	2.0E-05	2.0E+00	6E+00	2E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.246	4.59E-05	6.6E-06	2.0E-05	2.0E+00	2E+00	1E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.246	1.99E-04	2.8E-05	2.0E-05	2.0E+00	1E+01	6E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.246	6.15E-05	4.4E-06	2.0E-05	2.0E+00	3E+00	9E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.246	2.66E-04	1.9E-05	5.0E-05	2.0E+00	5E+00	4E-05
Total	2	CTE														6E-05
	2	RME														3E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.1E-06	1.17E-10	9.2E-11	7.0E-10	1.6E+05	2E-01	1E-05	1E+00	6E-05
	2	RME	0.227	1	52	55	70	25550	20075	1.1E-06	5.08E-10	4.0E-10	7.0E-10	1.6E+05	7E-01	6E-05	6E+00	2E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.1E-06	2.05E-10	2.9E-11	7.0E-10	1.6E+05	3E-01	5E-06	3E+00	2E-05
	2	RME	0.227	1	52	10	40	25550	3650	1.1E-06	8.89E-10	1.3E-10	7.0E-10	1.6E+05	1E+00	2E-05	1E+01	8E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.1E-06	2.75E-10	2.0E-11	7.0E-10	1.6E+05	4E-01	3E-06	3E+00	1E-05
	2	RME	0.114	1	52	5	15	25550	1825	1.1E-06	1.19E-09	8.5E-11	7.0E-10	1.6E+05	2E+00	1E-05	7E+00	5E-05
Total	2	CTE														2E-05		9E-05
	2	RME														1E-04		4E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Black Sea Bass in Area 3, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	3	CTE	0.227	1	12	55	70	25550	20075	0.15	1.60E-05	1.3E-05	2.0E-05	2.0E+00	8E-01	3E-05
	3	RME	0.227	1	52	55	70	25550	20075	0.15	6.93E-05	5.4E-05	2.0E-05	2.0E+00	3E+00	1E-04
Older Child	3	CTE	0.227	1	12	10	40	25550	3650	0.15	2.80E-05	4.0E-06	2.0E-05	2.0E+00	1E+00	8E-06
	3	RME	0.227	1	52	10	40	25550	3650	0.15	1.21E-04	1.7E-05	2.0E-05	2.0E+00	6E+00	3E-05
Young Child	3	CTE	0.114	1	12	5	15	25550	1825	0.15	3.75E-05	2.7E-06	5.0E-05	2.0E+00	7E-01	5E-06
	3	RME	0.114	1	52	5	15	25550	1825	0.15	1.62E-04	1.2E-05	5.0E-05	2.0E+00	3E+00	2E-05
Total	3	CTE														4E-05
	3	RME														2E-04

Dioxin-Like PCBs- TEQ (mg/kg)

Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	PCB&TEQ HQ	PCB&TEQ ELCR
Adult	3	CTE	0.227	1	12	55	70	25550	20075	5.5E-06	5.86E-10	4.6E-10	7.0E-10	1.6E+05	8E-01	7E-05	2E+00	1E-04
	3	RME	0.227	1	52	55	70	25550	20075	5.5E-06	2.54E-09	2.0E-09	7.0E-10	1.6E+05	4E+00	3E-04	7E+00	4E-04
Older Child	3	CTE	0.227	1	12	10	40	25550	3650	5.5E-06	1.03E-09	1.5E-10	7.0E-10	1.6E+05	1E+00	2E-05	3E+00	3E-05
	3	RME	0.227	1	52	10	40	25550	3650	5.5E-06	4.45E-09	6.4E-10	7.0E-10	1.6E+05	6E+00	1E-04	1E+01	1E-04
Young Child	3	CTE	0.114	1	12	5	15	25550	1825	5.5E-06	1.37E-09	9.8E-11	7.0E-10	1.6E+05	2E+00	2E-05	3E+00	2E-05
	3	RME	0.114	1	52	5	15	25550	1825	5.5E-06	5.96E-09	4.3E-10	7.0E-10	1.6E+05	9E+00	7E-05	1E+01	9E-05
Total	3	CTE														1E-04		2E-04
	3	RME														5E-04		7E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Scup in Area 2, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.69	7.36E-05	5.8E-05	2.0E-05	2.0E+00	4E+00	1E-04
	2	RME	0.227	1	52	55	70	25550	20075	0.69	3.19E-04	2.5E-04	2.0E-05	2.0E+00	2E+01	5E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.69	1.29E-04	1.8E-05	2.0E-05	2.0E+00	6E+00	4E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.69	5.58E-04	8.0E-05	2.0E-05	2.0E+00	3E+01	2E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.69	1.72E-04	1.2E-05	2.0E-05	2.0E+00	9E+00	2E-05
	2	RME	0.114	1	52	5	15	25550	1825	0.69	7.47E-04	5.3E-05	5.0E-05	2.0E+00	1E+01	1E-04
Total	2	CTE														2E-04
	2	RME														8E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	6.6E-06	7.04E-10	5.5E-10	7.0E-10	1.6E+05	1E+00	9E-05	5E+00	2E-04
	2	RME	0.227	1	52	55	70	25550	20075	6.6E-06	3.05E-09	2.4E-09	7.0E-10	1.6E+05	4E+00	4E-04	2E+01	9E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	6.6E-06	1.23E-09	1.8E-10	7.0E-10	1.6E+05	2E+00	3E-05	8E+00	6E-05
	2	RME	0.227	1	52	10	40	25550	3650	6.6E-06	5.34E-09	7.6E-10	7.0E-10	1.6E+05	8E+00	1E-04	4E+01	3E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	6.6E-06	1.65E-09	1.2E-10	7.0E-10	1.6E+05	2E+00	2E-05	1E+01	4E-05
	2	RME	0.114	1	52	5	15	25550	1825	6.6E-06	7.15E-09	5.1E-10	7.0E-10	1.6E+05	1E+01	8E-05	3E+01	2E-04
Total	2	CTE														1E-04		3E-04
	2	RME														6E-04		1E-03

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Scup in Area 3, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.3	3.20E-05	2.5E-05	2.0E-05	2.0E+00	2E+00	5E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.3	1.39E-04	1.1E-04	2.0E-05	2.0E+00	7E+00	2E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.3	5.60E-05	8.0E-06	2.0E-05	2.0E+00	3E+00	2E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.3	2.43E-04	3.5E-05	2.0E-05	2.0E+00	1E+01	7E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.3	7.50E-05	5.4E-06	2.0E-05	2.0E+00	4E+00	1E-05
	2	RME	0.114	1	52	5	15	25550	1825	0.3	3.25E-04	2.3E-05	5.0E-05	2.0E+00	6E+00	5E-05
Total	2	CTE														8E-05
	2	RME														3E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	6.2E-06	6.61E-10	5.2E-10	7.0E-10	1.6E+05	9E-01	8E-05	3E+00	1E-04
	2	RME	0.227	1	52	55	70	25550	20075	6.2E-06	2.86E-09	2.3E-09	7.0E-10	1.6E+05	4E+00	4E-04	1E+01	6E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	6.2E-06	1.16E-09	1.7E-10	7.0E-10	1.6E+05	2E+00	3E-05	4E+00	4E-05
	2	RME	0.227	1	52	10	40	25550	3650	6.2E-06	5.01E-09	7.2E-10	7.0E-10	1.6E+05	7E+00	1E-04	2E+01	2E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	6.2E-06	1.55E-09	1.1E-10	7.0E-10	1.6E+05	2E+00	2E-05	6E+00	3E-05
	2	RME	0.114	1	52	5	15	25550	1825	6.2E-06	6.71E-09	4.8E-10	7.0E-10	1.6E+05	1E+01	8E-05	2E+01	1E-04
Total	2	CTE														1E-04		2E-04
	2	RME														6E-04		9E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Scup in Reference Area, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.14	1.49E-05	1.2E-05	2.0E-05	2.0E+00	7E-01	2E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.14	6.47E-05	5.1E-05	2.0E-05	2.0E+00	3E+00	1E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.14	2.61E-05	3.7E-06	2.0E-05	2.0E+00	1E+00	7E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.14	1.13E-04	1.6E-05	2.0E-05	2.0E+00	6E+00	3E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.14	3.50E-05	2.5E-06	2.0E-05	2.0E+00	2E+00	5E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.14	1.52E-04	1.1E-05	5.0E-05	2.0E+00	3E+00	2E-05
Total	2	CTE														4E-05
	2	RME														2E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	6.5E-07	6.93E-11	5.4E-11	7.0E-10	1.6E+05	1E-01	9E-06	8E-01	3E-05
	2	RME	0.227	1	52	55	70	25550	20075	6.5E-07	3.00E-10	2.4E-10	7.0E-10	1.6E+05	4E-01	4E-05	4E+00	1E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	6.5E-07	1.21E-10	1.7E-11	7.0E-10	1.6E+05	2E-01	3E-06	1E+00	1E-05
	2	RME	0.227	1	52	10	40	25550	3650	6.5E-07	5.26E-10	7.5E-11	7.0E-10	1.6E+05	8E-01	1E-05	6E+00	4E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	6.5E-07	1.62E-10	1.2E-11	7.0E-10	1.6E+05	2E-01	2E-06	2E+00	7E-06
	2	RME	0.114	1	52	5	15	25550	1825	6.5E-07	7.04E-10	5.0E-11	7.0E-10	1.6E+05	1E+00	8E-06	4E+00	3E-05
Total	2	CTE														1E-05		5E-05
	2	RME														6E-05		2E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Quahogs in Area 2, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.223	2.38E-05	1.9E-05	2.0E-05	2.0E+00	1E+00	4E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.223	1.03E-04	8.1E-05	2.0E-05	2.0E+00	5E+00	2E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.223	4.16E-05	5.9E-06	2.0E-05	2.0E+00	2E+00	1E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.223	1.80E-04	2.6E-05	2.0E-05	2.0E+00	9E+00	5E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.223	5.57E-05	4.0E-06	2.0E-05	2.0E+00	3E+00	8E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.223	2.41E-04	1.7E-05	5.0E-05	2.0E+00	5E+00	3E-05
Total	2	CTE														6E-05
	2	RME														2E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	3.89E-07	4.15E-11	3.3E-11	7.0E-10	1.6E+05	6E-02	5E-06	1E+00	4E-05
	2	RME	0.227	1	52	55	70	25550	20075	3.89E-07	1.80E-10	1.4E-10	7.0E-10	1.6E+05	3E-01	2E-05	5E+00	2E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	3.89E-07	7.26E-11	1.0E-11	7.0E-10	1.6E+05	1E-01	2E-06	2E+00	1E-05
	2	RME	0.227	1	52	10	40	25550	3650	3.89E-07	3.15E-10	4.5E-11	7.0E-10	1.6E+05	4E-01	7E-06	9E+00	6E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	3.89E-07	9.72E-11	6.9E-12	7.0E-10	1.6E+05	1E-01	1E-06	3E+00	9E-06
	2	RME	0.114	1	52	5	15	25550	1825	3.89E-07	4.21E-10	3.0E-11	7.0E-10	1.6E+05	6E-01	5E-06	5E+00	4E-05
Total	2	CTE														8E-06		7E-05
	2	RME														3E-05		3E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Quahogs in Clark's Cove, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.0623	6.64E-06	5.2E-06	2.0E-05	2.0E+00	3E-01	1E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.0623	2.88E-05	2.3E-05	2.0E-05	2.0E+00	1E+00	5E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.0623	1.16E-05	1.7E-06	2.0E-05	2.0E+00	6E-01	3E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.0623	5.04E-05	7.2E-06	2.0E-05	2.0E+00	3E+00	1E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.0623	1.56E-05	1.1E-06	2.0E-05	2.0E+00	8E-01	2E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.0623	6.75E-05	4.8E-06	5.0E-05	2.0E+00	1E+00	1E-05
Total	2	CTE														2E-05
	2	RME														7E-05

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.87E-07	1.99E-11	1.6E-11	7.0E-10	1.6E+05	3E-02	3E-06	4E-01	1E-05
	2	RME	0.227	1	52	55	70	25550	20075	1.87E-07	8.64E-11	6.8E-11	7.0E-10	1.6E+05	1E-01	1E-05	2E+00	6E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.86E-07	3.47E-11	5.0E-12	7.0E-10	1.6E+05	5E-02	8E-07	6E-01	4E-06
	2	RME	0.227	1	52	10	40	25550	3650	1.87E-07	1.51E-10	2.2E-11	7.0E-10	1.6E+05	2E-01	3E-06	3E+00	2E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.87E-07	4.67E-11	3.3E-12	7.0E-10	1.6E+05	7E-02	5E-07	8E-01	3E-06
	2	RME	0.114	1	52	5	15	25550	1825	1.87E-07	2.02E-10	1.4E-11	7.0E-10	1.6E+05	3E-01	2E-06	2E+00	1E-05
Total	2	CTE														4E-06		2E-05
	2	RME														2E-05		9E-05

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Quahogs in Area 3, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.0525	5.60E-06	4.4E-06	2.0E-05	2.0E+00	3E-01	9E-06
	2	RME	0.227	1	52	55	70	25550	20075	0.0525	2.43E-05	1.9E-05	2.0E-05	2.0E+00	1E+00	4E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.0525	9.80E-06	1.4E-06	2.0E-05	2.0E+00	5E-01	3E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.0525	4.24E-05	6.1E-06	2.0E-05	2.0E+00	2E+00	1E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.0525	1.31E-05	9.4E-07	2.0E-05	2.0E+00	7E-01	2E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.0525	5.68E-05	4.1E-06	5.0E-05	2.0E+00	1E+00	8E-06
Total	2	CTE														1E-05
	2	RME														6E-05

Dioxin-Like PCBs- TEQ (mg/kg)

Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	PCB&TEQ HQ	PCB&TEQ ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	6.92E-07	7.38E-11	5.8E-11	7.0E-10	1.6E+05	1E-01	9E-06	4E-01	2E-05
	2	RME	0.227	1	52	55	70	25550	20075	6.92E-07	3.20E-10	2.5E-10	7.0E-10	1.6E+05	5E-01	4E-05	2E+00	8E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	6.92E-07	1.29E-10	1.8E-11	7.0E-10	1.6E+05	2E-01	3E-06	7E-01	6E-06
	2	RME	0.227	1	52	10	40	25550	3650	6.92E-07	5.59E-10	8.0E-11	7.0E-10	1.6E+05	8E-01	1E-05	3E+00	2E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	6.92E-07	1.73E-10	1.2E-11	7.0E-10	1.6E+05	2E-01	2E-06	9E-01	4E-06
	2	RME	0.114	1	52	5	15	25550	1825	6.92E-07	7.49E-10	5.4E-11	7.0E-10	1.6E+05	1E+00	9E-06	2E+00	2E-05
Total	2	CTE														1E-05		3E-05
	2	RME														6E-05		1E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Quahogs in Reference Area, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.0122	1.30E-06	1.0E-06	2.0E-05	2.0E+00	7E-02	2E-06
	2	RME	0.227	1	52	55	70	25550	20075	0.0122	5.64E-06	4.4E-06	2.0E-05	2.0E+00	3E-01	9E-06
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.0122	2.28E-06	3.3E-07	2.0E-05	2.0E+00	1E-01	7E-07
	2	RME	0.227	1	52	10	40	25550	3650	0.0122	9.86E-06	1.4E-06	2.0E-05	2.0E+00	5E-01	3E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.0122	3.05E-06	2.2E-07	2.0E-05	2.0E+00	2E-01	4E-07
	2	RME	0.114	1	52	5	15	25550	1825	0.0122	1.32E-05	9.4E-07	5.0E-05	2.0E+00	3E-01	2E-06
Total	2	CTE														3E-06
	2	RME														1E-05

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	9.72E-08	1.04E-11	8.1E-12	7.0E-10	1.6E+05	1E-02	1E-06	8E-02	3E-06
	2	RME	0.227	1	52	55	70	25550	20075	9.72E-08	4.49E-11	3.5E-11	7.0E-10	1.6E+05	6E-02	6E-06	3E-01	1E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	9.72E-08	1.81E-11	2.6E-12	7.0E-10	1.6E+05	3E-02	4E-07	1E-01	1E-06
	2	RME	0.227	1	52	10	40	25550	3650	9.72E-08	7.86E-11	1.1E-11	7.0E-10	1.6E+05	1E-01	2E-06	6E-01	5E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	9.72E-08	2.43E-11	1.7E-12	7.0E-10	1.6E+05	3E-02	3E-07	2E-01	7E-07
	2	RME	0.114	1	52	5	15	25550	1825	9.72E-08	1.05E-10	7.5E-12	7.0E-10	1.6E+05	2E-01	1E-06	4E-01	3E-06
Total	2	CTE														2E-06		5E-06
	2	RME														9E-06		2E-05

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Lobster (Meat & Tomalley) in Area 2, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	2.7	2.88E-04	2.3E-04	2.0E-05	2.0E+00	1E+01	5E-04
	2	RME	0.227	1	52	55	70	25550	20075	2.7	1.25E-03	9.8E-04	2.0E-05	2.0E+00	6E+01	2E-03
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	2.7	5.04E-04	7.2E-05	2.0E-05	2.0E+00	3E+01	1E-04
	2	RME	0.227	1	52	10	40	25550	3650	2.7	2.18E-03	3.1E-04	2.0E-05	2.0E+00	1E+02	6E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	2.7	6.75E-04	4.8E-05	2.0E-05	2.0E+00	3E+01	1E-04
	2	RME	0.114	1	52	5	15	25550	1825	2.7	2.92E-03	2.1E-04	5.0E-05	2.0E+00	6E+01	4E-04
Total	2	CTE														7E-04
	2	RME														3E-03

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.6E-04	1.71E-08	1.3E-08	7.0E-10	1.6E+05	2E+01	2E-03	4E+01	3E-03
	2	RME	0.227	1	52	55	70	25550	20075	1.6E-04	7.39E-08	5.8E-08	7.0E-10	1.6E+05	1E+02	9E-03	2E+02	1E-02
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.6E-04	2.99E-08	4.3E-09	7.0E-10	1.6E+05	4E+01	7E-04	7E+01	8E-04
	2	RME	0.227	1	52	10	40	25550	3650	1.6E-04	1.29E-07	1.8E-08	7.0E-10	1.6E+05	2E+02	3E-03	3E+02	4E-03
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.6E-04	4.00E-08	2.9E-09	7.0E-10	1.6E+05	6E+01	5E-04	9E+01	6E-04
	2	RME	0.114	1	52	5	15	25550	1825	1.6E-04	1.73E-07	1.2E-08	7.0E-10	1.6E+05	2E+02	2E-03	3E+02	2E-03
Total	2	CTE														3E-03		4E-03
	2	RME														1E-02		2E-02

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Lobster (Meat & Tomalley) in Area 3, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.5	1.60E-04	1.3E-04	2.0E-05	2.0E+00	8E+00	3E-04
	2	RME	0.227	1	52	55	70	25550	20075	1.5	6.93E-04	5.4E-04	2.0E-05	2.0E+00	3E+01	1E-03
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.5	2.80E-04	4.0E-05	2.0E-05	2.0E+00	1E+01	8E-05
	2	RME	0.227	1	52	10	40	25550	3650	1.5	1.21E-03	1.7E-04	2.0E-05	2.0E+00	6E+01	3E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.5	3.75E-04	2.7E-05	2.0E-05	2.0E+00	2E+01	5E-05
	2	RME	0.114	1	52	5	15	25550	1825	1.5	1.62E-03	1.2E-04	5.0E-05	2.0E+00	3E+01	2E-04
Total	2	CTE														4E-04
	2	RME														2E-03

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.0E-04	1.07E-08	8.4E-09	7.0E-10	1.6E+05	2E+01	1E-03	2E+01	2E-03
	2	RME	0.227	1	52	55	70	25550	20075	1.0E-04	4.62E-08	3.6E-08	7.0E-10	1.6E+05	7E+01	6E-03	1E+02	7E-03
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.0E-04	1.87E-08	2.7E-09	7.0E-10	1.6E+05	3E+01	4E-04	4E+01	5E-04
	2	RME	0.227	1	52	10	40	25550	3650	1.0E-04	8.08E-08	1.2E-08	7.0E-10	1.6E+05	1E+02	2E-03	2E+02	2E-03
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.0E-04	2.50E-08	1.8E-09	7.0E-10	1.6E+05	4E+01	3E-04	5E+01	3E-04
	2	RME	0.114	1	52	5	15	25550	1825	1.0E-04	1.08E-07	7.7E-09	7.0E-10	1.6E+05	2E+02	1E-03	2E+02	1E-03
Total	2	CTE														2E-03		2E-03
	2	RME														9E-03		1E-02

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Lobster (Meat & Tomalley) in Reference Area, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.596	6.35E-05	5.0E-05	2.0E-05	2.0E+00	3E+00	1E-04
	2	RME	0.227	1	52	55	70	25550	20075	0.596	2.75E-04	2.2E-04	2.0E-05	2.0E+00	1E+01	4E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.596	1.11E-04	1.6E-05	2.0E-05	2.0E+00	6E+00	3E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.596	4.82E-04	6.9E-05	2.0E-05	2.0E+00	2E+01	1E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.596	1.49E-04	1.1E-05	2.0E-05	2.0E+00	7E+00	2E-05
	2	RME	0.114	1	52	5	15	25550	1825	0.596	6.45E-04	4.6E-05	5.0E-05	2.0E+00	1E+01	9E-05
Total	2	CTE														2E-04
	2	RME														7E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	4.3E-05	4.58E-09	3.6E-09	7.0E-10	1.6E+05	7E+00	6E-04	1E+01	7E-04
	2	RME	0.227	1	52	55	70	25550	20075	4.3E-05	1.99E-08	1.6E-08	7.0E-10	1.6E+05	3E+01	2E-03	4E+01	3E-03
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	4.3E-05	8.02E-09	1.1E-09	7.0E-10	1.6E+05	1E+01	2E-04	2E+01	2E-04
	2	RME	0.227	1	52	10	40	25550	3650	4.3E-05	3.48E-08	5.0E-09	7.0E-10	1.6E+05	5E+01	8E-04	7E+01	9E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	4.3E-05	1.07E-08	7.7E-10	7.0E-10	1.6E+05	2E+01	1E-04	2E+01	1E-04
	2	RME	0.114	1	52	5	15	25550	1825	4.3E-05	4.66E-08	3.3E-09	7.0E-10	1.6E+05	7E+01	5E-04	8E+01	6E-04
Total	2	CTE														9E-04		1E-03
	2	RME														4E-03		4E-03

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Lobster (Meat) in Area 2, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.149	1.59E-05	1.2E-05	2.0E-05	2.0E+00	8E-01	2E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.149	6.88E-05	5.4E-05	2.0E-05	2.0E+00	3E+00	1E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.149	2.78E-05	4.0E-06	2.0E-05	2.0E+00	1E+00	8E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.149	1.20E-04	1.7E-05	2.0E-05	2.0E+00	6E+00	3E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.149	3.72E-05	2.7E-06	2.0E-05	2.0E+00	2E+00	5E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.149	1.61E-04	1.2E-05	5.0E-05	2.0E+00	3E+00	2E-05
Total	2	CTE														4E-05
	2	RME														2E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	7.9E-06	8.42E-10	6.6E-10	7.0E-10	1.6E+05	1E+00	1E-04	2E+00	1E-04
	2	RME	0.227	1	52	55	70	25550	20075	7.9E-06	3.65E-09	2.9E-09	7.0E-10	1.6E+05	5E+00	5E-04	9E+00	6E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	7.9E-06	1.47E-09	2.1E-10	7.0E-10	1.6E+05	2E+00	3E-05	3E+00	4E-05
	2	RME	0.227	1	52	10	40	25550	3650	7.9E-06	6.39E-09	9.1E-10	7.0E-10	1.6E+05	9E+00	1E-04	2E+01	2E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	7.9E-06	1.97E-09	1.4E-10	7.0E-10	1.6E+05	3E+00	2E-05	5E+00	3E-05
	2	RME	0.114	1	52	5	15	25550	1825	7.9E-06	8.55E-09	6.1E-10	7.0E-10	1.6E+05	1E+01	1E-04	2E+01	1E-04
Total	2	CTE														2E-04		2E-04
	2	RME														7E-04		9E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Lobster (Meat) in Area 3, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.0982	1.05E-05	8.2E-06	2.0E-05	2.0E+00	5E-01	2E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.0982	4.54E-05	3.6E-05	2.0E-05	2.0E+00	2E+00	7E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.0982	1.83E-05	2.6E-06	2.0E-05	2.0E+00	9E-01	5E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.0982	7.94E-05	1.1E-05	2.0E-05	2.0E+00	4E+00	2E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.0982	2.45E-05	1.8E-06	2.0E-05	2.0E+00	1E+00	4E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.0982	1.06E-04	7.6E-06	5.0E-05	2.0E+00	2E+00	2E-05
Total	2	CTE														3E-05
	2	RME														1E-04

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	5.8E-06	6.18E-10	4.9E-10	7.0E-10	1.6E+05	9E-01	8E-05	1E+00	9E-05
	2	RME	0.227	1	52	55	70	25550	20075	5.8E-06	2.68E-09	2.1E-09	7.0E-10	1.6E+05	4E+00	3E-04	6E+00	4E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	5.8E-06	1.08E-09	1.5E-10	7.0E-10	1.6E+05	2E+00	2E-05	2E+00	3E-05
	2	RME	0.227	1	52	10	40	25550	3650	5.8E-06	4.69E-09	6.7E-10	7.0E-10	1.6E+05	7E+00	1E-04	1E+01	1E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	5.8E-06	1.45E-09	1.0E-10	7.0E-10	1.6E+05	2E+00	2E-05	3E+00	2E-05
	2	RME	0.114	1	52	5	15	25550	1825	5.8E-06	6.28E-09	4.5E-10	7.0E-10	1.6E+05	9E+00	7E-05	1E+01	9E-05
Total	2	CTE														1E-04		1E-04
	2	RME														5E-04		6E-04

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2014 draft RI Calculation of Risks of Lobster (Meat) in Reference Area, OU#3 New Bedford Harbor Superfund Site

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.0133	1.42E-06	1.1E-06	2.0E-05	2.0E+00	7E-02	2E-06
	2	RME	0.227	1	52	55	70	25550	20075	0.0133	6.14E-06	4.8E-06	2.0E-05	2.0E+00	3E-01	1E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.0133	2.48E-06	3.5E-07	2.0E-05	2.0E+00	1E-01	7E-07
	2	RME	0.227	1	52	10	40	25550	3650	0.0133	1.08E-05	1.5E-06	2.0E-05	2.0E+00	5E-01	3E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.0133	3.32E-06	2.4E-07	2.0E-05	2.0E+00	2E-01	5E-07
	2	RME	0.114	1	52	5	15	25550	1825	0.0133	1.44E-05	1.0E-06	5.0E-05	2.0E+00	3E-01	2E-06
Total	2	CTE														3E-06
	2	RME														1E-05

Dioxin-Like PCBs- TEQ (mg/kg)

																	PCB&TEQ	
Receptor	Area	Exposure	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.3E-07	1.39E-11	1.1E-11	7.0E-10	1.6E+05	2E-02	2E-06	9E-02	4E-06
	2	RME	0.227	1	52	55	70	25550	20075	1.3E-07	6.01E-11	4.7E-11	7.0E-10	1.6E+05	9E-02	8E-06	4E-01	2E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.3E-07	2.43E-11	3.5E-12	7.0E-10	1.6E+05	3E-02	6E-07	2E-01	1E-06
	2	RME	0.227	1	52	10	40	25550	3650	1.3E-07	1.05E-10	1.5E-11	7.0E-10	1.6E+05	2E-01	2E-06	7E-01	5E-06
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.3E-07	3.25E-11	2.3E-12	7.0E-10	1.6E+05	5E-02	4E-07	2E-01	8E-07
	2	RME	0.114	1	52	5	15	25550	1825	1.3E-07	1.41E-10	1.0E-11	7.0E-10	1.6E+05	2E-01	2E-06	5E-01	4E-06
Total	2	CTE														3E-06		6E-06
	2	RME														1E-05		3E-05

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Average Total PCB Concentration in Tautog in Area 2, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.15	1.60E-05	1.3E-05	2.0E-05	2.0E+00	8E-01	3E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.15	6.93E-05	5.4E-05	2.0E-05	2.0E+00	3E+00	1E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.15	2.80E-05	4.0E-06	2.0E-05	2.0E+00	1E+00	8E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.15	1.21E-04	1.7E-05	2.0E-05	2.0E+00	6E+00	3E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.15	3.75E-05	2.7E-06	2.0E-05	2.0E+00	2E+00	5E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.15	1.62E-04	1.2E-05	5.0E-05	2.0E+00	3E+00	2E-05
Total	2	CTE														4E-05
	2	RME														2E-04

Using average fish tissue concentration (n=7)

IR = Ingestion Rate (kg/meal)

FI = Fraction Ingested (unitless)

EF = Exposure Frequency (meals/yr)

ED = Exposure Duration (years)

BW = Body Weight (kg)

AT-c = Averaging Time-carcinogenic (days)

AT-nc = Averaging Time-non-carcinogenic

CF = Concentration in Fish (mg/kg)

ADD = Average Daily Dose (mg/kg/day)

LADD = Lifetime Average Daily Dose (mg/kg/day)

RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)

HQ = Hazard Quotient

ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc

LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c

HQ = ADD/RfD

ELCR = LADD*SF

EPA 2015 Calculation of Risks of Maximum Total PCB Concentration in Tautog in Area 2, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	1.9	2.03E-04	1.6E-04	2.0E-05	2.0E+00	1E+01	3E-04
	2	RME	0.227	1	52	55	70	25550	20075	1.9	8.78E-04	6.9E-04	2.0E-05	2.0E+00	4E+01	1E-03
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	1.9	3.54E-04	5.1E-05	2.0E-05	2.0E+00	2E+01	1E-04
	2	RME	0.227	1	52	10	40	25550	3650	1.9	1.54E-03	2.2E-04	2.0E-05	2.0E+00	8E+01	4E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	1.9	4.75E-04	3.4E-05	2.0E-05	2.0E+00	2E+01	7E-05
	2	RME	0.114	1	52	5	15	25550	1825	1.9	2.06E-03	1.5E-04	5.0E-05	2.0E+00	4E+01	3E-04
Total	2	CTE														5E-04
	2	RME														2E-03

Using maximum fish tissue concentration (n=7)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Average Total PCB Concentration in Tautog in Area 3, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.08	8.53E-06	6.7E-06	2.0E-05	2.0E+00	4E-01	1E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.08	3.70E-05	2.9E-05	2.0E-05	2.0E+00	2E+00	6E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.08	1.49E-05	2.1E-06	2.0E-05	2.0E+00	7E-01	4E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.08	6.47E-05	9.2E-06	2.0E-05	2.0E+00	3E+00	2E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.08	2.00E-05	1.4E-06	2.0E-05	2.0E+00	1E+00	3E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.08	8.66E-05	6.2E-06	5.0E-05	2.0E+00	2E+00	1E-05
Total	2	CTE														2E-05
	2	RME														9E-05

Using average fish tissue concentration (n=4)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Maximum Total PCB Concentration in Tautog in Area 3, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.11	1.17E-05	9.2E-06	2.0E-05	2.0E+00	6E-01	2E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.11	5.08E-05	4.0E-05	2.0E-05	2.0E+00	3E+00	8E-05
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.11	2.05E-05	2.9E-06	2.0E-05	2.0E+00	1E+00	6E-06
	2	RME	0.227	1	52	10	40	25550	3650	0.11	8.89E-05	1.3E-05	2.0E-05	2.0E+00	4E+00	3E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.11	2.75E-05	2.0E-06	2.0E-05	2.0E+00	1E+00	4E-06
	2	RME	0.114	1	52	5	15	25550	1825	0.11	1.19E-04	8.5E-06	5.0E-05	2.0E+00	2E+00	2E-05
Total	2	CTE														3E-05
	2	RME														1E-04

Using maximum fish tissue concentration (n=4)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Average Total PCB Concentration in Flounder in Area 2, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.72	7.68E-05	6.0E-05	2.0E-05	2.0E+00	4E+00	1E-04
	2	RME	0.227	1	52	55	70	25550	20075	0.72	3.33E-04	2.6E-04	2.0E-05	2.0E+00	2E+01	5E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.72	1.34E-04	1.9E-05	2.0E-05	2.0E+00	7E+00	4E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.72	5.82E-04	8.3E-05	2.0E-05	2.0E+00	3E+01	2E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.72	1.80E-04	1.3E-05	2.0E-05	2.0E+00	9E+00	3E-05
	2	RME	0.114	1	52	5	15	25550	1825	0.72	7.80E-04	5.6E-05	5.0E-05	2.0E+00	2E+01	1E-04
Total	2	CTE														2E-04
	2	RME														8E-04

Using average fish tissue concentration for summer and winter flounder (n=4)

IR = Ingestion Rate (kg/meal)

FI = Fraction Ingested (unitless)

EF = Exposure Frequency (meals/yr)

ED = Exposure Duration (years)

BW = Body Weight (kg)

AT-c = Averaging Time-carcinogenic (days)

AT-nc = Averaging Time-non-carcinogenic

CF = Concentration in Fish (mg/kg)

ADD = Average Daily Dose (mg/kg/day)

LADD = Lifetime Average Daily Dose (mg/kg/day)

RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)

HQ = Hazard Quotient

ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc

LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c

HQ = ADD/RfD

ELCR = LADD*SF

EPA 2015 Calculation of Risks of Maximum Total PCB Concentration in Flounder in Area 2, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	2	2.13E-04	1.7E-04	2.0E-05	2.0E+00	1E+01	3E-04
	2	RME	0.227	1	52	55	70	25550	20075	2	9.24E-04	7.3E-04	2.0E-05	2.0E+00	5E+01	1E-03
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	2	3.73E-04	5.3E-05	2.0E-05	2.0E+00	2E+01	1E-04
	2	RME	0.227	1	52	10	40	25550	3650	2	1.62E-03	2.3E-04	2.0E-05	2.0E+00	8E+01	5E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	2	5.00E-04	3.6E-05	2.0E-05	2.0E+00	2E+01	7E-05
	2	RME	0.114	1	52	5	15	25550	1825	2	2.17E-03	1.5E-04	5.0E-05	2.0E+00	4E+01	3E-04
Total	2	CTE														5E-04
	2	RME														2E-03

Using maximum fish tissue concentration for summer and winter flounder (n=4)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Average Total PCB Concentration in Flounder in Area 3, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.37	3.94E-05	3.1E-05	2.0E-05	2.0E+00	2E+00	6E-05
	2	RME	0.227	1	52	55	70	25550	20075	0.37	1.71E-04	1.3E-04	2.0E-05	2.0E+00	9E+00	3E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.37	6.90E-05	9.9E-06	2.0E-05	2.0E+00	3E+00	2E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.37	2.99E-04	4.3E-05	2.0E-05	2.0E+00	1E+01	9E-05
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.37	9.24E-05	6.6E-06	2.0E-05	2.0E+00	5E+00	1E-05
	2	RME	0.114	1	52	5	15	25550	1825	0.37	4.01E-04	2.9E-05	5.0E-05	2.0E+00	8E+00	6E-05
Total	2	CTE														9E-05
	2	RME														4E-04

Using average fish tissue concentration for summer and winter flounder (n=2)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Maximum Total PCB Concentration in Flounder in Area 3, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	0.62	6.61E-05	5.2E-05	2.0E-05	2.0E+00	3E+00	1E-04
	2	RME	0.227	1	52	55	70	25550	20075	0.62	2.86E-04	2.3E-04	2.0E-05	2.0E+00	1E+01	5E-04
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	0.62	1.16E-04	1.7E-05	2.0E-05	2.0E+00	6E+00	3E-05
	2	RME	0.227	1	52	10	40	25550	3650	0.62	5.01E-04	7.2E-05	2.0E-05	2.0E+00	3E+01	1E-04
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	0.62	1.55E-04	1.1E-05	2.0E-05	2.0E+00	8E+00	2E-05
	2	RME	0.114	1	52	5	15	25550	1825	0.62	6.71E-04	4.8E-05	5.0E-05	2.0E+00	1E+01	1E-04
Total	2	CTE														2E-04
	2	RME														7E-04

Using maximum fish tissue concentration for summer and winter flounder (n=2)

IR = Ingestion Rate (kg/meal)

FI = Fraction Ingested (unitless)

EF = Exposure Frequency (meals/yr)

ED = Exposure Duration (years)

BW = Body Weight (kg)

AT-c = Averaging Time-carcinogenic (days)

AT-nc = Averaging Time-non-carcinogenic

CF = Concentration in Fish (mg/kg)

ADD = Average Daily Dose (mg/kg/day)

LADD = Lifetime Average Daily Dose (mg/kg/day)

RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)

HQ = Hazard Quotient

ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc

LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c

HQ = ADD/RfD

ELCR = LADD*SF

EPA 2015 Calculation of Risks of Maximum Total PCB Concentration in Eel in Area 1, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	133	1.42E-02	1.1E-02	2.0E-05	2.0E+00	7E+02	2E-02
	2	RME	0.227	1	52	55	70	25550	20075	133	6.14E-02	4.8E-02	2.0E-05	2.0E+00	3E+03	1E-01
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	133	2.48E-02	3.5E-03	2.0E-05	2.0E+00	1E+03	7E-03
	2	RME	0.227	1	52	10	40	25550	3650	133	1.08E-01	1.5E-02	2.0E-05	2.0E+00	5E+03	3E-02
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	133	3.32E-02	2.4E-03	2.0E-05	2.0E+00	2E+03	5E-03
	2	RME	0.114	1	52	5	15	25550	1825	133	1.44E-01	1.0E-02	5.0E-05	2.0E+00	3E+03	2E-02
Total	2	CTE														3E-02
	2	RME														1E-01

Using maximum fish tissue concentration (n=22)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Average Total PCB Concentration in Eel in Area 1, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	48.9	5.21E-03	4.1E-03	2.0E-05	2.0E+00	3E+02	8E-03
	2	RME	0.227	1	52	55	70	25550	20075	48.9	2.26E-02	1.8E-02	2.0E-05	2.0E+00	1E+03	4E-02
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	48.9	9.12E-03	1.3E-03	2.0E-05	2.0E+00	5E+02	3E-03
	2	RME	0.227	1	52	10	40	25550	3650	48.9	3.95E-02	5.6E-03	2.0E-05	2.0E+00	2E+03	1E-02
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	48.9	1.22E-02	8.7E-04	2.0E-05	2.0E+00	6E+02	2E-03
	2	RME	0.114	1	52	5	15	25550	1825	48.9	5.29E-02	3.8E-03	5.0E-05	2.0E+00	1E+03	8E-03
Total	2	CTE														1E-02
	2	RME														5E-02

Using average fish tissue concentration (n=22)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Average Total PCB Concentration in Eel in Area 2, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	40.2	4.29E-03	3.4E-03	2.0E-05	2.0E+00	2E+02	7E-03
	2	RME	0.227	1	52	55	70	25550	20075	40.2	1.86E-02	1.5E-02	2.0E-05	2.0E+00	9E+02	3E-02
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	40.2	7.50E-03	1.1E-03	2.0E-05	2.0E+00	4E+02	2E-03
	2	RME	0.227	1	52	10	40	25550	3650	40.2	3.25E-02	4.6E-03	2.0E-05	2.0E+00	2E+03	9E-03
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	40.2	1.00E-02	7.2E-04	2.0E-05	2.0E+00	5E+02	1E-03
	2	RME	0.114	1	52	5	15	25550	1825	40.2	4.35E-02	3.1E-03	5.0E-05	2.0E+00	9E+02	6E-03
Total	2	CTE														1E-02
	2	RME														4E-02

Using average fish tissue concentration (n=4)

IR = Ingestion Rate (kg/meal)
FI = Fraction Ingested (unitless)
EF = Exposure Frequency (meals/yr)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT-c = Averaging Time-carcinogenic (days)
AT-nc = Averaging Time-non-carcinogenic
CF = Concentration in Fish (mg/kg)
ADD = Average Daily Dose (mg/kg/day)
LADD = Lifetime Average Daily Dose (mg/kg/day)
RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)
HQ = Hazard Quotient
ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc
LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c
HQ = ADD/RfD
ELCR = LADD*SF

EPA 2015 Calculation of Risks of Maximum Total PCB Concentration in Eel in Area 2, New Bedford Harbor Superfund Site 2013 data

Total PCB Congeners (mg/kg)

Receptor	Area	Exp.	IR	FI	EF	ED	BW	AT-c	AT-nc	CF	ADD	LADD	RfD	SF	HQ	ELCR
Adult	2	CTE	0.227	1	12	55	70	25550	20075	83	8.85E-03	7.0E-03	2.0E-05	2.0E+00	4E+02	1E-02
	2	RME	0.227	1	52	55	70	25550	20075	83	3.83E-02	3.0E-02	2.0E-05	2.0E+00	2E+03	6E-02
Older Child	2	CTE	0.227	1	12	10	40	25550	3650	83	1.55E-02	2.2E-03	2.0E-05	2.0E+00	8E+02	4E-03
	2	RME	0.227	1	52	10	40	25550	3650	83	6.71E-02	9.6E-03	2.0E-05	2.0E+00	3E+03	2E-02
Young Child	2	CTE	0.114	1	12	5	15	25550	1825	83	2.07E-02	1.5E-03	2.0E-05	2.0E+00	1E+03	3E-03
	2	RME	0.114	1	52	5	15	25550	1825	83	8.99E-02	6.4E-03	5.0E-05	2.0E+00	2E+03	1E-02
Total	2	CTE														2E-02
	2	RME														9E-02

Using maximum fish tissue concentration (n=4)

IR = Ingestion Rate (kg/meal)

FI = Fraction Ingested (unitless)

EF = Exposure Frequency (meals/yr)

ED = Exposure Duration (years)

BW = Body Weight (kg)

AT-c = Averaging Time-carcinogenic (days)

AT-nc = Averaging Time-non-carcinogenic

CF = Concentration in Fish (mg/kg)

ADD = Average Daily Dose (mg/kg/day)

LADD = Lifetime Average Daily Dose (mg/kg/day)

RfD = Reference Dose (mg/kg/day)

SF = oral Slope Factor (per mg/kg/day)

HQ = Hazard Quotient

ELCR = Elevated Lifetime Cancer Risk

ADD = CF*IR*FI*ED*EF*1/BW*1/AT-nc

LADD = CF*IR*FI*ED*EF*1/BW*1/AT-c

HQ = ADD/RfD

ELCR = LADD*SF

RE: Eel and flounder

Delete Reply Reply all Forward

MV Malkoski, Vincent (FWE) <Vincent.Malkoski@MassMail.State.M Mark as unread
Mon 9/28/2015 12:09 PM

To: Lombardo, Ginny;

Cc: ☐ Craffey, Paul (DEP) <paul.craffey@state.ma.us>; ☐ Sugatt, Richard;

You replied on 9/28/2015 12:17 PM.

This item will expire in 0 days.

Hi Ginny

Eels will pass through Area III but they do not aggregate anywhere in sufficient numbers or with enough frequency for us to catch them. Likewise, it is unlikely that anyone else is catching them out there other than as a random event. Directed fishing occurs in brackish and freshwater. Bottom line, no worries for Area III.

Flounder – In years past, winter flounder (*Pseudopleuronectes americanus*) were taken from Areas 2 &3, however the species has been in serious decline throughout the southeastern management area. Basically, the stock has crashed. We've tried to catch them over the years but have had no luck in the last 10+ years. They do occur, but again not in sufficient numbers to be caught for samples or regular consumption. I honestly cannot remember the last time I saw anything other than a juvenile (age 0 – age 2). Summer flounder or fluke *(Paralichthys dentatus)* do move into the area in late spring but we've never submitted these as samples and I am not aware of a data set for this area.

Vin

Please note new office address and phone number

Vin Malkoski
MA Division of Marine Fisheries
1213 Purchase Street
New Bedford, MA 02740
508-990-2860, ext.107 Fax: 508-990-0449

From: Lombardo, Ginny [mailto:Lombardo.Ginny@epa.gov]
Sent: Monday, September 28, 2015 11:40 AM
To: Malkoski, Vincent (FWE)
Cc: Craffey, Paul (DEP); Sugatt, Richard
Subject: Eel and flounder

Vin-

We are looking at the New Bedford fish tissue data to confirm the protectiveness of our fish consumption advisories. We have no data from any of the years for eel in Area III. Is this species not found in Area III? Our advisories consider human health risks from eating 1-4 meals per month of a species. Is this species potentially available in Area III at an abundance that could possibly meet a 1-4 meal per month consumption frequency?

Also, for flounder, we only have 2 data points from Area III from 2003. Is this species not readily found in Area III?

I am of course trying to tie up some loose ends on this data for the end of FY – which is Wednesday – so if you could get back to me asap it would be a HUGE help. Thanks.

Ginny Lombardo, Team Leader
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