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New Bedford Harbor Superfund Site

U.S. Army Corps of Engineers New England District

Draft Final Ambient Air Monitoring Plan for Remediation Activities

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ACRONYMS AND ABBREVIATIONS

AAL	allowable ambient limit
BMP	Best Management Practices
CAD	confined aquatic disposal
CDF	confined disposal facility
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
Foster Wheeler	Foster Wheeler Environmental Corporation
HQ	hazard quotient
Jacobs	Jacobs Engineering Group, Inc.
LHCC	Lower Harbor CAD Cell
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter of air
mg/kg-day	milligrams per kilogram per day
NAE	U.S. Army Corps of Engineers – New England District
ng/m^3	nanograms per cubic meter of air
OU	operable unit
OVM	organic vapor monitor
PAL	perimeter action limit
PAV	perimeter assessment value
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PETS	Public Exposure Tracking System
PID	photoionization detector
PM	particulate matter
ppm	parts per million
PUF	polyurethane foam

RAM	respirable aerosol monitor
RBG	risk based goals
TAT	turn-around-time
TCE	trichloroethene
TERC	Total Environmental Restoration Contract
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound
WWTP	waste water treatment plant

1.0 INTRODUCTION

This work plan describes the ambient air sampling program for the New Bedford Harbor Superfund Site and presents the locations, sampling strategies, and exposure limits for monitoring remedial activities in the Harbor. The sampling strategy follows 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 by Jacobs Engineering Group, Inc. (Jacobs, 2006b). This *Draft 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. 4 (Air Monitoring Plan 2015) supersedes the previous version (Jacobs, 2006b) and sets the actions necessary to match the remedial approaches forthcoming over the next several years. The knowledge and experience gathered over the past 10 years of harbor remediation and air monitoring have enabled refinements that are incorporated in this Air Monitoring Plan 2015 update to further ensure that public health will continue to be protected as the project moves into an accelerated schedule.

1.1 Site Setting

The New Bedford Harbor Superfund Site is located in Bristol County, Massachusetts (Figure 1-1), approximately 55 miles south of Boston, and is bordered by the towns of Acushnet and Fairhaven on the east side of New Bedford Harbor, and by the City of New Bedford and the Town of Dartmouth on the west. From north to south, the Site extends from the upper reaches of the Acushnet River estuary through New Bedford's commercial port and into Buzzards Bay. The Harbor is geographically divided into three areas and comprises approximately 18,000 acres. The "Upper Harbor" refers to that portion of the Harbor north of the Coggeshall Street Bridge and is approximately 187 acres in size. The "Lower Harbor" refers to that part of the Harbor south of the Coggeshall Street Bridge and north of the Hurricane Barrier comprising approximately 850 acres. The "Outer Harbor" is that portion of the Harbor south of the Hurricane Barrier and is approximately 17,000 acres in size. The sediments in the harbor are contaminated with high levels of polychlorinated biphenyls (PCBs) from the industrial development surrounding the harbor. From the 1940s through the 1970s, electrical capacitor manufacturing plants discharged PCBs into New Bedford Harbor and its estuaries. In the mid-1970s U.S. Environmental Protection Agency (EPA) sampling identified PCBs in the river and harbor sediments greater than 100,000 milligrams per kilogram (mg/kg). In 1979, the Massachusetts Department of Public Health prohibited fishing and shell-fishing from the river and harbor due to the high levels of PCB contamination found in the harbor and in the seafood from the area. The site was included on the National Priorities List in September 1983 as one of the most contaminated PCB sites in the United States.

Removal of PCB-contaminated sediment in the Upper and Lower Harbors was selected as the remedial action for the New Bedford Harbor Site in accordance with the 1998 Record of Decision (ROD) (EPA 1998). The focus of the ROD is to reduce PCB concentrations in the sediment in subtidal and intertidal areas. PCBs in sediment are bioavailable to the food chain and consumption of contaminated seafood is the primary human health risk driver at the site. An institutional control that bans the taking of fish in the Upper and Lower Harbor and restricts the taking of fish and shellfish in the outer harbor is in effect.

The current remedial approach is primarily hydraulic dredging and management of contaminated sediments and treatment of filtrate, which includes desanding, dewatering, and wastewater treatment operations. Future operations will also include mechanical excavation of subtidal areas and intertidal areas along the shorelines, excavation of previously stored materials in Area C, and mechanical excavation and transport of sediments to a confined aquatic disposal (CAD) cell in the Lower Harbor (Figure 1-2).

Although PCB emission sources have not been a major risk driver for the New Bedford Harbor Site, a comprehensive ambient air monitoring program has been implemented to monitor PCBs in the air and ensure that inhalation exposure budgets remain below risk thresholds. Given the ability of PCBs to volatilize and the highly contaminated nature of sediments in New Bedford Harbor, air monitoring will be conducted to provide an adequate and protective ambient air monitoring network. The air monitoring network allows for the tracking of exposure budgets (chronic exposure over time) for the purpose of protecting the public from inhalation exposures related to remediation activity and to verify and update air dispersion models conducted for the site.

PCB emission sources at New Bedford Harbor consist of background and remediation sources. The background sources include the following:

- PCB contaminated harbor mudflat and intertidal sediments, and
- point or land sources with PCB contamination.

The volatilization of PCBs from exposed unremediated sediments, and other sources of PCB emissions in the vicinity, contributes to the current background ambient air levels. Remediation sources include airborne PCBs that may be released due to disturbance of harbor sediments as a result of remediation activities.

During the Baseline Ambient Air Sampling and Analysis Program, (which was conducted from June 1999 through May 2000 for EPA), Foster Wheeler Environmental Corporation (Foster Wheeler 2001a) collected ambient air samples from six baseline sampling stations on a monthly basis. Foster Wheeler derived a yearly average from the data collected at these stations. Jacobs derived quarterly average concentrations for the same air stations and continues to use quarterly averages for determining ambient background concentrations.

1.2 Plan Development History

EPA produced two major plans that have assessed the potential for health impacts associated with emissions of volatile PCBs during the remediation of PCB impacted sediments and the development of a cumulative exposure budgeting program that ensures the protection of public health. The development of the health-based cumulative exposure budgets is presented in the *Draft Final Development of PCB Air Action Levels for the Protection of the Public* (Foster Wheeler 2001a) (the Development Document). The principal components associated with the implementation of the cumulative exposure tracking program are described in the document *Draft Final Implementation Plan for the Protection of the Public from Volatilized PCBs during Contaminated Sediment Remediation at the New Bedford Harbor Superfund Site* (Foster Wheeler 2001b) (the Implementation Plan). The Implementation Plan provided guidelines for implementing the principal components of an air sampling program including: locating sampling stations, collecting air samples, evaluating air sample data, tracking cumulative exposures, and recommending appropriate responses to reduce or mitigate potential PCB inhalation exposures to the public. Foster Wheeler prepared the original Air Management Plan entitled *Draft Plan for the Sampling of Ambient Air PCB Concentrations to Support Decisions to Ensure the Protection of the Public during Remediation Activities, New Bedford Harbor Superfund Site, New Bedford Harbor, Massachusetts* (Foster Wheeler 2003) under U.S. Army Corps of Engineers (USACE) Total Environmental Restoration Contract (TERC) No. DACW33-94-D-0002 (Foster Wheeler 2003). In January 2004, prior to the initiation of full-scale remediation activities, the USACE – New England District (NAE) modified the Plan (Revision No. 2 to the Plan) to incorporate changes in the remediation approach, primarily using hydraulic dredging rather than mechanical (Jacobs 2005). The third revision (Plan Revision No.3) of the Air Management Plan was issued in 2006 and modified the Plan to incorporate changes based on the results of the 2004 and 2005 ambient air sampling program, the results of the 2005 air modeling efforts (Jacobs 2005) that utilized previous modeling programs, and historical air data (Jacobs 2006b). Additionally in the Plan Revision No. 3, the allowable ambient limits (AALs) were recalculated for the increased exposure duration to 26 years to account for the estimated period of performance of the remedy. These recalculations of the AALs resulted in lower, more conservative AALs and were used until this revision.

1.3 Reason for Revisions

In this Revision No. 4, the Air Monitoring Plan has been updated to account for several important developments in the remediation of the New Bedford Harbor Superfund Site. These new and/or planned future conditions include:

- expedited overall remediation schedule from 26 years in the 2006 Air Monitoring Plan Revision No. 3 (Jacobs 2006b) to 18 years;
- extension of the dredge season from the previous average of 45 dredge days per year to a projected annual average of approximately 100 to 170 days per year;

- concurrent hydraulic and mechanical dredging in the upper harbor;
- mechanical dredging and the filling and capping of the CAD cell in the lower harbor;
- removal of the NSTAR submarine electrical cables; and,
- remediation of intertidal and shoreline areas in the Upper and Lower Harbors, including Marsh Island.

Likewise, additional factors and conditions that warrant consideration in the Air Monitoring Plan update for the Upper and Lower Harbors that were not considered in the 2006 Plan Revision (Jacobs 2006b) include:

- intertidal and shoreline excavation will disturb a few areas of sediments with potential PCB concentrations greater than 5000 mg/kg, limited primarily in the areas north and east of the cable crossing and east of Aerovox;
- areas within the lower portion of the Upper Harbor and areas within the Lower Harbor will be mechanically dredged and sediments from these operations will be transported by scow to fill the Lower Harbor CAD Cell (LHCC);
- mechanical excavation of the former Aerovox facility shoreline; and,
- mechanical excavation of Cell #1 in the confined disposal facility (CDF) located in Area C.

To ensure an adequate and protective ambient air monitoring program that accounts for these planned activities, additional air sampling approaches are required to maintain a robust and understandable ambient air monitoring program. New approaches have been added so that the reporting of ambient air results is responsive to community concerns. This Air Monitoring Plan Revision No. 4 presents the rationale for identifying sample locations and the overall sampling strategy for collecting ambient air PCB, volatile organic compounds (VOCs), and/or particulate matter (PM) concentration data during remediation activities beginning in 2015. This Air Monitoring Plan includes the following:

- ensures adequate sampling station coverage for protection of community health during the remedial activities by evaluating the relative density of the sampling network based on modeled results, receptor locations, and meteorological information (primarily annual wind rose data);
- updates of non-carcinogenic risk criteria;
- adds Public Exposure Tracking System (PETS) for tracking of non-carcinogenic risk based goals;
- adds sampling stations to complete the spatial coverage necessary to monitor the remedial activities within the Lower Harbor;
- clarifies the decision logic and trigger levels for notifications, resampling, laboratory analysis turn-around-time (TAT), and operational modifications;
- includes Best Management Practices (BMPs) to minimize and mitigate ambient air impacts from remedial operations; and
- implements additional procedures for the routine reporting of air sampling results to the public through the New Bedford Harbor Superfund Site website.

1.4 Upcoming Remedial Activities

Remediation of contaminated sediments in New Bedford Harbor will consist of a multi-phase approach using several sediment removal strategies to address contaminated sediments in the harbor. Hydraulic dredging will be employed in the upper harbor where sediment is removed from the harbor bottom and piped to facilities for processing prior to shipment offsite. Contaminated sediment will be piped to a desanding facility and subsequently to a dewatering facility. The sand and filter cake that is produced will be shipped to a licensed off-site disposal facility. The on-site waste water treatment plant (WWTP) will treat the process water and the treated water will be returned to the lower harbor. Mechanical dredging will be employed for the removal of all lower harbor sediments, those sediments to be placed in the LHCC and additional locations where hydraulic dredging is impractical. In contrast to hydraulic dredging, mechanical dredging does not include follow-on sediment processing. Subtidal sediments collected by mechanical dredging will be placed in scows for transport and subsequent disposal in the EPA's Lower Harbor CAD Cell. Mechanical excavation will be used to remove PCB contaminated sediments in the intertidal areas and the shoreline areas within the Upper Harbor and in the Lower Harbor (including Marsh Island). These intertidal and shoreline sediments will be ultimately transported to a licensed off-site facility for disposal.

1.5 Objectives of the Plan

The objective of this Plan is to describe the ambient air monitoring program that will be implemented to support decisions to minimize risk to the public in terms of a cumulative exposure budget from volatile and particulate contamination released to the air during remediation activities. In the process of remedial operations, vapor phase PCBs above background concentrations could be released into the atmosphere and transported to neighboring communities. Additionally, there is a limited potential of remedial activities to release VOC and respirable particulate matter into the atmosphere. Actions to monitor and control releases of PCBs as well as any VOCs or PM that may be released during remedial operations are discussed within this plan. This Plan update presents the monitoring and reporting program that will be implemented to protect public health from chronic exposure to PCBs and acute exposure to VOCs and PM during the next phase of harbor remediation activities.

1.6 Plan Layout

This Air Monitoring Plan is divided into seven sections. Section 1.0 provides an overview of the air monitoring program, background on the New Bedford Harbor Site, and a brief discussion of upcoming remedial activities. Section 2.0 presents the risk based goals (RBGs), provides an overall summary of cumulative exposure budgeting and tracking, and discusses the role of atmospheric dispersion modeling in support of this Air Monitoring Plan. This section also includes the derivation of the carcinogenic budget and non-carcinogenic budget. The non-carcinogenic level for ambient air PCB was updated and incorporated into the Air Monitoring Plan consistent with similar PCB remediation projects in the United States. Section 3.0 addresses the development of the time series of airborne PCB concentrations, presents the ambient air monitoring station locations and explains the basis for the locations. It also specifies the use of a network of sampling station locations to collect the data needed to track potential exposures relative to the established budgets. The selection of locations, sampling methods and sampling frequencies for the sampling stations based on specific remedial actions are explained. Section 4.0 discusses Best Management Practices to be implemented to reduce impacts to ambient air quality during remedial actions. Section 5.0 discusses reporting procedures for each of the constituents monitored and general frequencies for each. Section 6.0 discusses the role of annual review of the Air Monitoring Plan. Section 7.0 lists the references cited in this Air Monitoring Plan.

2.0 EXPOSURE DETERMINATION

This section describes the process for defining the cumulative exposure budget for a sampling location and how the ambient air PCB data will be tracked considering both carcinogenic and non-carcinogenic exposure budgets. This section also addresses concentrations of VOCs and PM that will be monitored to protect nearby residents from acute exposures to these contaminants.

2.1 PCBs

The ambient air PCB concentrations have been measured at locations around the remediation area since 1999, and these data have been used for the determination of cumulative exposures over time. Since 2004, ambient air data have been collected to identify and track air quality trends at sampling locations affected by remedial activities in the upper and lower harbors. These trends are in turn, providing projected cumulative exposures at nearby potential points of public exposure versus a carcinogenic exposure budget. Ambient air concentrations, RBGs, air dispersion modeling, and cumulative exposure budgets as determined by PETS curves are presented in this section.

2.1.1 Ambient Concentrations

Background ambient concentrations of PCBs in air are attributable to existing conditions in the Harbor, such as volatilization of PCBs from sediments exposed due to tidal action as well as other sources of PCBs. During the baseline ambient air sampling and analysis program, (which was conducted from June 1999 through May 2000), Foster Wheeler collected background air samples from six sampling stations on a monthly basis for EPA (Foster Wheeler 2001c). In some cases the samples were collected on a more frequent basis. From these data, a yearly average baseline value from the ambient background data was derived for these stations and is presented in the Development Document (Foster Wheeler 2001a).

Since 2005 quarterly average PCB concentrations that reflect seasonal variability have been used to supplement periods of non-activity, that is, when air monitoring did not occur (data gaps). The baseline air quality stations and the associated quarterly baseline concentrations are presented in Table 2-1. These quarterly baseline concentrations will continue to be used to fill data gaps in the cumulative exposure budget calculation during periods of non-activity. Current background concentrations will be evaluated based on recent measurements during periods of non-activity. If there is a substantial change from the 1999 - 2000 baseline concentrations, going forward, the more recent background levels will be used to represent periods of non-activity.

2.1.2 History of Risk Based Goals for Carcinogenic and Non-Carcinogenic Effects

The AALs typically represents the concentration of a contaminant in the ambient air to which a person could be exposed over a specified period of time without adverse health effects, which originally was set at 5 and 10 years (Foster Wheeler 2001a), and then increased to 26 years (Jacobs 2006b), as explained in the paragraph below. The Development Document (Foster Wheeler 2001a) presents the development and calculation of the AALs originally used to evaluate cumulative exposures to airborne PCBs. The AALs for PCBs were developed considering child and adult resident and commercial worker receptors. The selection of the appropriate AAL depended on the type of receptors at the potential exposure point (see Section 3.2 of this Air Monitoring Plan). Appropriate body weights, breath (lung) volumes, and breathing rates were assumed for each receptor. The AALs are a direct function of the potential duration of exposure.

In the 2006 update to the Air Monitoring Plan, the AALs were revised to account for a longer duration of remedial actions of 26 years (Jacobs 2006b). This increased duration results in the calculated AALs being more conservative (lower) exposure values. Applying 26 years of exposure results in AALs for a child resident and commercial worker of 202 and 344 nanograms of total PCBs per cubic meter of air (ng/m^3), respectively. The results of air monitoring conducted since 2002 have been tracked against these AALs to calculate the cumulative exposure budget at each monitoring station, as documented in annual data summary reports.

The approach for tracking human health risk from exposure to PCBs in air previously used at New Bedford Harbor tracked a cumulative exposure budget over time to evaluate the potential cancer risk from periodic increases in PCB concentrations associated with dredging or other disturbance of sediments.

2.1.3 Development of Risk Based Goals for Carcinogenic and Noncarcinogenic Effects

In this Air Monitoring Plan update, the technical risk assessment approach to the original methodology for derivation of AALs has been modified slightly and is incorporated to adopt approaches updated by the EPA. The term Ambient Allowable Limit (AAL) has been changed to the term risk based goals (RBGs). In the past, the AAL was construed to be an air concentration that could not be exceeded, whereas the RBG is understood to be an air concentration when averaged over time will not result in unacceptable excess cancer risks or noncancer hazards. This change in the conceptual approach reflects current risk assessment methodologies.

The methodology described in Appendix A, was used to calculate the cancer risk and non-cancer hazards and trigger levels for the following receptors:

- child resident over the most recent six years (non-cancer),
- long-term resident from childhood to adult over the entire sampling period since beginning sampling (cancer),
- short-term worker over the most recent six years (non-cancer), and
- long-term worker over the entire sampling period since beginning sampling (cancer).

The exposure duration of six years for a child resident was chosen because it is the minimum exposure duration for chronic exposures and coincides with the EPA default exposure duration for a young child (birth to age 6), the most sensitive receptor. EPA's current default exposure duration is 6 years for a child resident, 20 years for an adult resident (for a total of 26 years), and 25 years for a worker.

Using the approach presented for the evaluation of cancer risk and non-cancer hazards (Appendix A), RBGs and trigger levels have been derived for the New Bedford Harbor cleanup.

Receptor	**RBG Non-cancer (ng/m^3)**	**RBG Cancer (ng/m^3)**	**1st Trigger (ng/m^3)**	**2nd Trigger (ng/m^3)**
Child/Adult resident	110	202	110[1]	330[2]
Long-term worker	Not Applicable	344	344[3]	1100[3]

Notes:

[1] HQ-1

[2] HQ-3

3 ECLR 1E-05

Consistent with risk management guidance for Comprehensive Environmental Response, Compensation, and Liability Act sites (EPA 1990), the risk management criteria for dredging activity will be hazard quotient (HQ) values approaching HQ=1 and excess lifetime cancer risk (ELCR) values of 1E-05. The first RBG trigger for PCBs is 110 ng/m^3 based on non-cancer hazards for a child resident. The 110 ng/m^3 level was approved by EPA for the Hudson River PCBs Superfund Site. A trigger for non-cancer hazards to a child resident has been set at 330, a HQ = 3 (330 ng/m^3). The RBG for long-term workers in industrial settings is based on cancer risk over the working lifetime of the worker. All of the triggers presented are to maintain exposures below chronic exposure budgets. Exceedance of any trigger will result in the evaluation of mitigation options that are described in Section 3.3.1.

2.1.4 Air Dispersion Modeling

Air dispersion modeling has been conducted for pilot studies and for remedial dredging activities at New Bedford Harbor. Both Foster Wheeler and Jacobs have performed air dispersion modeling utilizing EPA's Industrial Source Complex Model for the purpose of predicting concentrations of ambient air PCBs generated by dredging and the associated treatment facilities. The historical results of the modeling efforts are described in detail from Foster Wheeler (2001b) and Jacobs (2005b, 2006a, 2007, 2008a, 2009, 2010, 2011, 2012 and 2014). This air dispersion modeling approach will continue for the duration of air sampling operations conducted under this remedial action program.

Since 2004, Jacobs has conducted annual dispersion modeling for two purposes. The first was to aid in the placement of sampling stations and to predict the ambient air concentrations at locations a distance away from the various remediation and background source areas. As site-specific air sampling data has been collected at various receptor locations, the air modeling was refined to more closely represent the actual site sampling results in an effort to improve model predictions. The second was to further refine the location and concentration of maximum ground impact (i.e., the highest ground level ambient air concentration of PCBs released during remedial activities). Because the modeling results were primarily based on the dispersion of documented source concentrations, it was critical that the initial model input data reflect the maximum starting source concentrations to avoid underestimating the potential exposure to downwind receptors. Subsequently through 2014, integrated ambient PCB results continue to support the fact that both Area C desanding plant (Stations 47, 48, and 49) and the Area D WWTP (Stations 50, 51, and 52) do not significantly impact air quality as once thought from initial modeling assumptions (Table 2-2).

The Jacobs 2005 air dispersion modeling incorporated hydraulic and mechanical dredging, changes in the remediation strategy (PCB mass removal techniques) along with the changes in the source areas, which were different from the input sources used in the Foster Wheeler model. Jacobs classified the source areas into two following categories: background sources and remediation emission sources (Jacobs 2005). The identified background source areas included the following:

- harbor mudflat and intertidal sediments;
- point or area land sources with previous PCB sediments;

- PCB-contaminated soil piles;
- holding ponds for PCB contaminated sediments; and
- a source at Aerovox.

The assumed remediation emission sources in the model are sources that only contribute contamination to the atmosphere during periods of active remediation. They include dredging operations, debris removal activities, and releases from the desanding plant operated in Area C and the WWTP operated in Area D. The Jacobs modeling efforts in 2005 and 2006 considered these data and made adjustments in model calibration accordingly.

2.1.5 Cumulative Exposure Tracking

The cumulative exposure budget provides a benchmark for comparison with a time series of airborne PCB concentrations to evaluate potential inhalation risks to the public. The series of PCB concentrations at a location have been established using a combination of actual sample results and baseline values. The established cumulative exposure tracking methodology will continue until the remedial action is complete. Previously, a limited number of stations were tracked against a cancer risk exposure budget. Now, all stations will be tracked to the cancer budget and a noncancer budget.

The slope of the cumulative exposure budget line is the allowable ambient PCB concentration at the sampling station that is protective of the most sensitive target receptor. This slope of the cumulative exposure budget line is quantitatively dependent on three primary established risk assessment criteria factors (Foster Wheeler 2001a):

- the Allowable Ambient Limit assuming a Target Risk of 1 x 10-5; a Cancer Slope Factor of 0.4 milligrams per kilogram per day (mg/kg/day)-1; and an exposure duration of 26 years (EPA-estimated project duration in 2006). The recalculated cancer AALs for residential and commercial receptors is 202 ng/m^3 and 344 ng/m^3, respectively;
- the Annual Average Background Concentration of airborne PCBs at the point of potential exposure; and
- the Air Dispersion Factor between the sampling station and the assumed point of exposure.

Since the initiation of full-scale remediation activities in 2004, Jacobs has performed these calculations utilizing a spreadsheet developed by Foster Wheeler called Public Exposure Tracking System (PETS) as presented in the Implementation Plan (Foster Wheeler 2001b). A brief standardized summary report is generated for each sampling station that uses real data collected following each sampling event or baseline concentrations. That report contains the current plot of the comparison of the cumulative exposures to the established budget line and a review of any triggers present during that sampling period. Further details are presented in the Implementation Plan (Foster Wheeler 2001b). The completed 2013 PETS curves are found in Appendix B. None of the budgets have been exceeded since the inception of tracking the cumulative exposure budgets.

2.2 Volatile Organic Compounds

The rationale and methods taken to monitor for Volatile Organic Compounds (VOCs) were successfully conducted during the 2008 remedial activities at the former Aerovox facility shoreline. The same approach will be applied during future remedial activities at the Aerovox intertidal area and Cell #1. VOCs will be monitored using a photoionization detector (PID) with a 10.6 electron volt (eV) lamp measuring the chemicals of concern as total VOCs. An exposure limit of 1 part per million (ppm) total VOCs will trigger monitoring for specific VOCs including tetrachloroethene (PCE), trichloroethene (TCE), hydrogen sulfide and vinyl chloride. Should readings on the PID and/or colorimetric tubes exceed action levels, organic vapor monitors (OVMs) will be deployed around the perimeter of the site with samples being submitted to the analytical laboratory for testing. For each of these, the ceiling exposure limit, perimeter assessment value (PAV), and perimeter action limit (PAL) will be evaluated based on industrial hygiene practices and threshold limits set by the American Conference of Governmental Industrial Hygienists. Table 3-3 presents the various thresholds for the chemicals of concern and Section 3.3 provides more details of air sampling activities for VOCs. Likewise, the PALs for VOCs are considered protective of the general public beyond the site perimeter as the PALs are one or two orders of magnitude below the EPA's Acute Exposure Guideline Levels. An exceedance of a PAL would result in work stoppage.

2.3 Respirable Particulates

Respirable Particulate Monitoring will be initiated at all work sites where intertidal remediation is taking place such as wetlands and during the excavation of material stored in Cell #1. A ceiling of 0.15 mg/m^3 will be used to evaluate short term exposure (15 minute average). A PAV of 0.3 milligram per cubic meter (mg/m^3) of air will be used to evaluate and initiate dust control measures and a PAL of 0.075 mg/m^3 will be used as the trigger to stop all work and reassess work practices and increase control measures.

3.0 PCB SAMPLING NETWORK

This section presents the network of sampling station locations that have been used and that will be used consistent with this Revision No. 4 in providing data for tracking cumulative exposure budgets relative to potential public exposure points around New Bedford Harbor. This section also identifies the monitoring schemes for each dredging and excavation scenario that may release airborne contaminants and includes the rationale for responding to contaminant levels that exceed prescribed guidelines.

3.1 Station and Receptor Locations

Locations of potential receptors (Figure 3-1) for airborne PCBs were developed to facilitate air modeling and are the primary consideration when selecting a sampling location based on remedial activities. Other key considerations in selecting sampling locations include:

- previously located sampling stations selected through the historical Air Management Plans;
- receptors' proximity to and downwind from remediation activities;
- site accessibility; and
- wind rose data.

Meteorological conditions were considered when selecting a monitoring network for PCB air sampling stations. Prevailing wind directions at different times of the year were determined by site-specific meteorological data collected to date:

- Summer – Prevailing winds are from the south or southwest (off the ocean, toward the land), and would generally transport PCBs toward the north or northeast;
- Fall – Prevailing winds are typically from either the northwest or the south/southwest, and would generally transport PCBs toward the southeast or the north/northeast, respectively;
- Winter – Prevailing winds are from the northwest (off the land, toward the ocean) with secondary peak winds from the northeast and southeast, and would generally transport PCBs toward the southeast; and
- Spring – Prevailing winds are transitional, but most typically from either the northwest with secondary easterly component winds (north or south of east), and would generally transport PCBs toward the southeast or components of the west, respectively.

The site monitoring locations have been selected previously based on three criteria, (1) a receptor's proximity to remedial activity, (2) site accessibility, and (3) meteorological patterns. Evaluating additional work in the Lower Harbor, five additional locations were identified based on those three criteria

(Figure 3-3). These five additional locations supplement the three existing Lower Harbor locations in providing a more comprehensive network of air sampling stations during Lower Harbor remedial operations.

3.2 Sampling Locations

Table 3-1 identifies the ambient air sampling locations. The historical ambient air sampling locations are presented in Figure 3-2 for the Upper and Lower Harbor. Figure 3-4 shows the density of the available sampling network for ambient PCBs based on major remedial activities. Each major remedial action is listed on Table 3-2 along with the sampling stations anticipated for sample collection during that action. There are any number of combinations of stations for use depending on the remedial action and their locations. Not all sample stations will be used for every remedial action, but the intent is to collect samples that are representative of possible exposures to residential and commercial receptors in the vicinity of active remedial activities.

Stations that may be used to monitor airborne contamination from remediation of PCB contaminated sediments include (Figure 3-4, Table 3-1):

Station 24—Aerovox—Commercial—located along the western shoreline of upper New Bedford Harbor—used to monitor hydraulic dredging activities in the upper harbor adjacent for former Aerovox facility.

Station 25—Manomet/Cliftex—Residential—located off of Manomet Street on west side of harbor adjacent to two condominium complexes—used to monitoring dredging in the upper harbor.

Station 27—Porter—Residential—located in open field on east side of harbor—used to monitor dredging activities in the upper harbor, contributions of contaminants from mudflats on the east side of the harbor, and for future excavation activities in the wetlands.

Station 30—Fibre Leather—Commercial—located on west side of harbor in open area adjacent to industrial complex—used to monitor dredging activities in the upper harbor.

Station 42—NSTAR North—Commercial--located in open field adjacent to NSTAR substation—used to monitor dredging activities in the upper harbor.

Station 43—Veranda—Residential--located in residential neighborhood at end of Veranda Avenue on east side of harbor—used for background and to monitor long range effects of dredging in the upper harbor.

Station 44—Taber—Residential--located adjacent to water pump house at the end of Taber Street on east side of harbor—used to monitor activities in the lower harbor, the LHCC in particular.

Station 46—Coffin—Residential—located on west side of harbor near cove and adjacent to residential neighborhood and Riverside park—used to monitor dredging activities in the upper harbor.

Stations 47, 48, and 49—Area C—Commercial--located near the Area C desanding building depending on prevailing wind direction—used to monitor desanding activities during active hydraulic dredging and to monitor emissions from the Pilot CDF and Cell #1.

Stations 50, 51, and 52—Area D—Commercial--located near the Area D dewatering building depending on prevailing wind direction—used to monitor dewatering and water treatment activities during active hydraulic dredging.

Station 53—Hydraulic Dredge—Point Source—used for dispersion modeling data.

Station 55—Aerovox West—Residential—located on west side of former Aerovox building adjacent to residential neighborhood on Belleville Avenue—used to monitor impacts to residential area from hydraulic dredging and any residual effects from the former factory.

Station 56—Acushnet Park—Residential—located north of Wood Street on east bank of the Acushnet River in Acushnet Park—originally used to monitor north of Wood Street excavation activities, currently used during hydraulic dredging.

Station 58—Pearl—Residential—located at Pearl Street to monitor impacts from Area D operations.

Station 59—Popes—Commercial—Located on Popes Island to monitor impacts from the LHCC filling and mechanical dredging in the lower harbor.

Station 60—Washburn—Residential—located on the west bank of the harbor, south of the I-195 bridge to monitor mechanical dredging near this location.

Station 62—Century House—Residential—located on east bank of the harbor in parking lot of Century House Restaurant—used to monitor hydraulic dredging activities in the upper harbor and to monitor exposed mudflats on the east side of the harbor.

Station 64—Pilgrim—Residential—located on city property at the end of Pilgrim Avenue on east side of the lower harbor—used to monitor activities in the lower harbor, such as Area D and the LHCC.

Station 65—CAD Cell Dredge—located on mechanical dredge as point source for dispersion modeling.

Station 66—Huddleston—Residential—located west of the Fairhaven High School to monitor LHCC activities.

Station 67—Revere—Commercial—located on the east side of the lower harbor to monitor LHCC activities.

3.3 Summary of Ambient Air Sampling Activities

Ambient air samples for PCB analyses will be collected using sample methods as specified in EPA Method TO-10A [using low volume polyurethane foam (PUF)]. Portable air monitoring devices will be deployed to pre-selected locations based on the activity and the aerial coverage needed to assess the release of airborne contamination. Each of the air samples will be collected using a calibrated and programmed BGI brand PQ-100 air sampling pump. The calibrated sampling pump has a mass flow controller to accurately (± 2 percent) adjust the 5-liter per minute flow rate based on the calibrated standard temperature and pressure. The media is a 22 millimeter Supelco Orbo-1500 PUF/XAD-2/PUF sample tube with a 32 millimeter quartz microfiber filter as the lead media. The locations of the PUF samplers is flexible since each sampler is battery operated and capable of operating greater than 24 hours without loss of air flow or pump fault due to media loading. The samplers are mounted on tripods to meet an inlet height requirement of approximately 4-6 feet, a range comparable to adult/child breathing zone height. At sites where samplers are co-located, the sampler spacing is approximately 2 meters. For security purposes, fencing may be installed around the samplers.

Samples will be collected over a 24-hour period. It is anticipated that the start time will be between 7 a.m. and 2 p.m. The sample media will be installed the day the sampling starts and a quality control check of the samplers will be done to insure they are operating as calibrated. Each sampler will be programmed to run for 24 hours. After the 24-hour run is completed, the sample media will be retrieved within one hour.

Concentrations of VOCs will be monitored in the breathing zone (4 to 6 ft) using a MultiRAE multi-gas meter such as a photoionization detector (PID) at 10.6 eV. This device can be used for oxygen and lower explosive limit (LEL) plus total VOCs and hydrogen sulfide. An initial trigger of 1 ppm above background for VOCs will prompt VOC monitoring using colorimetric tubes for vinyl chloride, TCE, and tetrachloroethene (PCE). While PIDs and colorimetric tubes can provide real-time results, an alternative method like organic vapor monitor such as 3M 3500 or equivalent can provide a less timely but more reliable estimate of VOC concentrations in the affected area.

Particulates will be monitored in the breathing zone using a respirable aerosol monitor (RAM), a two-wavelength nephelometric monitor with a light scattering sensing configuration optimized for the measurement of the fine particle fraction (10 micron or less) of airborne dust under ambient conditions.

All instrumentation will be calibrated to manufacturer recommendations. Any instruments that cannot meet calibration criteria will be sent for repair and factory recalibration. Where sampling media is used, the media will be within its useful life (not expired) and the media will be used according to the EPA, National Institute of Occupational Safety and Health, or Occupational Safety and Health Administration method for the contaminant of concern. All laboratories under contract to analyze the media will have current certifications and accreditations as required.

3.3.1 Upper Harbor Hydraulic Dredging-Upper Harbor Mechanical Dredging-Lower Harbor Mechanical Dredging

Air monitoring for dredging activities in the upper and lower harbor locations will be conducted to determine airborne PCBs levels during dredging activities. As currently planned, hydraulic dredging will be used only in the Upper Harbor for the removal of PCB impacted sediments. However, mechanical dredging is planned in both the upper and lower harbors with deposition of dredged materials in the Lower Harbor CAD Cell. A flow chart for the air monitoring program for PCB sampling is presented in Figure 3-5.

Prior to dredging, a set of samples will be collected to understand ambient air conditions and provide a comparison to previously modeled results. This initial monitoring event will provide exposure tracking data prior to hydraulic dredging. The sampling network will consist of monitoring locations that have been used for previous air monitoring investigations or new locations in the lower harbor that have been added to accommodate updated dredging activities (Table 3-2, Figure 3-5).

After the pre-dredge sampling event, the next set of samples will be collected from the same pre-dredge network of stations and the operating dredge on a monthly basis, approximately two weeks into dredging. The initial sample analysis will be scheduled for a 20 day turnaround time (TAT) for results. Should the receptor specific second trigger be exceeded, the impacted sampling station will be resampled during the next monthly round and the analysis will be scheduled for a 10 day TAT. Should this expedited sample result in an exceedance of the second trigger level again, the station will be resampled immediately with a 10 day TAT for analysis. One post-demobilization round of sampling will be collected from the station network no sooner than two weeks on a 20 day TAT after the completion of dredging. Refer to Section 5.0 for the full reporting process.

3.3.2 Aerovox Near-shore Area and Cell #1 Excavation

In 2008, remedial operations along the former Aerovox shoreline were monitored for airborne PCBs, VOCs and respirable PM. Future operations in the Aerovox Near-shore area and Cell #1 excavation may potentially release similar constituents thus impacting air quality in the surrounding community. Airborne PCBs will be monitored using the existing monitoring network and follow procedures as outlined in Section 3.3.1 for dredging (Table 3-2). PCB sampling frequency will be bi-weekly initially and, pending no exceedances of the applicable second trigger, the sampling frequency for PCBs can be adjusted to monthly sample collection. The flow diagram of air monitoring activities for remedial excavation is presented in Figure 3-6.

The monitoring of VOCs will be performed using real time instrumentation and passive dosimetry, as necessary. There are three available methods for the measurement and detection of VOCs; PIDs, colorimetric tubes, and passive dosimeters. PIDs provide real time results for total VOCs in local air quality. Colorimetric tubes are used to determine the compounds from the total VOC readings with vinyl chloride, TCE and PCE being measured and compared to their ceiling values. The ceiling value is a 5 minute measurement unique to each compound (Table 3-3). OVMs are passive dosimeters that measure 8 hour time weighted average of more specific VOCs and are dispersed around the perimeter of the work zone. The OVM method has limited use because laboratory analysis is required of the media and the results are not immediate. The colorimetric tube or OVM methods are typically used to validate the PID readings. Suspended particulates will be monitored using a RAM which provides real time results.

VOC and particulate monitoring will incorporate PIDs and RAMs and will be used as the primary means to collect data on a daily basis to measure potential operational impacts to air quality. The PIDs and RAMs will be placed around the site either on stationary fixtures or carried by hand to monitor the air quality in the breathing zone in proximity to the excavation activities. The initial trigger points will be 1 ppm for VOCs, 1 ppm for hydrogen sulfide gas, and 0.75 ng/m^3 for respirable particulates. If the initial trigger is exceeded for more than 15 minutes, colorimetric tubes will be used to differentiate the total VOCs. If a ceiling limit is reached for a specific compound passive dosimeters (OVMs) will be placed upwind, downwind, and crosswind around the perimeter of the work site. The media in the passive dosimeter will be analyzed to include the VOC contaminants PCE, TCE, vinyl chloride, and cis-1,2-dichloroethene (Table 3-3). If concentrations exceed the short term exposure limit then the PAV for that compound will be evaluated. If the concentrations exceed the PAV, then the PAL will be evaluated. If the concentrations exceed the PAL, then work will be suspended until corrective action is employed to bring the PAL to concentrations at or below the PAV. This information is summarized in Tables 3-2, 3-3, and Figure 3-6.

Monitoring for VOCs and particulates will be conducted every day during active excavation. Should ceilings be exceeded, sampling via OVMs will conducted weekly around the perimeter of the site. If any triggers are initiated, the results will be reported to NAE and EPA as discussed in Section 5.0.

3.3.3 Submarine Electrical Cables Removal

Fifteen high voltage cables laid on the bottom of the Acushnet River in Dredge Management Unit-8 will be physically removed to allow for hydraulic dredging of contaminated sediments. This area is relatively small so the impacted surface area can be controlled with containment systems. However, the possibility exists that sediments could be disturbed during cable removal. A small air monitoring network will be employed for PCBs using procedures and frequencies outlined in Section 3.3.1 and consisting of air monitoring stations in the Upper Harbor.

3.3.4 Shoreline and Intertidal Remediation

Contaminant transport in New Bedford Harbor affected not only deep channel sediments, but low lying mudflat areas where contaminants were deposited as a result of alluvial transport and tidal influences. PCB contaminated sediments were deposited on these landforms which resulted in contamination in some intertidal and shoreline areas of the harbor. The mudflats and wetlands pose a continuing threat for the release of airborne contaminants as the areas can dry and become a source of airborne PCBs and particulates. Disturbance of these wetlands during excavation can accelerate this process potentially liberating airborne contaminants. Numerous wetland sediment core samples have been collected over the years to characterize the vertical and lateral extent of contamination along the shorelines of the City of New Bedford and Towns of Acushnet and Fairhaven.

Monitoring for PCBs will follow the same procedure as outlined in Section 3.3.1 using the existing monitoring network. However, the sampling frequency will be modified based on the concentrations of PCBs in soil to be excavated along the shoreline or in the mudflats. During remediation of areas where sediment concentrations exceed 5,000 mg/kg, PCB air sampling will be conducted weekly. Sampling media will be sent to an offsite laboratory using a 10-day TAT. As presented in Section 3.3.1, should an air sample location exceed the second trigger level, an additional sampling event will be completed at the affected station. This sample will also be subjected to a 10-day TAT (Table 3-3, Figure 3-7).

There is no indication that VOCs are contaminants of concern along the shoreline and mudflats of New Bedford Harbor. Only VOC screening will be conducted during excavation of the mudflat, intertidal or shoreline areas.

During remediation of areas with PCB sediment concentrations greater than 500 mg/kg PM sampling will be conducted. Sediment sample results will be used to determine a feasible air monitoring approach using real-time PM air sampling during the remediation of the shoreline systems. Based on PCB sediment concentrations, calculations were made to establish action levels for particulates that will be used as a surrogate concentration for PCBs that may be anticipated due to the potential generation of airborne particulate matter from remedial operations. The formula used for this calculation is from the American Industrial Hygiene Association.

The calculation for the air monitoring approach is:

$AL = [10^6 \text{ mg/kg}] * [EL (\text{mg/m}^3)] / [C (\text{mg/kg})] \times [SF]$

Where:

- AL = action level
- EL = exposure limit of contaminant
- C = sediment concentration
- SF = Safety Factor

In all cases the airborne exposure limit used is 110 ng/m^3 or about 0.0001 mg/m^3. Various sediment concentrations ranging from 500 mg/kg to 20,000 mg/kg were used to develop action levels based on the sediment concentrations to be excavated. The Safety Factor used was two (2). This safety factor was used because it was assumed that 100 percent of the airborne particulates were composed of sediments contaminated with PCBs and to reflect uncertainty in the extent of contamination. As determined for PCB monitoring, sediment concentrations greater than 500 mg/kg would serve as the lower threshold value for PM sampling.

Calculated Results of Air Action Levels Based on Surrogate Sediment PCB Concentrations

Sediment Concentrations (mg/kg)	Air Action Level (µg/m^3)
500	100
1,000	50
5,000	10
7,500	7
10,000	5
20,000	2.5

Particulates will be monitored to assess impacts during excavation of the mudflat and shoreline areas. Where soil concentrations of PCBs are greater than 500 mg/kg, PM sampling will be conducted daily. RAMs will be placed around the areas of excavation to monitor the release of PM as a result of remedial activities. Particulate matter as PCBs will be monitored to assess any potential air quality impacts during the excavation of mudflat and shoreline areas where sediment concentrations are greater than 500 mg/kg. To delineate an area considered representative of the core sample results, a twenty-five foot radius was selected to denote the impacted sediments from that sample. During the remediation of sediments within the radius, surrogate PM sampling will be conducted while those sediments are handled.

When intertidal and shoreline areas are being excavated, direct-read area PM monitoring will be used to measure airborne concentrations above background. Typically, three monitors may be placed around the work area at an up-wind, down-wind and cross-wind location. The intent is to have at least one monitor adjacent to a residential receptor to monitor the air quality. The sampling layout for ambient PCBs as PM at these locations will be modified dependent on sediment concentrations, meteorological conditions, and proximity to residential receptors.

The direct-read instrument readings for the RAM will be compared to the calculated results of air action levels. If any of the ambient readings are more than double the applicable calculated air action level for a 15 minute averaging time on the meter, Jacobs will conduct an evaluation of the source and mitigation measures and report the findings to the on-site NAE Project Engineer and EPA (Tables 3-2, 3-3 and Figure 3-7).

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4.0 BEST MANAGEMENT PRACTICES

BMPs will be employed for each of the activities including hydraulic dredging, mechanical dredging, subtidal excavation and near shore excavation to mitigate release of contaminants to the air. There may be occasions when site conditions such as higher sediment concentrations, elevated solar radiation, elevated air temperature, lower wind speed, and other influences can produce unwanted air quality impacts. BMPs were developed to mitigate these impacts and will be employed as needed to reduce airborne contamination.

4.1 Hydraulic Dredging and Debris Removal

Hydraulic dredging is an activity that can contribute to airborne contamination. The hydraulic device, for the most part, remains under water during dredging activities and contaminated sediment is contained within the pipeline as it is transported to the desanding and dewatering facilities. However, there are methods that can reduce impact from the sediment phase to the airborne phase:

- The proper use of oil boom is a key method in controlling the release of oil on the water. Oil can be released from the sediment when disturbed by the excavator during debris removal or by the hydraulic dredge. This agitates the sediment and some oil can be released to the surface during this operation. To mitigate this effect, an oil boom will be deployed to surround the perimeter of the hydraulic dredge or debris removal barge. This boom serves as the first point of contact with any oil released from the sediment and absorbs the oil in order to mitigate ambient air releases. A second ‘layer’ of oil booms will be deployed around the perimeter of the working dredge zone to capture any oil that is not captured by the boom around the dredge or barge.
- Should the RBG for a station be exceeded, continuous oil sheen be observed within the dredge area during dredging or debris removal, or the existing oil boom be unable to maintain control of the sheen, additional oil booms will be deployed in a double “V” configuration within the working dredge zone. Each of the points of the “V” will be in line with the tidal flow of the river so that the oil boom collects oils that are spreading within the dredge zone. This configuration will work during the ebb and flow tidal changes to catch errant oils. The angle of the “V” can be changed to accommodate varying flows within the river and reduce the surface area available for PCB volatilization. This oil boom placement will bolster as needed, the perimeter boom during tidal fluctuations in the river.
- Oil booms will be changed on a frequent schedule based on visual oil impact, thus better managing any floating oil or sheen and reducing the potential for air quality impacts. Used oil booms will be routinely collected and placed in plastic bags for off-site disposal.

4.2 Mechanical Dredging

Subtidal excavation is currently planned for sites around New Bedford Harbor. This activity involves mechanical dredging to remove contaminated sediment from the bottom of the harbor, load it into scows, and transport the material for disposition in the LHCC. Several practices and techniques can be employed to mitigate airborne releases and reduce exposure as follows:

- Use of oil boom on the inside perimeter of the silt curtain to absorb any oils released during the filling of the LHCC.
- Maintenance of sediment in a wet state to limit the exposure of contaminants to air. Assuring the scow will not sit once the decanted water is removed to ensure sediment does not desiccate in order to reduce the chance that contaminants become airborne.
- Careful placement of contaminated sediment in the scow. By avoiding "dead drops" there is lesser disturbance to the sediment reducing suspension of contaminated materials into the air.

BMPs and their effectiveness will be documented at a minimum during ambient air sampling activities.

4.3 Cell #1 Sediment Removal

Over the course of the New Bedford Harbor Superfund Program, several operations including Field Design, North Lobe, North of Wood Street remediation and Aerovox mechanical excavation have used Cell #1 as an interim CDF for contaminated materials. In general, the materials placed in Cell #1 have concentrations of PCBs up to approximately 10,000 ppm. The last such materials were stabilized sediment deposited in 2008 and topped with six to eight inches of clean fill material. Under the operable unit 1 (OU1) cleanup plan, the material currently stored in Cell #1 will be removed and disposed off-site. If treatment to stabilize the materials is required prior to shipment, the operation will be conducted using engineering controls appropriate for the treatment method. Lime will not be used to stabilize spoils due to its high heat of reaction and the potential for volatizing PCBs into the ambient air. The intent is to minimize volatilization and spread of contamination to the surrounding area. Work methods appropriate for the site conditions will dictate the type and combination of BMPs used:

- Material will be kept moist to the extent possible. Sediments and soils will be worked wet whenever possible, stockpiles will be allowed to drain but not dry out, and drier materials may be comingled with wet materials prior to load out;
- Visible oil and or oil sheens will be collected for disposal with impacted spoils and areas that may produce an oil sheen overnight will be covered with polyethylene sheeting or other means to reduce potential air quality impacts; and
- Areas that have sediment results greater than 5,000 mg/kg may need to be addressed when meteorological conditions do not exacerbate the release of airborne contamination. For example, the timeframe for addressing high sediment concentrations are ideally late fall through early spring when ambient temperatures and solar radiation impacts are lower and reduce the incidence of airborne contamination.

4.4 Mechanical Excavation (Near-Shore and Shoreline)

Several nearshore, mudflat and intertidal areas around New Bedford Harbor, in particular, the Aerovox Near-shore area has become contaminated as a result of discharge of PCBs to the harbor. Intertidal and shoreline areas above applicable OU1 cleanup levels will require remediation. The primary remedial method is excavation of the impacted sediments and soils and removal for off-site disposal. Work methods appropriate for the site conditions will dictate the type and combination of BMPs used:

- Material will be kept moist to the extent possible. Sediments and soils will be worked wet whenever possible, stockpiles will be allowed to drain but not dry out, and drier materials may be comingled with wet ones prior to load out;
- Visible oil and or oil sheens will be collected for disposal with impacted spoils and areas that may produce an oil sheen overnight will be covered with polyethylene sheeting or other means to reduce potential air quality impacts;
- Areas that have sediment core results greater than 5,000 mg/kg may need to be addressed when meteorological conditions do not exacerbate the release of airborne contamination. For example, the timeframe for addressing high sediment concentrations are ideally late fall through early spring when ambient temperatures and solar radiation impacts are lower and reduce the incidence of airborne contamination;
- Lime will not be used to stabilize spoils due to its high heat of reaction and the potential for volatizing PCBs into the ambient air; and
- Shoreline remediation will entail constructing access roads to the excavation boundary of the wetlands for truck and equipment access. As much as is feasible, excavated sediments will be direct loaded into dump trucks for disposal. There will be areas where the spoils will be gravity drained before final shipment off site. During this dewatering event there is the possibility of drying of the spoils pile. At no time will any of the work areas be allowed to produce visible dust. Dust control will be routinely deployed in particular on the access roads.

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5.0 REPORTING

Activities that may generate airborne contamination will be monitored using the methods, procedures, and guidelines presented in this work plan. Data generated during these activities will be reported as part of the overall remediation process. Reporting considerations will vary according to the remedial action taken (hydraulic/mechanical dredging, subtidal excavation, and intertidal excavation), the constituents monitored, and any action taken to mitigate risk due to airborne contamination. This reporting process is based on the contaminant of concern, its potential for impacting air quality, and the air sampling and analytical method used.

5.1 Integrated PCB Results

Airborne PCBs are and will be routinely monitored for all phases of remediation in New Bedford Harbor. There are two means by which the total PCB concentration for each air station is evaluated. One means is against a set of trigger levels and the other means is evaluating the PCB concentration against the RBGs. The trigger levels and RBG values are presented in Section 2.1.2.

When an ambient air result is less than the first trigger level for the applicable receptor, the result will be inputted to the PETS and reported monthly. If an ambient air result is greater than the first applicable trigger level, but less than the second applicable trigger level, in addition to the PETS, a report on the operational and meteorological conditions for the day of sampling will be generated to evaluate contributing factors. If the second trigger level is exceeded, in addition to the PETS evaluation, the station will be resampled. Should a third consecutive sample result exceed the second trigger, controls and meteorological conditions will be evaluated to determine if the exceedances can be mitigated by implementing Best Management Practices (BMPs).These BMPs may entail modifying dredging activities or performing dredging under more amenable meteorological conditions. A technical memorandum will be prepared detailing BMPs and/or operational changes implemented.

All ambient air results will be entered into the PETS. However, whenever an ambient air result is greater than an applicable trigger level, the PETS will be used to calculate the updated cancer and non-cancer cumulative exposure budget to demonstrate the cumulative exposure remains below the risk based goals. This information will be reported immediately after the PETS curve is developed. When the PETS result is less than one-half of the cumulative exposure budgets for the sampling period, no further action will be taken.is necessary. Should the cumulative exposure budget exceed one-half of the cumulative exposure budgets for the sampling period, available operational changes or BMPs will be implemented. A technical memorandum will be prepared detailing BMPs and/or operation changes that were implemented. If the cumulative exposure budgets exceed three-quarters of the cumulative exposure budget for the sampling period and if conditions cannot be met to lower the incidence of airborne PCBs due to dredging and related activities, then work will be temporarily suspended in the vicinity of the station of concern and further options will be evaluated. A discussion of Best Management Practices for hydraulic and mechanical dredging is found in Section 4.0. This information is summarized in Table 3-2 with the logic flow chart found in Figure 3-5.

If any RGBs or trigger levels are exceeded during the course of PCB monitoring, the NAE and EPA will be notified immediately about the concentrations and the actions that will be used to further assess the airborne risk at those stations. For more immediate reporting, Jacobs will have two business days to review the preliminary data received from the laboratory and report the preliminary analytical results to the NAE and EPA. The preliminary data will be noted as unvalidated and posted by the EPA on the New Bedford Harbor Superfund website at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data. Likewise, once data are validated (approximately 6 weeks after the release of preliminary tabulated data) the validated tabulated data will be released to the EPA, who will in turn post the validated results on the New Bedford Harbor Superfund website at http://www2.epa.gov/new-bedford-harbor/new-bedford-harbor-cleanup-plans-technical-documents-and-environmental-data.

Stations that will be used to construct PETS curves for commercial worker cancer risk include:

- Station 24—Aerovox
- Station 30—Fibre Leather
- Station 42—NSTAR
- Station 47—Area C
- Station 50—Area D
- Station 59—Popes
- Station 67—Revere

Stations that will be used to construct PETS curves for child resident cancer risk and non-cancer hazard include:

- Station 25—Manomet
- Station 27—Porter
- Station 43—Veranda
- Station 44—Taber
- Station 46—Coffin
- Station 55—Aerovox West
- Station 56—Acushnet Park
- Station 58—Pearl

- Station 60—Washburn
- Station 64—Pilgrim
- Station 66—Huttleston

Data collected from the various air monitoring stations will be used to construct the PETS curves to determine when cumulative risks may be approaching the cumulative budget. The validated data will be uploaded into PETS that was developed by Foster Wheeler to track exposures of airborne PCB concentrations. The PETS curves graphically represent the exposure budget (the risk-based allowable PCB intake by either a commercial worker or a child/adult resident) versus the monitored exposure (as determined by the ambient air PCB concentrations) for the active remediation periods and the ambient air baseline concentrations presented in Section 2.0. Two sets of PETS curves will be developed for each receptor to track cumulative cancer risk and non-cancer hazard RBGs. Examples of these PETS curves (completed through 2013) are presented in Appendix C. All PCB monitoring results will be compiled in an air monitoring report when directed by the EPA.

5.2 Volatile Organic Compounds

The monitoring of VOCs will occur only during the near-shore area excavation of the former Aerovox facility and as part of the excavation of Cell #1. The readings for total VOCs as determined by the PID will be tabulated daily and reported to the EPA and NAE similarly as the integrated PCB results are reported. The key difference for VOC reporting is the reporting of any exceedances of the limits discussed in Section 2.2. Once the laboratory results are obtained, the results will be placed in the tabulated data sheet for the sample collection day and reported to the NAE and EPA. This approach has been used satisfactorily in 2008 for similar operations. At the end of the remedial activity, the results will be tabulated and distributed to the NAE and EPA. The data will then be summarized in the air monitoring report.

5.3 Respirable Particulate Matter Sampling

PM sampling is expected to be used in three of the remedial operations; intertidal and shoreline (wetlands) excavation, former Aerovox facility near-shore area excavation and the excavation of Cell #1 in the immediate area of the work. These three operations have the potential to generate PM that can locally impact air quality due to their proximity to receptors as well as the potentially dry nature of the material disturbed. These data will be collected daily by a RAM and results reported to the EPA and NAE. The key difference for PM reporting is the reporting of any exceedances of the limits discussed in Section 2.3. The results will be presented in tabular format at the end of the day and summarized in the annual air monitoring report.

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6.0 ANNUAL REVIEW

During the project, it is anticipated that the plans for remediation will continue to be updated in response to changes in the project. The approach outlined in this document will be reviewed annually as the remediation of the Harbor progresses to ensure that it remains appropriate for accomplishing the stated objectives of the Air Monitoring Plan. Based upon this annual review, changes to the sampling approach may be appropriate and can be incorporated as a modification to this document.

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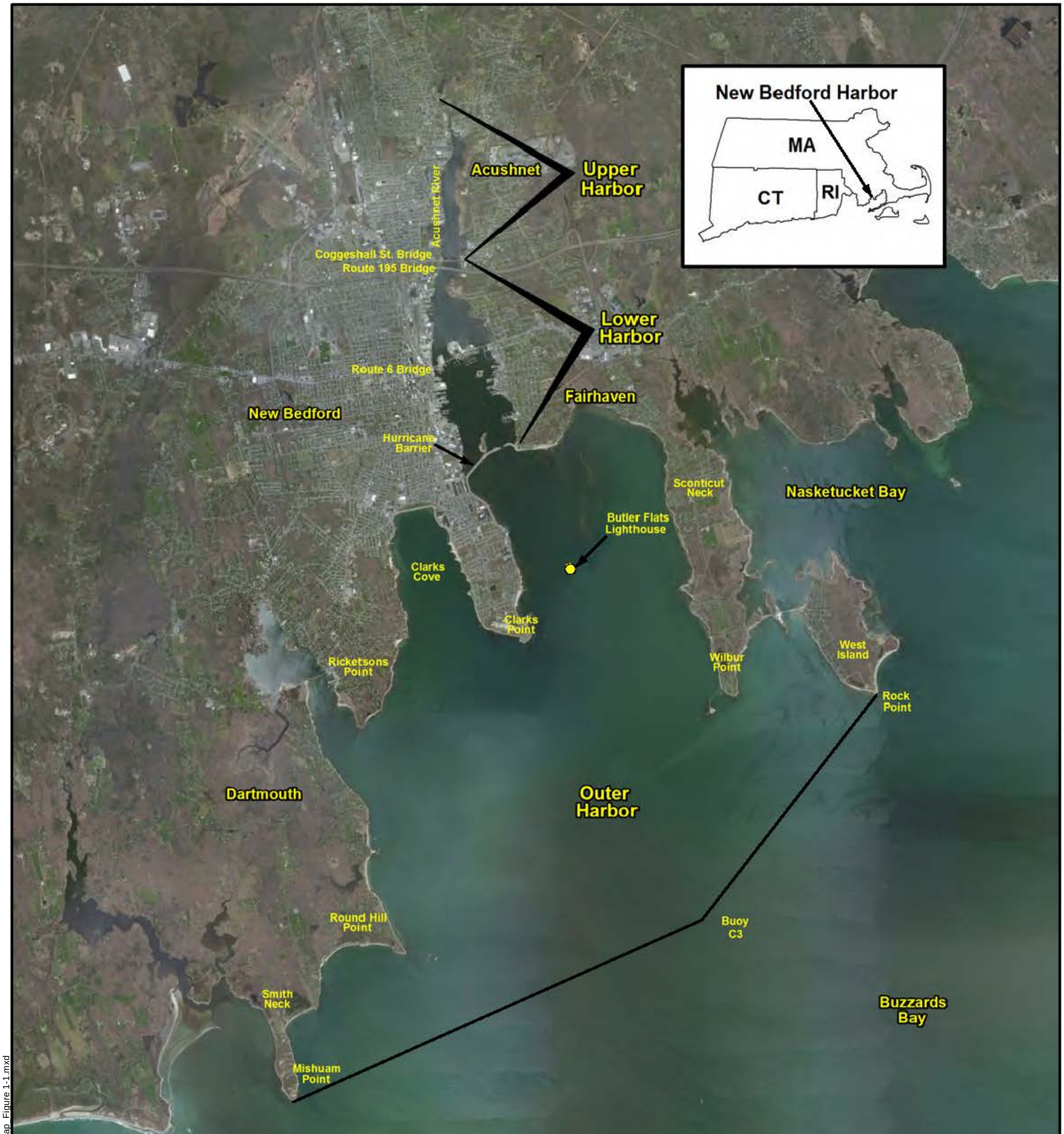
FIGURES



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Site Location Map

New Bedford Harbor Superfund Site

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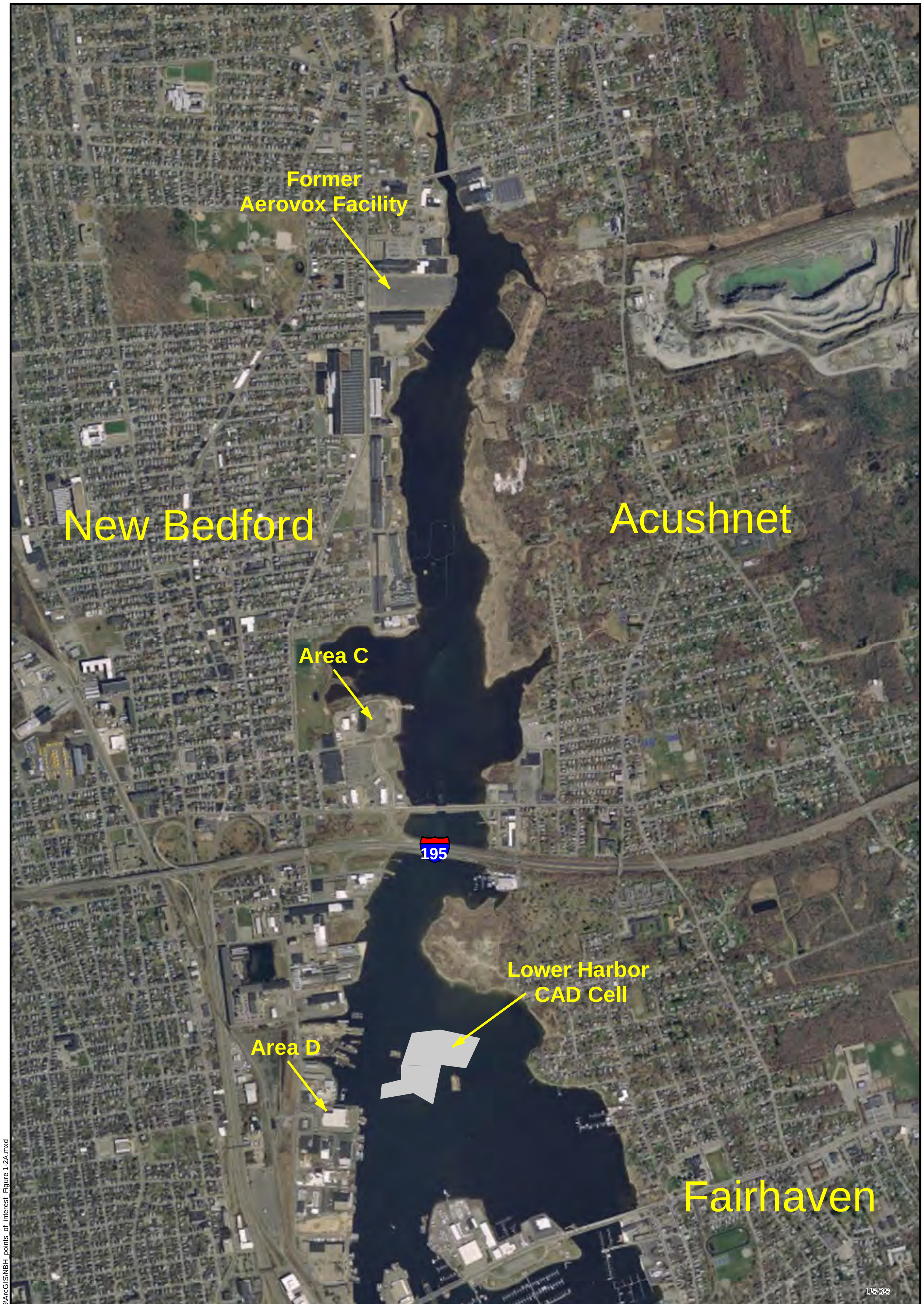
Figure 1-1

Path: Y:\NBH\Projects\35BG1001\20150402\ArcGIS\NBH_Site_Map_Figure 1-1.mxd



Legend

Aerial Photography MASSGIS 2014

0 900 1,800
Feet
1:21,600
N

JACOBS

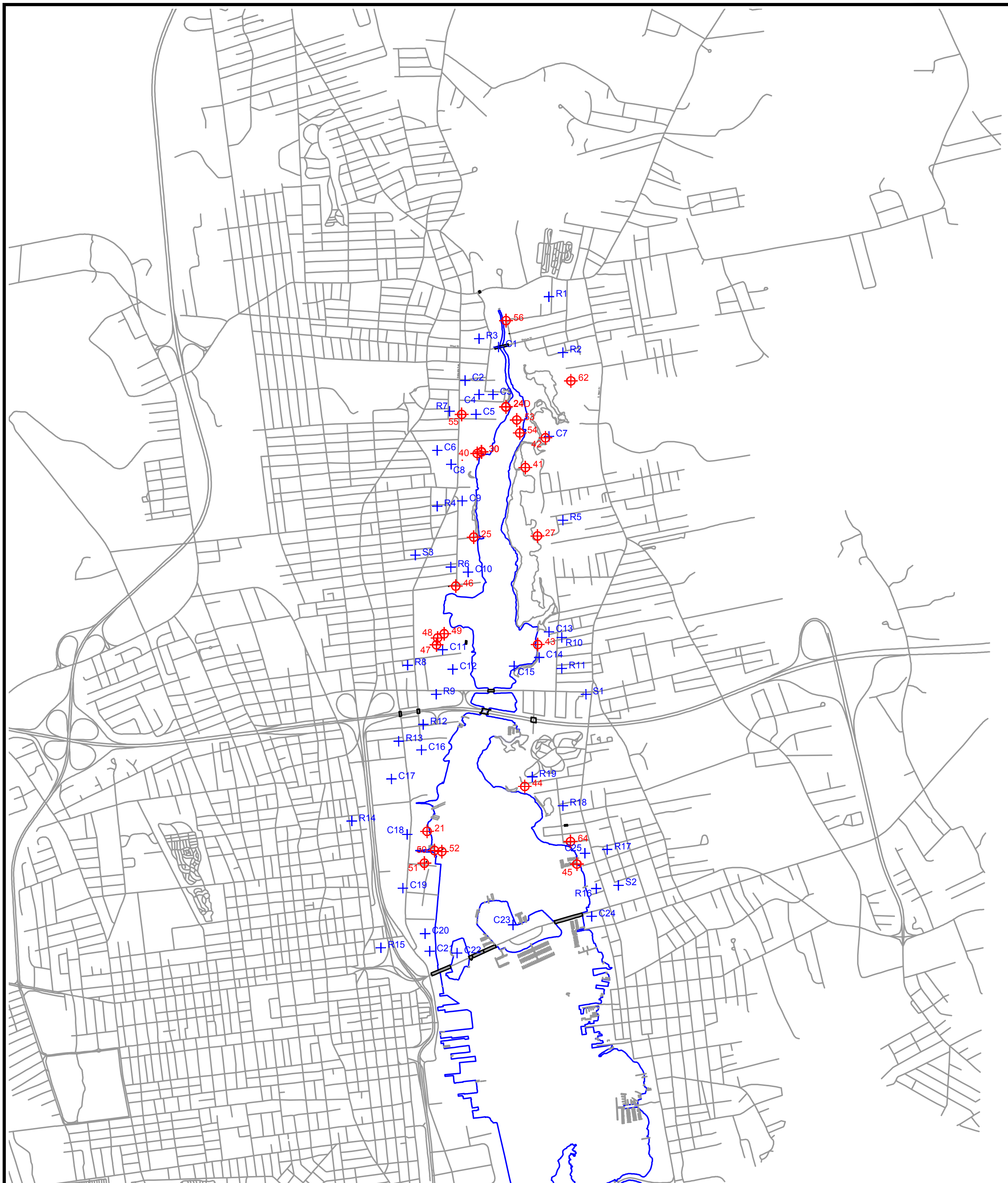
New Bedford Harbor
Points of Interest

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 4/9/2015

Figure 1-2

Path: Y:\NBH\Projects\35BG1001\20150409\ArcGIS\NBH_points_of_interest_Figure 1-2A.mxd



Legend

Air Monitoring Station

Discrete Receptors

N

0 1000

Scale in Meters

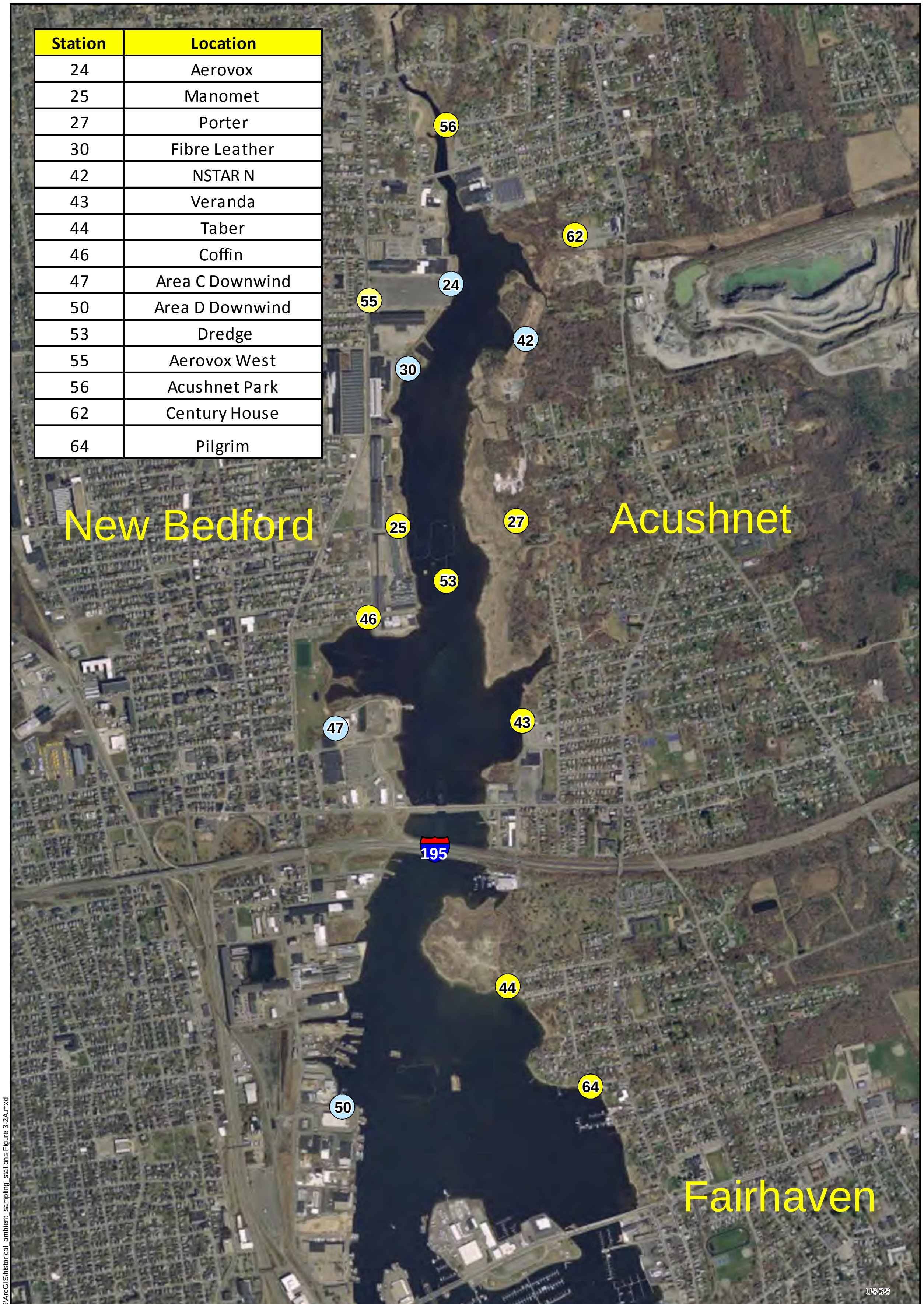
JACOBS

Discrete Receptors for Air Dispersion Modeling

New Bedford Harbor Superfund Site
New Bedford, Massachusetts

06/18/14 DF
Fig19 Receptor Locs.dwg

Figure 3-1



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
62	Century House
64	Pilgrim

Legend

Residential Ambient Air Sampling Station Location

Commercial Ambient Air Sampling Station Location

Aerial Photography MASSGIS 2014

N

0 900 1,800 Feet 1:21,600

JACOBS

Historical Ambient Air Sampling Station Locations

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 4/9/2015

Figure 3-2

Path: Y:\NBH\Projects\35BG1001\20150409\ArcGIS\historical_ambient_sampling_stations Figure 3-2A.mxd

Legend

EPA CAD CELL

Aerial Photography MASSGIS 2014

44	TABER	60	WASHBURN	67	REVERE
50	AREA D	64	PILGRIM		
58	PEARL	65	LH DREDGE		
59	POPES	66	HUTTLESTON		

N

0 500 1,000 Feet

1:9,600

JACOBS

Lower Harbor Ambient Air Sampling Station Locations

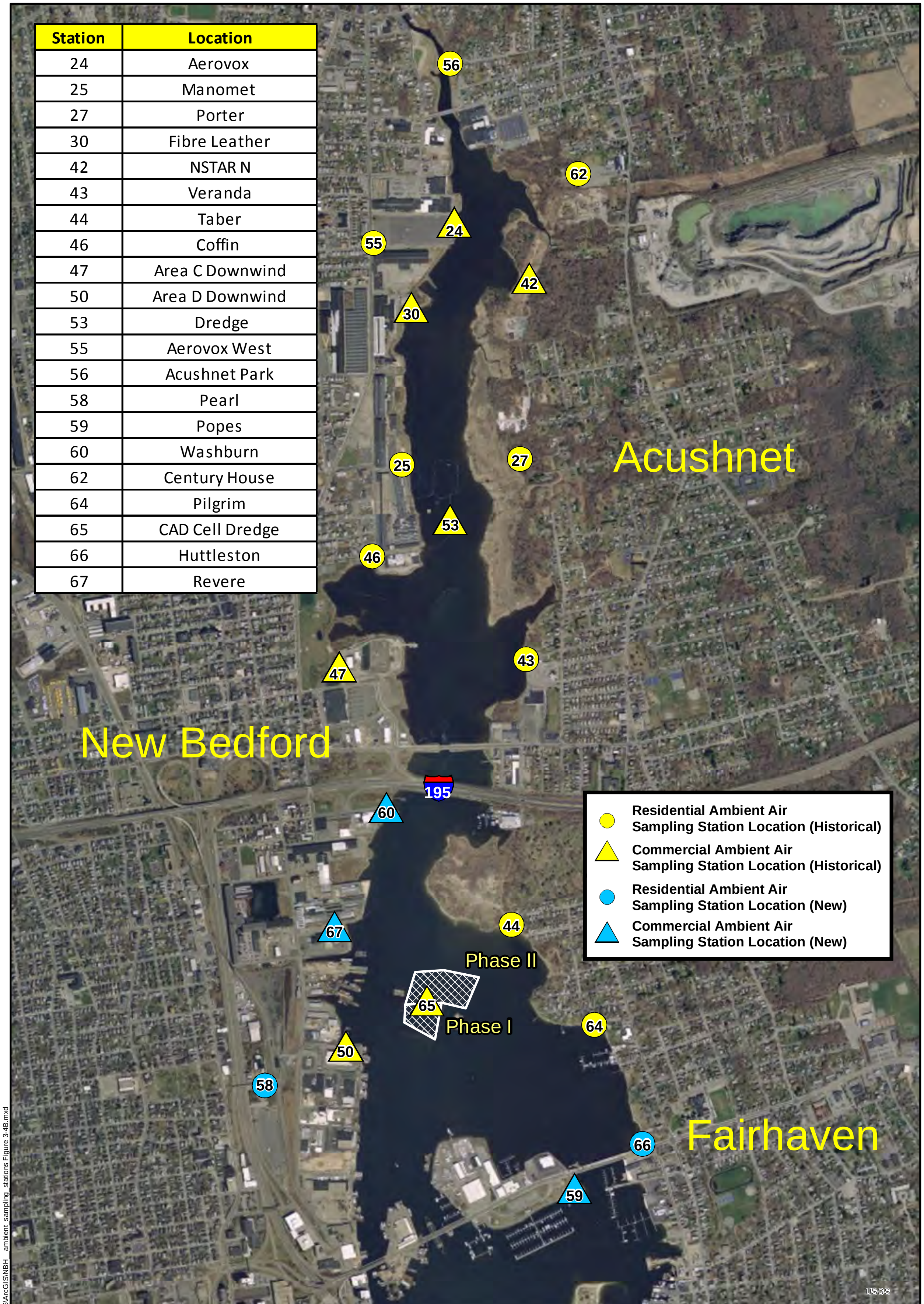
New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 8/6/2015

Figure 3-3

Path: Y:\NBH\Projects\35BG1001\20150806\ArcGIS\lower_harbor_epa_ambient_air_stations Figure 3-3A.mxd

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

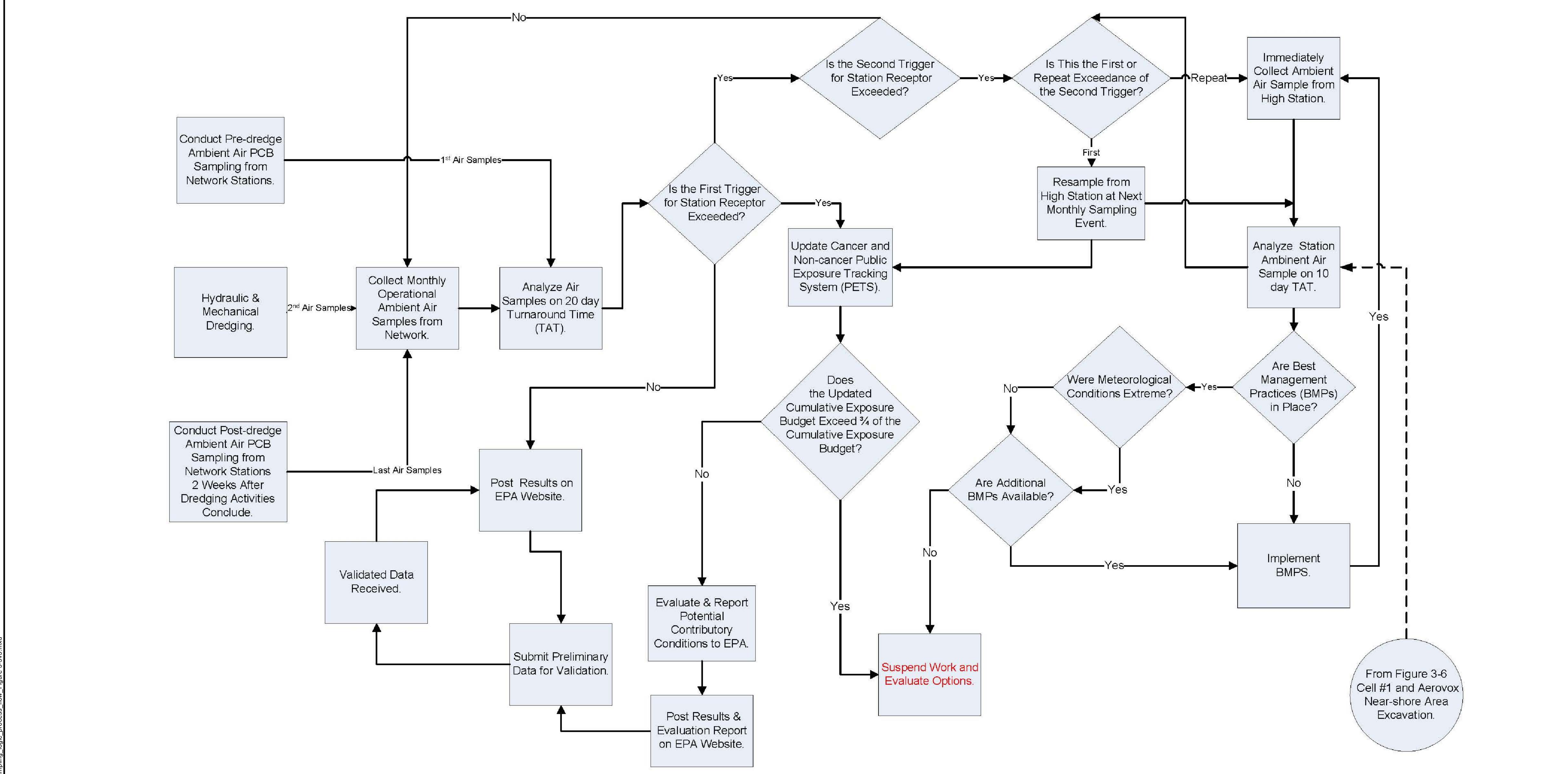
JACOBS

Available Ambient Air Sampling Station Locations

New Bedford Harbor Superfund Site

Figure 3-4

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



Legend

JACOBS

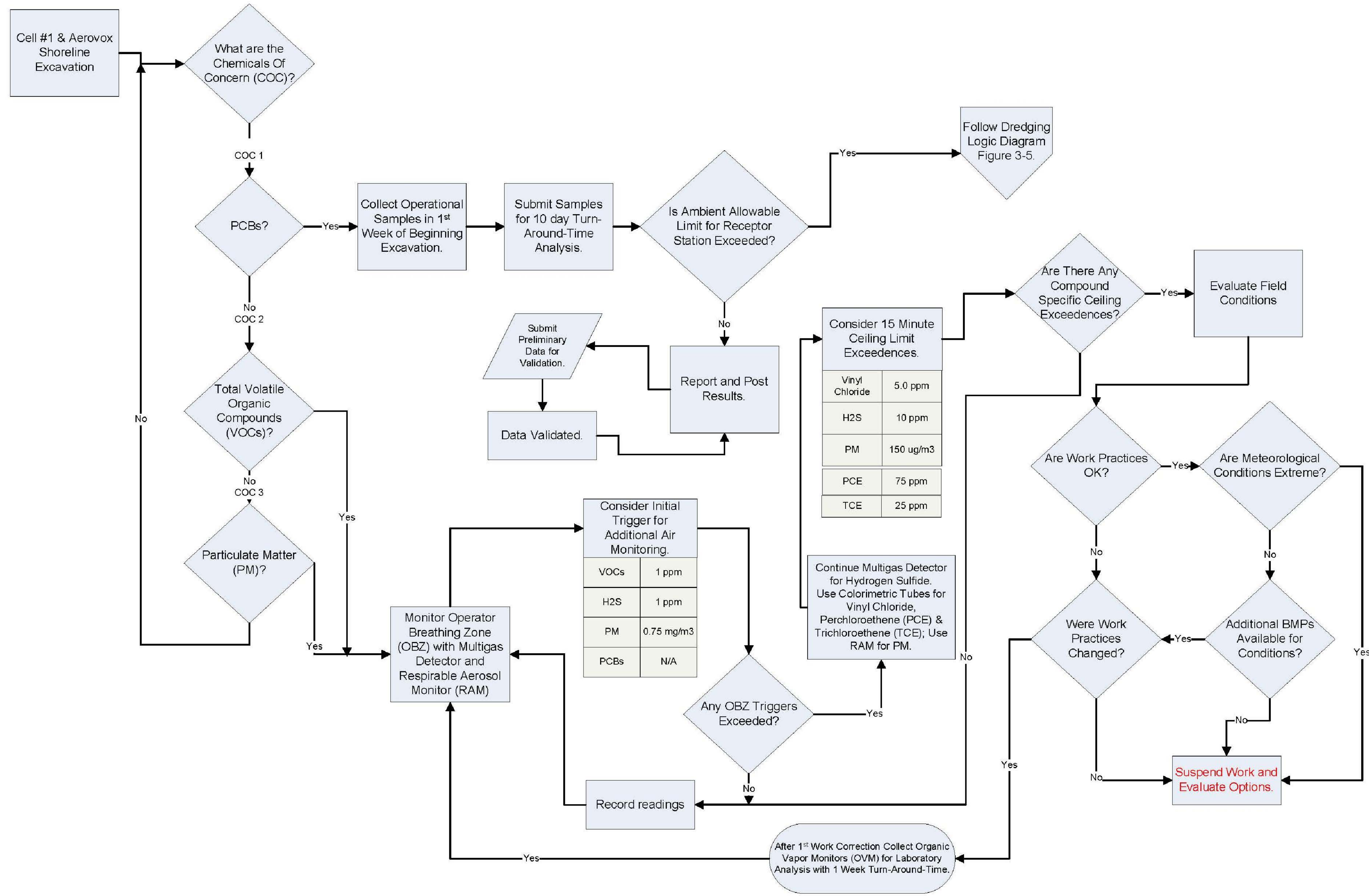
Ambient Air PCB Sampling Logic for Hydraulic and Mechanical Dredging

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 7/21/2015

Figure 3-5

Path: Y:\NBH\Projects\358G1001\20150720\ArcGIS\air_sampling_logic_process_flow_Figure 3-5v3.mxd



Legend

JACOBS

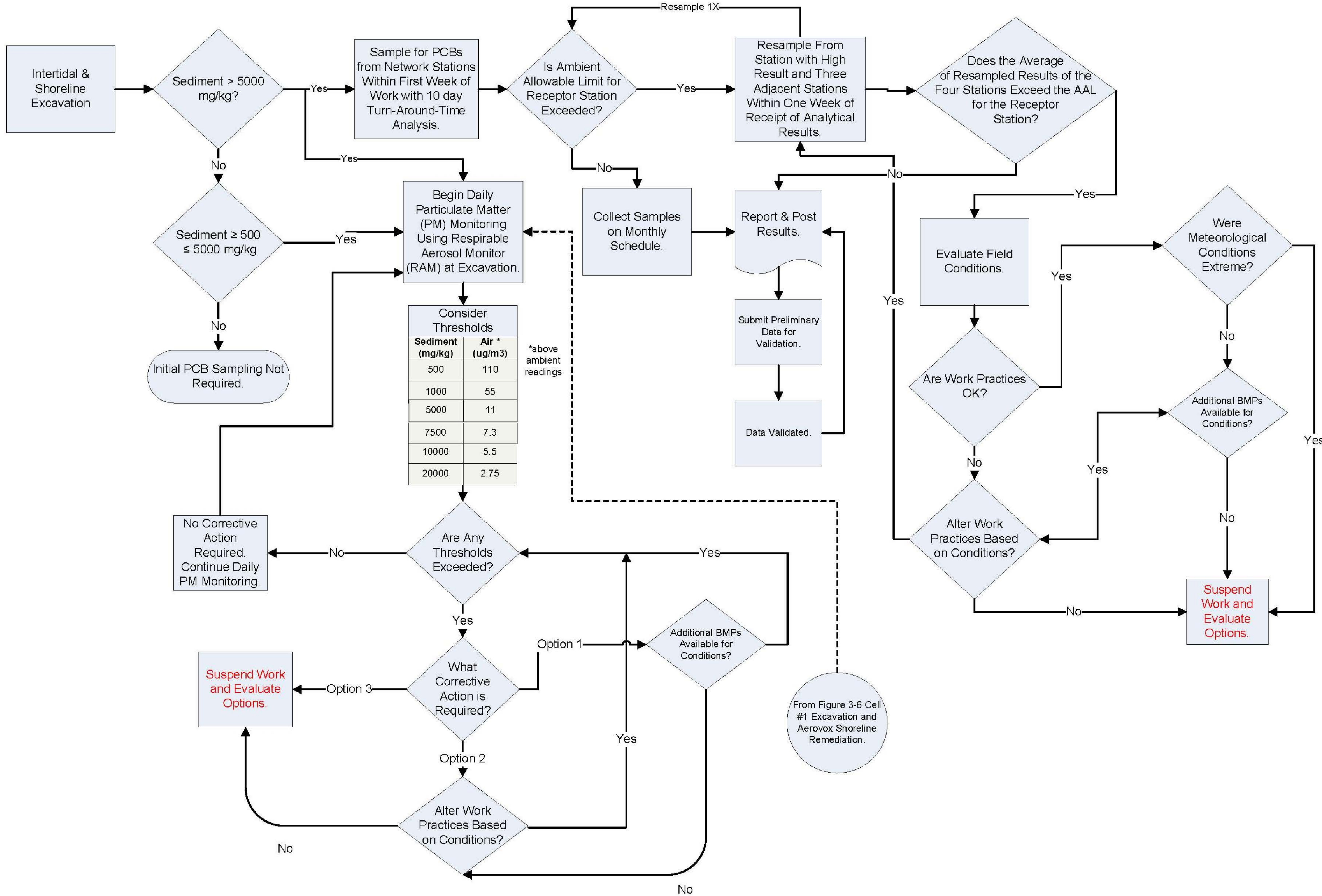
Sampling Logic for Cell #1 and Aerovox Shoreline Excavations

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 4/3/2015

Figure 3-6

Path: Y:\NBH\Projects\358G1001\20150402\ArcGIS\air_sampling_logic_process_flow_Figure 3-6.mxd



Legend

JACOBS

Sampling Logic for Intertidal and Shoreline Excavation

New Bedford Harbor Superfund Site

NAME: jpiccuito Date: 4/3/2015

Figure 3-7

Path: Y:\NBH\Projects\35BG1001\20150402\ArcGIS\air_sampling_logic_process_flow_Figure 3-7.mxd

TABLES

Table 2-1
Quarterly Average PCB Background Concentrations at the Baseline Sampling Locations at New Bedford Harbor

Baseline Air Quality Site Number [1]	Air Quality Site Location	2005 Air Monitoring Station	Quarterly PCB Background Concentration Averages (ng/m^3) [1, 2]
21	CDF D Area	50, 51, and 52	3.2, 35, 46, and 22
23	Acushnet Substation	42	9.9, 29, 31, and 24
24 and 24D	Aerovox	24	32, 76, 130, 67
25	Cliftex (Manomet)	25 and 46	3.2, 35, 46, and 22
26	Sawyer Street	47, 48, and 49	89, 61, 33, and 43
40	Wood Street	55 and 56 [3]	5.2

Notes:

[1] Quarterly average PCB background concentrations were presented in Appendix D: (Average/Maximum Total PCB Concentrations) of the March 2001 FW document titled *Final Annual Report Baseline Ambient Air Sampling & Analysis, 1 June 1999 – 30 May 2000, Operable Unit #1, New Bedford Harbor Superfund Site, New Bedford, Massachusetts* (FW 2001c).

[2] The quarterly averages represent the following quarterly timeframes for each year: December-February; March-May; June-August; and September-November.

[3] The concentration for Stations 55 and 56 reflects a maximum concentration for Station 40 (Wood Street). Quarterly average PCB concentrations were not available for Station 40 from the 1999 through 2000 FW sampling event.

Table 2-2
Ambient Air Monitoring Program - Total Detectable PCB Homologues
New Bedford Harbor Superfund Site

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										
12/29/14	NS	NS		NS	NS	NS	NS	0.980	NS	NS	NS	NS	0.504	NS	NS	NS	NS	NS					1.646/1.90	3.47	Rapid TAT data. Lower Harbor CAD Cell Construction Phase II (top of CAD Cell dredging). Unvalidated data.
12/18/14	NS	NS		NS	NS	NS	NS	1.00	NS	NS	NS	NS	0.49	NS	NS	NS	NS	NS					2.27	3.50/4.59d	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. Unvalidated data.
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. Validated data.
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). Validated data.
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	
12/4/2013								3.31/3.0d					0.643										2.16	3.57	Lower Harbor CAD Cell Construction Phase 1 (top of CAD Cell dredging)
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.
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				
7/20/2010	270	NS	NS		29	NS	26		47	NS	NS	79/73d	37.0	NS	NS	450	93	26			2.7				2010 Hydraulic Dredging.
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 Restaurant (#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							
10/14/2009	48.79	NS	NS		11.77	17.92	10.01		8.8/6.07d	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							2009 Hydraulic Dredging.
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.

Table 2-2
Ambient Air Monitoring Program - Total Detectable PCB Homologues
New Bedford Harbor Superfund Site

Sampling Date	PCB Concentration by Location (ng/m^3 in 24-hour time-weighted average): 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	Activity Period
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		121.94	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
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).

Table 3-1
Available Ambient Air Stations New Bedford Harbor Superfund Site

Location	Name	Type	Description	Easting	Northing
21	New Bedford Welding	A	Original background station	814013.00	2696913.00
24	Aerovox	A	Riverside NE corner	815574.00	2706941.00
25	Manomet	A	Also has been used as Cliftex	814907.00	2703854.00
27	Porter	A	On Francis Street	816405.00	2703925.00
30	Fibre Leather	A	Shoreline at boulder	815029.00	2705861.00
40	Titleist	A	Wood Street	815827.10	2707958.83
41	NSTAR Substation	A	East side	816074.00	2705524.00
42	NSTAR N	A	North of substation on road	816524.00	2706236.00
43	Veranda (Bus Terminal)	A	Parking Lot	816482.00	2701377.00
44	Taber	A	Taber Street Pumping Station	816299.14	2697997.14
45	Cozy Cove	A	Discontinued. Replaced by station 64	817660.46	2696229.34
46	Coffin	A	Coffin Ave	814526.25	2702691.52
47	Area C Downwind	A	Area C	814106.50	2701284.13
48	Area C Crosswind	A	Area C	813935.15	2701567.19
49	Area C Upwind	A	Area C	814279.00	2701564.00
50	Area D Downwind	A	Area D	814190.12	2696462.84
51	Area D Crosswind	A	Area D	813858.00	2696500.00
52	Area D Upwind	A	Area D	813994.44	2696189.80
53	Dredge	A	Upper Harbor	Varies by year	Varies by year
55	Aerovox West	A	Hadley & Belleville	814540.00	2706728.00
56	Acushnet Park	A	By shower on fenceline	815519.00	2708962.00
57	Riverside Park	A	At Park bench	813944.73	2702070.81
58	Pearl	A	NB Career Center	813157.94	2695954.03
59	Popes	A	Popes Island (north side)	815507.09	2695226.63
60	Washburn	A	I-195 easement	814710.07	2699497.33
61	South Fence	A	For mechanical dredge at Aerovox	815347.24	2706523.80
62	Century House	A	At parking lot/field	817152.98	2707558.15
63	Boat House	A	Area Q mech dredge	814733.64	2701176.71
64	Pilgrim	A	Pilgrim Street Pumping Station	817354.78	2696724.25
65	LHCC Dredge	A	Dredging by others	Varies by year	Varies by year
66	Huttleston	A	Parkway before Fairhaven H.S.	817964.46	2695208.57
67	Revere	A	Located on West Side Lower Harbor		

Table 3-2
Remedial Action Sampling Schemes

Remedial Action	Location	Sampling Stations Available for Use	Contaminant of Concern	Sampling Method	Sampling Frequency	Resampling Criteria
Hydraulic Dredging	Upper Harbor	24,25,27,30,42,43,44,46,47,48,49,50,51,52,53,55,56,64	PCBs	TO 10A	Monthly	Any one station with result greater than Risk Based Goal (RBG) will be resampled.
Mechanical Dredging and LHCC Filling	Upper Harbor	27,43,44,47,48,49,50,51,52,57,58,59,60,63,64,65,66	PCBs	TO 10A	Monthly	Any one station with result greater than RBG will be resampled.
Mechanical Dredging and LHCC Filling	Lower Harbor	27,43,44,5051,52,58, 59,60,64,65,66	PCBs	TO 10A	Monthly	Any one station with result greater than RBG will be resampled.
Former Aerovox Shoreline Excavation	Upper Harbor	24,25,27,30,40,43,46,55,56,57,61	PCBs	TO 10A	Biweekly/Monthly	Any one station with result greater than RBG will be resampled.
			VOCs	PID/OVM	Daily/Weekly	Refer to Table3-3
			PM_{10}	Nephelometer	Daily	
Cell #1 Excavation	Upper Harbor	25,27,43,46,47,48,49,57	PCBs	TO 10A	Biweekly/Monthly	Any one station with result greater than RBG will be resampled.
			VOCs	PID/OVM	Daily/Weekly	Refer to Table3-3
			PM_{10}	Nephelometer	Daily	
Shoreline Remediation	Upper Harbor	24,25,27,30,40,42,43,46,47,48,49,55,56,57,60,61,63,64	PCBs	TO 10A	Sediment < 5000 mg/kg - Monthly; Sediment >5000 mg/kg - Weekly	Any one station with result greater than RBG will be resampled.
			PM_{10}	Nephelometer	Daily	Refer to Table3-3
Shoreline Remediation	Lower Harbor	43,44,48,48,49,50,51,52,58,59,60,61,63,64,65,66	PCBs	TO 10A	Sediment < 5000 mg/kg - Monthly; Sediment >5000 mg/kg - Weekly	Any one station with result greater than RBG will be resampled.
			PM_{10}	Nephelometer	Daily	Refer to Table3-3

Notes:
PCBs - polychlorinated biphenyls
TO 10A - EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Air
ng/m^3 - nanograms per cubic meter of air
mg/kg - milligrams per kilogram
PID - photoionization detector with a 10.6 eV lamp
PM_{10} - particulate matter 10 microns or less in diameter
OVM - organic vapor monitor (3M 3500 or equivalent)

Table 3-3
Results and Associated Action Limits for Remedial Actions of the Former Aervox Shoreline and Interim CDF (Cell #1)

Contaminants	Greatest Observed Concentration in Sediment	Greatest Observed Concentration in Air While Hydraulically Dredging Off Aerovox	Exposure Limits[1]			
			Total VOCs	STEL[2]	PAV[3]	PAL[4]
Perchloroethene	240 ppm[5]	30 ppm	1 ppm	25 ppm	5 ppm	10 ppm
Trichloroethene	22,000 ppm	30 ppm	1 ppm	10 ppm	5 ppm	10 ppm
Hydrogen sulfide	Not Measured	400 ppm	1 ppm	1 ppm	1 ppm	0.5 ppm
Particulate Matter (PM_{10})	Not Measured	0.2 mg/m^3		0.15 mg/m^3	0.3 mg/m^3	0.075 mg/m^3
Vinyl Chloride	320 ppm	0.69 ppm	1 ppm	1 ppm	No detections	No detections
Polychlorinated biphenyls	20,000 ppm	0.286 mg/m^3		0.5 mg/m^3 [6]	0.35 mg/m^3	0.25 mg/m^3
cis-1,2-Dichloroethene	2,200 ppm	33 ppm	1 ppm	200 ppm	150 ppm	100 ppm

[1] The first threshold for Total VOCs is one part per million sustained for 15 minutes on the PID (10.6eV). If this threshold is achieved, colorimetric tubes for specific chemicals of concern (VOCs) will be used to determine the STEL. If the STEL is achieved then the PAV will be measured. If the PAV is achieved, operations will be reviewed for sources of VOCs. At the same time, the PAL will be measured. If the PAL is achieved, work will be suspended until corrective action has brought the PAL to or below the PAV.

[2] STEL is the short-term exposure limit based on 15 minutes of exposure up to four times in a work shift.

[3] PAV = perimeter assessment value; evaluate and observe conditions.

[4] PAL = perimeter action limit; suspend operations and mitigate to PAV or less.

[5] ppm – parts per million by volume

[6] mg/m^3 - milligrams per cubic meter of air

APPENDIX A

Derivation of Risk Based Goals for Airborne PCBs

Appendix A: Derivation of Risk-Based Goals for Air-Borne PCBs

This appendix summarizes the derivation of risk-based goals for air-borne PCBs for the New Bedford Harbor Superfund Site, specifically, the derivation of the original allowable ambient limit by Foster Wheeler (Foster Wheeler 2001), subsequent changes made by Jacobs (Jacobs 2006), development of "Quality of Life Performance Standards" (QoLPS) for the Hudson River PCB Superfund Site (EPA 2004), and potential risk-based goals following EPA's current guidance for inhalation risk assessment (EPA 2009).

A.1 Foster Wheeler PCB Allowable Ambient Limits

Foster Wheeler (2001) derived the initial PCB Ambient Air Limits to address the potential impact to the public health due to the incremental amount of volatile PCBs that may be released during remediation of New Bedford Harbor. Foster Wheeler determined that the non-threshold effect exposure limit (i.e., based on potential cancer risk) was more stringent than the threshold effect limit (i.e., based on non-cancer effects). The derivation of the non-threshold effect limit (NTEL) is presented in the following paragraphs.

Non-threshold exposure effect limits were calculated for a child resident, adult resident, and commercial worker (Table A.1). The NTELs were calculated for the adult resident and commercial worker using the following equation:

$$NTEL_{Adult} = \frac{(TR)(BW)(AT_c)(CV)}{(EF)(ED)(IR)(CSF)} \qquad \textbf{Eq. A.1}$$

Where:

$NTEL_{Adult}$	=	Non-threshold Effects Exposure Limit for carcinogenic effects (ng/m^3)
TR	=	Target Risk Level (unitless)
BW	=	Body Weight (kg)
AT_c	=	Averaging Time, carcinogenic (days)
CV	=	Conversion Factor (1,000,000 ng/mg)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
IR	=	Inhalation Rate (m^3/day)
CSF	=	Cancer Slope Factor for Total PCBs or a Specific Congener ((mg/kg-day)$^{-1}$)

The NTEL for the child resident receptor used an age-adjusted approach for an exposure duration of 10 years. The age-adjustment accounted for 6 years as a child and 4 years as an adult. The age-adjusted equation for the NTEL for a child resident is:

$$NTEL_{Child} = \frac{\left(\dfrac{(TR)(AT_c)(CV)}{(EF)(CSF)}\right)}{\left(\dfrac{(IR_c)ED_c}{BW_c}\right) + \left(\dfrac{(IR_a)ED_a}{BW_a}\right)} \quad \textbf{Eq. A.2}$$

Where:

$NTEL_{child}$	=	Non-threshold Effects Exposure Limit for carcinogenic effects (ng/m^3)
TR	=	Target Risk Level (10^{-5} unitless)
BW_c	=	Body Weight, child (kg)
BW_a	=	Body Weight, adult (kg)
AT_c	=	Averaging Time, carcinogenic (days)
CV	=	Conversion Factor (1,000,000 ng/mg)
EF	=	Exposure Frequency (days/year)
ED_c	=	Exposure Duration, child (years)
ED_a	=	Exposure Duration, adult (years)
IR_s	=	Inhalation Rate, child (m^3/day)
IR_a	=	Inhalation Rate, adult (m^3/day)
CSF	=	Cancer Slope Factor for Total PCBs or a Specific Congener ((0.4 mg/kg-day)$^{-1}$)

A.1.1 Exposure Assumptions

The exposure assumptions for the child resident, adult resident, and commercial worker are as follows:

Child Resident

Exposure Duration	10 years (6 as a child plus 4 as an adult)
Exposure Frequency	350 days/year
Body Weight	15 kg (child), 70 kg (adult)
Averaging time	25,550 days
Inhalation Rate	12 m^3/day (child)

Adult Resident

Exposure Duration	10 years
Exposure Frequency	350 days/year
Body Weight	70 kg
Averaging time	25,550 days
Inhalation Rate	20 m^3/day)

Commercial Worker

Exposure Duration	10 years
Exposure Frequency	250 days/year
Body Weight	70 kg
Averaging time	25,550 days
Inhalation Rate	20 m^3/day

A.1.2 Results of the Non-Threshold Effect Exposure Limit Calculations

Using the equations and assumptions presented above, the NTEL values for the three receptors are:

Child Resident 409 ng/m^3

Adult Resident 639 ng/m^3
Commercial Worker 894 ng/m^3

The ambient air limits to be tracked for the project were, therefore, 409 ng/m^3 for a residential receptor, and 894 ng/m^3 for a commercial worker.

A.2 Jacobs' Revisions to the Ambient Air Limits

Jacobs Engineering revised the sampling plan for ambient Air PCB concentrations (Jacobs 2006) to incorporate changes in the remediation approach, specifically, an increase in the project duration to 26 years.

Using the methodology developed by Foster Wheeler and incorporating an increase in the project duration from 10 years to 26 years, the allowable ambient limits for the child resident and commercial worker were recalculated to 202 and 344 ng/m^3, respectively. These risk-based goals have been used to track cumulative exposure budgets since 2006.

A.3 Hudson River PCB Superfund Site QoLPS

In 2004, EPA issued the *Hudson River PCBs Superfund Site Quality of Life Performance Standards* (EPA 2004). This document presented the performance standards, including air quality, that were developed by USEPA in accordance with the 2002 Record of Decision for the Site.

The performance standard for air quality addressed the potential exposure of both adults and children in the project area to emissions from the project. The standard prescribed emission thresholds or ambient concentrations that limited the pollutants that could be emitted during remedial activities. The primary air pollutant for the project was PCBs.

The performance standard for PCB air emissions were primarily based upon risk assessments and calculations that were developed using information from the USEPA's consensus database for toxicity information, the Integrated Risk Information System (IRIS), and thresholds established for other projects. To provide protection from both cancer risk and non-cancer hazard, a 24-hour standard was established for daily monitoring of the project. Where commercial and residential areas are mixed, the residential standard for PCBs was applied. The residential standard also applied to commercial or industrial locations where children may be present for extended periods of time (i.e., schools, day care facilities) (EPA 2004).

There are no federal or state regulatory standards for daily PCB emissions. The daily standard was developed using the IRIS Reference Dose for non-cancer health effects specific for Aroclor 1016, yielding a concentration of 0.11 μg/m^3 for a child resident (0 to 6 years old) (EPA 2004).

A.3.1 Calculation of QoLPS for Ambient Air

The ambient air QoLPS for the Hudson River Site for noncancer effects was calculated using the following equation:

$$QoLPS = \frac{(THQ)(BW)(AT)}{(EF)(ED)(IR)(CV)(1/RfD)}$$ **Eq. A.3**

Where:

QoLPS	=	Quality of Life Performance Standard (ng/m^3)
THQ	=	Target Hazard Quotient (1.0 unitless)
BW	=	Body Weight (kg)
AT	=	Averaging Time, noncarcinogenic (days)
CV	=	Conversion Factor (0.001 μg/mg)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
IR	=	Inhalation Rate (m^3/day)
RfD	=	Reference Dose for Total PCBs or a Specific Congener (0.00007 mg/kg-day)

A.3.2 Exposure Assumptions

The exposure assumptions for the child resident are as follows:

Exposure Duration 6 years
Exposure Frequency 350 days/year
Body Weight 15 kg (child)
Averaging time 365 days
Inhalation Rate 10 m^3/day

Therefore, the QoLPS for the Hudson River PCB Superfund Site based on protection of children exposed to air-borne PCBs is 0.11 μg/m^3 or 110 ng/m^3 (Table A.3).

A.4 Calculation of Risk-Based Goals Following Updated EPA Guidance

This section presents the derivation of potential risk-based goals for air-borne PCBs following EPA's current guidance for evaluation of risk to human health via inhalation of air-borne contaminants. The methodology previously used to calculate cancer and non-cancer risk exposure budget levels at New Bedford Harbor and the Hudson River PCBs Superfund Site is outdated due to a change in EPA inhalation risk assessment methods (EPA 2009) for calculating cancer risk and non-cancer hazards.

The revised methodology described below may be used to derive the risk-based goals for cancer risk from the inhalation of total PCBs. Dioxin-like PCBs have been detected in air monitoring samples and determined not to pose an unacceptable cancer risk (Foster Wheeler 2003, and See attachment A1 - EPA 2015), therefore, early warning levels will not be derived for dioxin-like PCBs.

The revised approach was used to calculate the risk-based goals for the following receptors:

1) child resident over the most recent six years ,
2) long-term resident from childhood to adult over the entire sampling period since beginning sampling,
3) short-term worker over the most recent six years, and
4) long-term worker over the entire sampling period since beginning sampling

The exposure duration of six years for a child resident was chosen because it is the minimum exposure duration for chronic risk and coincides with the EPA default exposure duration for a young child (birth to age 6), the most sensitive receptor for non-cancer hazards. EPA's current default exposure duration is 6 years for a child resident, 20 years for an adult resident (for a total of 26 years), and 25 years for a worker.

Cancer risk is expressed as the Excess Lifetime Cancer Risk (ELCR), which is calculated as the product of the cancer potency of the chemical, expressed as an Inhalation Unit Risk (IUR), and the Lifetime Average Daily Concentration (LADC). The IUR is derived by EPA, preferably, or other agencies and represents the probability of cancer associated with a unit exposure concentration. The IUR for total PCBs is 1.0E-04 $(\mu g/m^3)^{-1}$, which is the IUR for Low Risk PCBs. The ELCR is calculated according to the following equation:

$$RBG_c = \frac{(TR)}{(EF)(ED)(ET)(CF1)(CF2)(IUR)} \quad \textbf{Eq. A.5}$$

Where:
TR = Target Risk (10^{-5})
RBG_c = Carcinogenic Risk-Based Goal for PCBs in air (ng/m^3)
CF1 = Conversion Factor 1 (0.001 µg/ng)
ET = Exposure Time (hr/day)
CF2 = Conversion Factor 2 (4.17E-02 day/hr)
EF = Days per year
ED = years
IUR = Inhalation Unit Risk ((1.0E-04 $\mu g/m^3)^{-1}$)

EPA default exposure assumptions for calculation of cancer risk are tabulated below:

Receptor	Exposure Time (hour/day)	Exposure Frequency (day/year)	Exposure Duration (year)
Resident-child	24	350	6
Resident-adult	24	350	20
Worker-short term	8	250	6
Worker-long term	8	250	25

Using the approach presented above the following potential risk-based goals have been derived for the New Bedford Harbor cleanup (Table A.4):

Child Resident Cancer based RBG = 1,167 ng/m^3

Adult Resident Cancer based RBG = 350 ng/m^3

Short-term Worker Cancer based RBG = 5,110 ng/m^3

Long-term Worker Cancer based RBG = 2, 044 ng/m^3.

These goals are higher and, therefore, less stringent than those being used on the project and are provided for reference only.

A.5 Uncertainty Analysis

This section discusses the uncertainties associated with the proposed RBGs based on the potential use of upper reference point toxicity values for PCBs and their effect on calculated RBGs, and modeling of potential particulate emissions.

Selection of the appropriate toxicity values for PCBs is associated with uncertainty. EPA's Cancer Dose-Response Assessment document (EPA 1996) and IRIS database (EPA 2015) provide a mid-tier cancer slope factor of 0.4 per mg/kg-d based on tumor incidence in rats that were exposed to Aroclor-1242. EPA (1996, 2015) states that this mid-tier toxicity value is appropriate for evaluating exposure via inhalation of vapors, and it is the slope factor that was used in the derivation of the original non-threshold RBGs presented in the 2001 Development Document (Foster Wheeler, 2001), as discussed in Section A.2 and A.3. EPA (1996, 2015) also indicates that for early life exposures and inhalation of dust or aerosols it may be appropriate to use an upper reference point cancer slope factor of 2 per mg/kg-d, which is based on tumor incidence in rats that were exposed to Aroclor-1254.

However, to provide information on the range of potential RBGs, the more stringent cancer toxicity values were plugged into the equations presented above to evaluate the potential effect on the calculated RBGs. RBGs were calculated for a child resident using the upper reference point toxicity values. RBGs based on cancer endpoints was 220 ng/m^3 compared to the currently proposed RBGs of 202 ng/m^3 for cancer and 110 ng/m^3 for noncancer endpoints. Since the proposed RBG for cancer is lower than the RBG calculated using the upper reference point toxicity value, the proposed RBG is still considered protective.

Modeling of potential particulate emissions during remedial actions at New Bedford Harbor, conducted by Jacobs (2015) and expounded upon by AECOM indicates that particulate emissions during remedial actions and the resulting air borne PCB concentrations are minimal compared to the ambient background. Similarly, modeling of vapor phase emissions of PCBs was conducted by Jacobs (2010). This modeling indicated that vapor phase emissions of PCBs and the resultant exposures would be below the proposed RBGs. The evaluation of particulate and vapor phase emissions of PCBs supports the use of the mid-tier cancer slope factor based on Aroclor 1242 and the noncancer reference dose based on Aroclor 1016 for deriving RBGs for the New Bedford Harbor air monitoring program.

Based on the derivation of RBGs for early life exposures to air borne PCBs using upper reference point toxicity values, and the comparison to these RBGs with the proposed RBGs calculated using the middl reference point toxicity values indicates that the proposed RBGs are within EPA's criteria for making risk management decisions. Additionally, an evaluation of the modeling of particulate and vapor phase PCB emissions supports the selection of the RBGs calculated using the middle reference point toxicity values.

A.6 Risk-Based Goals for PCBs in Air

Consistent with risk management criteria for CERCLA sites (EPA 1990), the risk management criteria for the project will be HQ values approaching HQ =1 and ELCR values approaching 1E-05. For consistency with the project history and decisions made for protection of public health at other sites, RBGs have been selected for the site based on potential residential exposures. The first RBG for PCBs is 110 ng/m^3 based on non-cancer hazards for a child resident derived for the Hudson River PCBs Superfund Site. The second RBG for PCBs is 344 ng/m^3 based on cancer risk for a long-term worker derived by Jacobs in 2006. An additional RBG for residential receptors based on potential cancer endpoints (202 ng/m^3) will be evaluated, however, the RBG based on non-cancer exposures is more stringent and will be the basis for the evaluation of the need to modify site work.

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Table A-1
Original Allowable Ambient Limits (AALs) - Cancer (From Foster Wheeler 2001 Development Document - provided for informational purposes only)
New Bedford Harbor Superfund Site

Adult Resident-Cancer NTEL - 10 year exposure duration

Chemical	TR Unitless	BW kg	AT-c (day)	CV ng/mg	IR m^3/day	EF (day/yr)	ED (yr)	CSF $(mg/kg\text{-}day)^{-1}$	$NTEL_{Adult}$ ng/m^3
PCBs	1.E-05	70	25550	1.E+06	20	350	10	4.0E-01	639

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight
AT = Averaging Time
CV = Conversion Factor
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CSF = Cancer Slope Factor (low risk and persistence CSF for PCBs)
$NTEL_{Adult}$ = Non-threshold Effects Exposure Limit

$$NTEL_{Adult}=(TR*BW*AT*CV)/(EF*ED*IR*CSF)$$

Child Resident-Cancer NTEL - 10 year exposure duration

Chemical	TR Unitless	AT-c (day)	CV ng/mg	EF (day/yr)	CSF $(mg/kg\text{-}day)^{-1}$	IR_c m^3/day	ED_c (yr)	BW_c kg	IR_a m^3/day	ED_a (yr)	BW_a kg	$NTEL_{Child}$ ng/m^3
PCBs	1.E-05	25550	1.E+06	350	4.0E-01	8.3	6	15	2.E+01	4	70	409

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
AT = Averaging Time
CV = Conversion Factor
EF = Exposure Frequency
CSF = Cancer Slope Factor (low risk and persistence CSF for PCBs)
IR_c = Inhalation Rate, child
IR_a = Inhalation Rate, adult
ED_c = Exposure Duration, child
ED_a = Exposure Duration, adult
BW_c = Body Weight, child
BW_a = Body Weight, adult
$NTEL_{Child}$ = Non-threshold Effects Exposure Limit

$$NTEL_{Child}=[(TR*AT*CV)/(EF*CSF)]/[(IR_c*EDc)/BW_c)+(IRa*ED_a)/BW_a)$$

Table A-1
Original Allowable Ambient Limits (AALs) - Cancer (From Foster Wheeler 2001 Development Document - provided for informational purposes only)
New Bedford Harbor Superfund Site

Commercial Worker-Cancer NTEL - 10 year exposure duration

Chemical	TR	BW	AT-c	CV	IR	EF	ED	CSF	$NTEL_{Adult}$
	Unitless	kg	(day)	ng/mg	m^3/day	(day/yr)	(yr)	$(mg/kg\text{-}day)^{-1}$	ng/m^3
PCBs	1.E-05	70	25550	1.E+06	2.E+01	250	10	4.0E-01	894

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight
AT = Averaging Time
CV = Conversion Factor
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CSF = Cancer Slope Factor (low risk and persistence CSF for PCBs)
$NTEL_{Adult}$ = Non-threshold Effects Exposure Limit

$NTEL_{Adult}$=(TR*BW*AT*CV)/(EF*ED*IR*CSF)

Table A-2
Risk-Based Goals for Air - Cancer - Non-Threshold Effects Exposure Limit (NTEL) (Jacobs 2006 Revision)
New Bedford Harbor Superfund Site

Child/Adult Resident-Cancer RBG - 26 year exposure duration

Chemical	TR	AT-c	CV	EF	CSF	IR_c	ED_c	BW_c	IR_a	ED_a	BW_a	$RBG_{Child/Adult\ Resid}$
	Unitless	(day)	ng/mg	(day/yr)	$(mg/kg\text{-}day)^{-1}$	m^3/day	(yr)	kg	m^3/day	(yr)	kg	ng/m^3
PCBs	1.E-05	25550	1.E+06	350	4.0E-01	8.3	6	15	2.E+01	20	70	202

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
AT = Averaging Time

$$RBG_{Child}=[(TR*AT*CV)/(EF*CSF)]/[(IR_c*EDc)/BW_c)+(IRa*ED_a)/BW_a)$$

CV = Conversion Factor
EF = Exposure Frequency
CSF = Cancer Slope Factor (low risk and persistence CSF for PCBs)
IR_c = Inhalation Rate, child
IR_a = Inhalation Rate, adult
ED_c = Exposure Duration, child
ED_a = Exposure Duration, adult
BW_c = Body Weight, child
BW_a = Body Weight, adult
RBG = Risk-Based Goal

Commercial Worker-Cancer RBG - 26 year exposure duration

Chemical	TR	BW	AT-c	CV	IR	EF	ED	CSF	$RBG_{Adult\ Worker}$
	Unitless	kg	(day)	ng/mg	m^3/day	(day/yr)	(yr)	$(mg/kg\text{-}day)^{-1}$	ng/m^3
PCBs	1.E-05	70	25550	1.E+06	2.E+01	250	26	4.0E-01	344

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight

$$RBG_{Adult\ Worker}=(TR*BW*AT*CV)/(EF*ED*IR*CSF)$$

AT = Averaging Time
CV = Conversion Factor
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CSF = Cancer Slope Factor (low risk and persistence CSF for PCBs)
RBG = Risk-Based Goal

Table A-3
Risk-Based Goals for Air - Noncancer - Quality of Life Performance Standard
New Bedford Harbor Superfund Site

Child Resident - 6 year exposure duration

Chemical	THQ Unitless	BW kg	AT (day)	EF (day/yr)	ED (yr)	IR m^3/day	CV mg/ng	RfD (mg/kg-day)	RBG ng/m^3
PCBs	1.E+00	15	2190	350	6	1.E+01	1.E-06	7.0E-05	110

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight
AT = Averaging Time
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CV = Conversion Factor
RfD = Reference Dose (Aroclor 1016)
RBG = Risk-Based Goal

RBG=(THQ*BW*AT)/(EF*ED*IR*CV*1/RfD)

Note: From Hudson River Dredging Quality of Life Performance Standard (QoLPS)

Table A-4
Risk-Based Goals for Air - Cancer - Using EPA 2009 Inhalation Guidance Methodology (provided for informational purposes only)
New Bedford Harbor Superfund Site

Child/Adult Resident-Cancer RBG - 26 year exposure duration

Chemical	TR Unitless	AT day	EF (day/yr)	ED (yr)	ET hour/day	CF1 ng/ug	CF2 day/hr	IUR $(ug/m^3)^{-1}$	$RBG_{age\ group}$ ng/m^3	$RBG_{Child/Adult\ Resid}$ ng/m^3
PCBs	1.E-05	25500	350	20	24	1.E-03	4.17E-02	1.0E-04	364	280
PCBs	1.E-05	25500	350	6	24	1.E-03	4.17E-02	1.0E-04	1214	

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight
AT = Averaging Time
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CV = Conversion Factor
IUR = Inhalation Unit Risk (low risk and persistence CSF for PCBs)
RBG = Risk Based Goal

$RBG_{age\ group} = (TR*AT)/(EF*ED*ET*CF1*CF2*IUR)$

$RBG_{Child/Adult\ Resid} = 1/(1/RBG_{child} + 1/RBG_{adult})$

Short-term Worker-Cancer RBG - 6 year exposure duration

Chemical	TR Unitless	AT day	EF (day/yr)	ED (yr)	ET hour/day	CF1 ng/ug	CF2 day/hr	IUR $(ug/m^3)^{-1}$	RBG ng/m^3
PCBs	1.E-05	25500	250	6	8	1.E-03	4.17E-02	1.0E-04	5100

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight
AT = Averaging Time
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CV = Conversion Factor
IUR = Inhalation Unit Risk (low risk and persistence CSF for PCBs)
RBG = Risk Based Goal

$RBG=(TR*AT)/(EF*ED*ET*CF1*CF2*IUR)$

Table A-4
Risk-Based Goals for Air - Cancer - Using EPA 2009 Inhalation Guidance Methodology (provided for informational purposes only)
New Bedford Harbor Superfund Site

Long-term Worker-Cancer RBG - 25 year exposure duration

Chemical	TR Unitless	AT day	EF (day/yr)	ED (yr)	ET hour/day	CF1 ng/ug	CF2 day/hr	IUR $(ug/m^3)^{-1}$	RBG ng/m^3
PCBs	1.E-05	25500	250	25	8	1.E-03	4.17E-02	1.0E-04	1224

PCBs = Polychlorinated Biphenyls
TR = Target Risk Level
BW = Body Weight

RBG=(TR*AT)/(EF*ED*ET*CF1*CF2*IUR)

AT = Averaging Time
IR = Inhalation Rate
EF = Exposure Frequency
ED = Exposure Duration
CV = Conversion Factor
IUR = Inhalation Unit Risk (low risk and persistence CSF for PCBs)
RBG = Risk Based Goal

APPENDIX B

Evaluation by the EPA of the Relative Contribution of Risk from Dioxin-like Congeners

DRAFT TECHNICAL MEMORANDUM

To:	Ginny Lombardo
From:	Richard Sugatt
Date:	July 2, 2015
Subject:	Relative contribution of dioxin-like PCB congeners to inhalation risk of total PCBs for worst-case Station 24 at New Bedford Harbor

The purpose of this technical memorandum is to update the evaluation of whether the inhalation risk due to dioxin-like PCB congeners is significant relative to the risk due to total PCBs. This issue was addressed previously in the December 2001 “Draft Final Development of PCB Air Action Levels for the Protection of the Public, New Bedford Harbor Superfund Site, New Bedford Harbor, Massachusetts” (FWEC, 2001). FWEC (2001) concluded that, at a maximum, the small quantity of dioxin-like PCB congeners are associated with approximately the same level of potential inhalation cancer risk as the remaining 98.7% of the airborne mass of total PCBs. Due to the conservative nature of the assessment (i.e. assuming nondetects occurred at ½ the detection limit, somewhat elevated detection limits for the low concentration congener results, and use of exposure assumptions for the most potentially impacted individual, etc.), it was recommended not to adjust the “allowable ambient limit”, although it was recommended that congener analysis be performed on a periodic basis once remediation begins to reassess the contribution of any dioxin-like PCB congeners.

The measured concentrations of total PCBs (tPCBs) and dioxin Toxicity Equivalents (TEQ) of dioxin-like PCBs in 60 air samples taken from June, 1999 to September, 2013 at Station 24 (Aerovox) were compiled and are presented in Table 1. This station is likely to have the highest concentrations of airborne PCBs so it is representative of worst-case conditions for both tPCBs and TEQ. As shown in table 1, the simple average concentrations were 341 ng/m^3 tPCB and 0.00146 ng/m^3 TEQ. The time-weighted total PCB averages are much lower (see PETs curve reports); therefore, the simple average concentrations result in higher calculated risks.

Cancer Risk

Inhalation cancer risks of the average concentration of tPCBs and TEQ were calculated for a combined adult and child resident, using the exposure assumptions and equation provided in Table 2. According to the EPA IRIS file on PCBs (Section II.C.3), for inhalation of evaporated congeners, the middle-tier slope factor (0.4 per (mg/kg)/day) can be converted to an inhalation unit risk (IUR) of 1 x 10^{-4} per ug/m^3. This IUR was used for calculation of cancer risk of tPCBs. The IRIS IUR for 2, 3, 7, 8-TCDD (2, 3, 7, 8-tetrachlorodibenzodioxin) (38 per ug/m^3) was used for calculation of cancer risk of PCB TEQ.

As shown in Table 2, the elevated lifetime cancer risk (ELCR) of dioxin-like PCB TEQ (2.0E-05) is slightly higher, but functionally equivalent to the ELCR of tPCB (1.2E-05) with regard to risk management. PCB TEQ cancer risk is about 1.7 times higher than tPCB cancer risk and about 63% of the combined tPCB and TEQ ELCR. These differences are not considered significant because the combined cancer risk would be only about two times higher than the tPCB cancer risk alone. This factor is well within the same order of magnitude, given the uncertainty associated with the toxicity factors and conservativeness of the exposure factors.

Non-Cancer Risk

Inhalation non-cancer risks of the average concentrations of tPCBs and PCB TEQ were calculated separately for an adult resident and a child resident, using the exposure assumptions and equations in Table 3. Noncancer risk of dioxin-like PCBs, with concentrations expressed as total Toxic Equivalents

(TEQ), was calculated using the IRIS inhalation Reference Concentration (RfC_i) for 2, 3, 7, 8-TCDD (4.0E-05 ug/m^3). Because there is no inhalation Reference Concentration (RfC_i) for PCBs other than individual dioxin-like PCBs, route-to-route extrapolation from the oral route to the inhalation route was used. The oral Reference Dose (RfD_o) for Aroclor 1016 (7.0E-05 mg/kg-day) was used because the congener pattern of baseline air samples (Table 3-2 in FWEC, 2001) is closer to Aroclor 1016 than to Aroclor 1254, the only other PCB mixture with an IRIS-issued RfD_o . In addition, the chlorine weight % is higher in Aroclor 1254 (54%) than in Aroclor 1016 (41%)(Table 1 in Frame et al, 1996). There is a high level of uncertainty concerning the use of route-to-route extrapolation, but, in the absence of an RfC_i for total PCBs, this approach is considered useful for the purpose of evaluating the relative contribution of total PCBs to noncancer risk, compared with dioxin-like PCBs. The non-cancer inhalation toxicity of PCBs is currently under reassessment by EPA. The IRIS RfCi for 2, 3, 7, 8-TCDD (4×10^{-5} ug/m^3) was used to calculate non-cancer inhalation risk of dioxin-like PCBs.

The non-cancer risks of PCB TEQ were HQ =0.035 for the child resident and 0.12 for the adult resident. The non-cancer risks of tPCBs were HQ = 3.1 for the child resident and 0.97 for the adult resident. The HQ for tPCBs was higher than the HQ for PCB TEQ by a factor of about 86 (3.1/0.035) for the child resident and by a factor of about 8 (0.97/0.12) for the adult resident. As described elsewhere, the most stringent risk-based concentration is 110 ng/m3 total PCBs for a HQ =1 for the child resident. For the child resident, the HQ due to dioxin-like PCBs is only about 1% of the HQ for tPCBs; therefore, the risk due to dioxin-like PCBs is not considered significant relative to the risk of tPCBs. In the absence of an RfCi values for tPCBs, these results indicate that dioxin-like PCBs make an insignificant contribution to non-cancer risk for the most sensitive receptor.

The results of this reevaluation indicate that 1) the slightly higher risk of dioxin-like PCBs (less than two-fold) compared to tPCBs is not significant for risk management purposes, given uncertainty and conservativeness of toxicity and exposure factors, and 2) non-cancer risk of dioxin-like PCBs is insignificant compared to tPCBs for the most sensitive receptor, whose risk will drive risk management actions at New Bedford Harbor Superfund site.

Therefore, it is recommended that the air monitoring program continue to evaluate cancer and non-cancer risks of tPCBs without regard to dioxin-like PCB congeners. It is recommended that this recommendation be reevaluated as the EPA reassessment of non-cancer inhalation toxicity of PCBs proceeds.

References

Foster Wheeler Environmental Corporation (FWEC). 2001. *Draft Final Development of PCB Air Action Levels for the Protection of the Public,* New Bedford Harbor Superfund Site, New Bedford Harbor, Massachusetts. December, 2001.

Frame, G. M. et al. 1996. *Comprehensive, Quantitative, Congener-Specific Analyses of Eight Aroclors and Complete PCB Congener Assignments on DB-1 Capillary Columns. Chemosphere 33(4)*: 603-623.

U.S. Environmental Protection Agency (EPA). 1994. *Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry*. EPA/600/8-90/066F. October, 1994.

Table 1
Station 24-New Bedford Harbor Air Monitoring Data

Monitoring Data			
Sample No.	Sample Date	Total PCBs (ng/m^3)	Total PCB-TEQ (ng/m^3)
06049924	06/04/99	230	4.74E-04
06109924	06/10/99	96	2.33E-04
06169924	06/16/99	110	2.67E-04
06229924	06/22/99	150	4.86E-04
07069924	07/06/99	160	9.97E-04
07109924	07/10/99	74	5.18E-05
07229924	07/22/99	120	2.10E-03
07289924	07/28/99	140	1.30E-04
08039924	08/03/99	130	7.07E-05
08099924	08/09/99	120	5.53E-05
08159924	08/15/99	110	2.06E-05
08219924	08/21/99	88	3.00E-02
10089924	10/08/99	74	2.35E-04
03150024	03/15/00	68	2.53E-05
04040024	04/04/00	73	4.66E-02
04170024	04/17/00	57	1.33E-05
A-090804-24	09/08/04	1000	1.79E-04
A-091304-24	09/13/04	1400	1.06E-04
A-092204-24	09/22/04	590	1.05E-04
A-092704-24	09/27/04	790	2.73E-04
A-101804-24	10/18/04	560	4.93E-05
A-110404-24	11/04/04	0.13	0.00E+00
A-091405-24	09/14/05	1500	7.92E-04
A-092205-24	09/22/05	180	4.72E-06
A-092805-24	09/28/05	380	1.07E-05
A-100505-24	10/05/05	1800	4.53E-04
A-102705-24	10/27/05	15	1.31E-06
A-111705-24	11/17/05	16	9.57E-07
A-122805-24	12/28/05	83	4.24E-06
A-083006-24	08/30/06	1600	7.54E-04
100506-24	10/04/06	2400	9.97E-05
A111806-24	11/18/06	41	2.41E-06
082007-24	08/20/07	280	4.82E-05
A-091707-24	09/17/07	180	1.61E-05
A110807-24	11/08/07	20	5.52E-07
A-061609-24	06/16/09	150	1.25E-05
A-071309-24	07/13/09	130	2.28E-05
081309-24	08/13/09	130	2.71E-05
091709-24	09/17/09	160	9.67E-06
101409-24	10/14/09	49	4.83E-06

Table 1
Station 24-New Bedford Harbor Air Monitoring Data

Monitoring Data			
Sample No.	Sample Date	Total PCBs (ng/m^3)	Total PCB-TEQ (ng/m^3)
110909-24	11/09/09	45	4.45E-06
A121609-24	12/16/09	2.6	3.12E-07
A052110-24	05/21/10	85	1.30E-04
A063010-24	06/30/10	110	2.90E-04
A072010-24	07/20/10	270	8.07E-05
A081810-24	08/18/10	1800	2.79E-04
A101310-24	10/13/10	80	7.82E-06
A052511-24	05/25/11	56	2.70E-05
A071311-24	07/13/11	1000	1.43E-04
A082311-24	08/23/11	280	1.15E-03
A091411-24	09/14/11	480	2.22E-05
A101111-24	10/11/11	36	1.32E-05
A052112-24	05/21/12	51	2.20E-06
A071612-24	07/16/12	220	2.94E-05
A082112-24	08/21/12	67	2.20E-06
A100112-24	10/01/12	98	7.03E-06
A032613-24	03/26/13	14	1.06E-06
A071613-24	07/16/13	240	5.68E-04
A082013-24	08/20/13	230	2.73E-05
A092513-24	09/25/13	26	3.11E-06
	AVERAGE:	3.41E+02	1.46E-03

Table 2
Cancer Risk-Station 24 New Bedford Harbor

Child and Adult Resident-Cancer Risk

Chemical	CA (ng/m^3)	CF1 (ug/ng)	ET (hr/day)	CF2 (day/hr)	EF (day/yr)	ED_c (yr)	ED_a (yr)	AT-c (day)	IUR $(ug/m^3)^{-1}$	ELCR
tPCBs	3.41E+02	0.001	24	4.2E-02	350	6	20	25550	1.0E-04	1.2E-05
TEQ	1.46E-03	0.001	24	4.2E-02	350	6	20	25550	3.8E+01	2.0E-05
									Total PCB & TEQ:	3.2E-05

$ELCR = ((CA*CF1*ET*CF2*EF*ED_a*1/AT\text{-}c)*IUR)) + ((CA*CF1*ET*CF2*EF*ED_c*1/AT\text{-}c)*IUR))$

CA = Concentration in air
CF1 = Conversion Factor 1 (ug/ng)
ET = Exposure Time
CF2 = Conversion Factor 2 (day/hr)
EF = Exposure Frequency
ED_c =Exposure Duration-child
ED_a = Exposure Duration-adult
AT-c = Averaging Time-cancer
IUR = Inhalation Unit Risk
ELCR = Elevated Lifetime Cancer Risk
TEQ = dioxin Toxicity Equivalents

Table 3
Noncancer Risk-Station 24 New Bedford Harbor

Child Resident-Noncancer Risk of Dioxin-like PCBs TEQ using Inhalation RfC for 2, 3, 7, 8-TCDD

Chemical	CA (ng/m^3)	ET (hr/day)	EF (day/yr)	ED (yr)	CF1 (ug/ng)	CF2 (day/hr)	AT-nc (day)	RfC (ug/m^3)	HQ (unitless)
TEQ	1.46E-03	24	350	6	0.001	4.2E-02	2190	4.0E-05	3.5E-02

HQ= (CA*CF1*CF2*ET*EF*ED*1/AT-nc)/RfC

Child Resident-Noncancer Risk of Total PCB using Oral RfD of Aroclor 1016 and route-to-route extrapolation

Chemical	CA (ng/m^3)	ET (hr/day)	EF (day/yr)	ED (yr)	CF2 (day/hr)	CF3 (mg/ng)	IR_c (m^3/d)	AT-nc (day)	BW_c (kg)	RfD (mg/kg-day)	HQ (unitless)
tPCBs	341	24	350	6	4.2E-02	1.0E-06	10	2190	15	7.0E-05	3.1E+00

HQ =(CA*EF*ED*IR*CF3*1/AT-nc*1/BW)/RfD

Adult Resident-Noncancer Risk of Dioxin-like PCBs TEQ using Inhalation RfC for 2, 3, 7, 8-TCDD

Chemical	CA (ng/m^3)	ET (hr/day)	EF (day/yr)	ED (yr)	CF1 (ug/ng)	CF2 (day/hr)	AT-nc (day)	RfC (ug/m^3)	HQ
TEQ	1.46E-03	24	350	20	0.001	4.2E-02	2190	4.0E-05	1.2E-01

HQ= (CA*CF1*CF2*ET*EF*ED*1/AT-nc)/RfC

Adult Resident-Noncancer Risk of Total PCB using Oral RfD of Aroclor 1016 and route-to-route extrapolation

Chemical	CA (ng/m^3)	ET (hr/day)	EF (day/yr)	ED (yr)	CF2 (day/hr)	CF3 (mg/ng)	IR_a (m^3/d)	AT-nc (day)	BW_a (kg)	RfD (mg/kg-day)	HQ (unitless)
tPCBs	341	24	350	20	4.2E-02	1.0E-06	20	8760	80	7.0E-05	9.7E-01

HQ =(CA*EF*ED*IR*CF3*1/AT-nc*1/BW)/RfD

CA = Concentration in air
CF1 = Conversion Factor 1 (ug/ng)
CF2 = Conversion Factor 2 (day/hr)
CF3 = Conversion Factor 3 (mg/ng)
ET = Exposure Time
EF = Exposure Frequency
ED = Exposure Duration
IR_a = Inhalation Rate-Adult
IR_c = Inhalation Rate-child
BW_a = Body Weight-adult
BW_c = Body Weight-child
AT-nc = Averaging Time-noncancer
RfC = inhalation Reference Concentration
RfD =oral Reference Dose
HQ = Hazard Quotient
TEQ = dioxin Toxicity Equivalents
tPCBs = total Polychlorinated Biphenyls
2, 3, 7, 8-TCDD = 2, 3, 7, 8-Tetrachlorodibenzodioxin

APPENDIX C

PETS Curves Examples

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
[#]	[month/day/year]	[days]	Running Sum of Column (C) to Date [days]	[days]	[ng/m^3]	[ng/m^3]	Column (L)/Column (D) [ng/m^3]	EBS * Column (C) [ng/m^3-days]	Sum of Column (I) [ng/m^3-days]	Column (G)* Column (C) [ng/m^3-days]	Sum of Column (K) [ng/m^3-days]	Column (K) /Column (I) [%]	Column (L) /Column (J) [%]
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

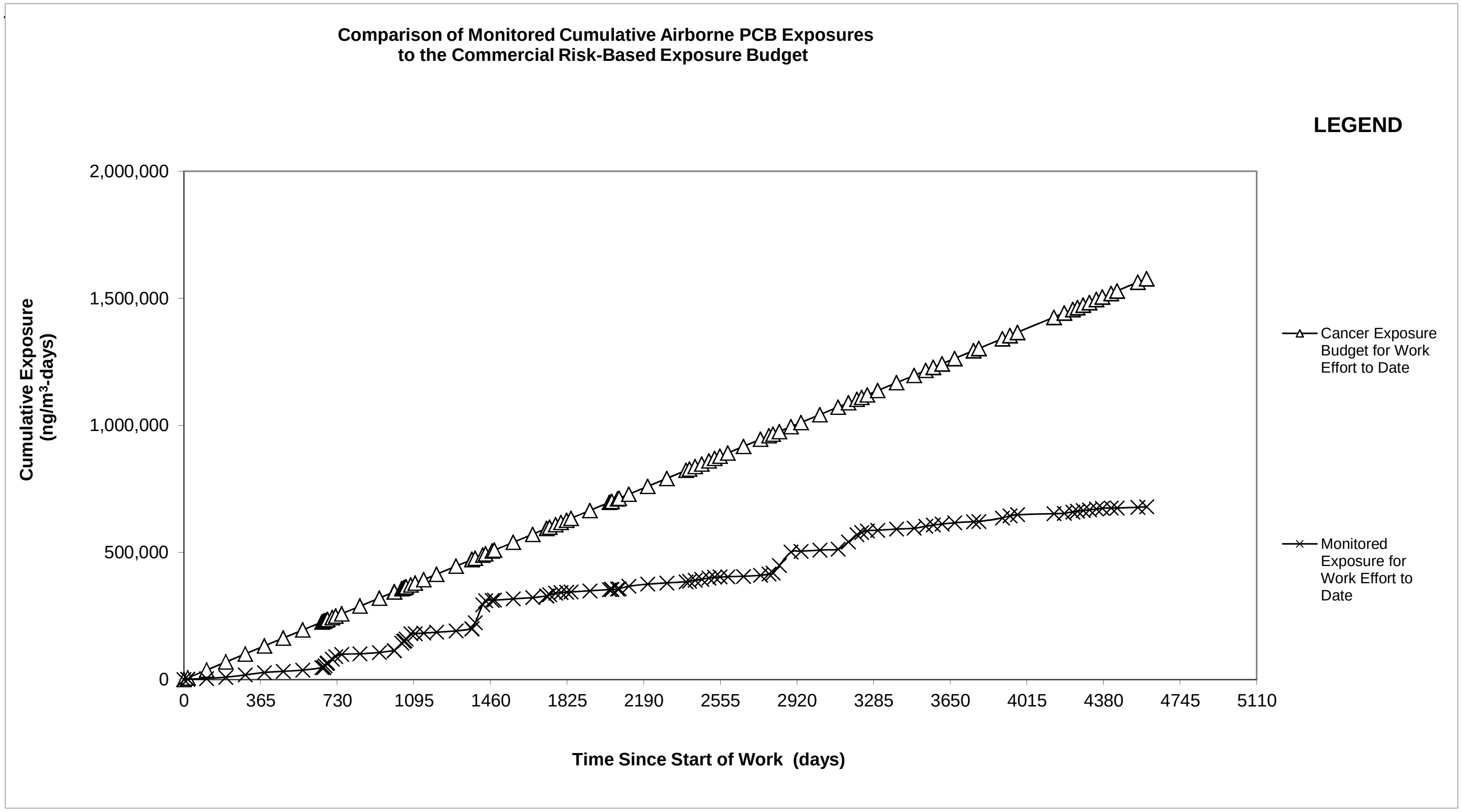
Sample Results, Calculated Budget and Exposure Values
Station: 24 Aerovox

(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