PHASE III IDENTIFICATION, EVALUATION AND SELECTION OF COMPREHENSIVE REMEDIAL ACTION ALTERNATIVES

New Bedford High School Mechanical Room
230 Hathaway Boulevard
New Bedford, Massachusetts
Release Tracking Number 4-22409

Submitted to:

Massachusetts Department of Environmental Protection
Southeast Region Main Office
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Prepared by:

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On behalf of:

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ACRONYMS

APH	Air Phase Petroleum Hydrocarbons
Atm-m^3/mol	Atmospheres-Cubic Meter per Mole
AUL	Activity and Use Limitation
BETA	The BETA Group, Incorporated
°C	Degrees Celsius
CEP	Critical Exposure Pathway
Cis-1,2-DCE	cis-1,2-dichloroethene
COC	Chemical of Concern
1,3-DCB	1,3-Dichlorobenzene
1,4-DCB	1,4-Dichlorobenzene
DNAPL	Dense Non-Aqueous Phase Liquid
ELCR	Excess Lifetime Cancer Risk
EPH	Extractable Petroleum Hydrocarbons
EPC	Exposure Point Concentration
GPS	Ground Penetrating Radar
HI	Hazard Index
IH	Imminent Hazard
IATV	Indoor Air Threshold Value
IRA	Immediate Response Action
Kg	Kilogram
LSP	Licensed Site Professional
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MSR	Material Shipping Record
m^3/day	Meters cubed per day
µg/m3	Micrograms per cubic meter
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MIPS	Membrane Interface Probe System
NBHS	New Bedford High School
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
OHM	Oil and/or Hazardous Material
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
POTW	Publicly Owned Treatment Works
PSWS	Parker Street Waste Site
PVC	Polyvinyl Chloride
RTN	Release Tracking Number
SRM	Substantial Release Migration
SVOC	Semi-Volatile Organic Compounds
SWPPP	Stormwater Pollution Prevention Plan
TCE	Trichloroethylene

TCLP	Toxic Characteristic Leaching Procedure
TFE	Total Fluid Extraction
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
trans-1,2-DCE	trans-1,2-Dichloroethylene
1,2,4-TCB	1,2,4-Trichlorobenzene
TRC	TRC Companies, Inc.
UCL	Upper Concentration Limit
µg/L	micrograms per liter
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) has prepared this Massachusetts Contingency Plan (MCP; 310 CMR 40.0000) Phase III Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives (Phase III) report for the New Bedford High School (NBHS) Mechanical Room Disposal Site (hereinafter "Disposal Site," and/or "the Site"). The Site is located within the footprint of the NBHS at 230 Hathaway Boulevard, which lies entirely within the larger Parker Street Waste Site (PSWS) in New Bedford, Massachusetts. The PSWS is tracked by the Massachusetts Department of Environmental Protection (MassDEP) separately under Release Tracking Number (RTN) 4-15685. The Disposal Site addressed by the Phase III is tracked by the MassDEP under RTN 4-22409. The Universal Transverse Mercator (UTM) coordinates for the Site are 337,849 meters east and 4,612,193 meters north in Zone 19. The Site location and its relationship to the overall NBHS campus are shown on Figure 1.

This Phase III was completed for the City of New Bedford, Massachusetts (the "City"). This document complements the documentation of response actions detailed in the Phase II Comprehensive Site Assessment report (hereinafter "Phase II CSA report") submitted to MassDEP on April 17, 2017. This document complies with the MassDEP requirements for a Phase III in accordance with 310 CMR 40.0850.

This Phase III report complements and is consistent with the Risk-Based Work Plan pursuant to 40 CFR 761.61(c) of the Toxic Substances Control Act (TSCA; 40 CFR §761) and United States Environmental Protection Agency (EPA) Region 1 guidance that will be submitted separately to EPA.

The Site owner and Licensed Site Professional (LSP) contact information is as follows:

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2.0 SITE DESCRIPTION AND BACKGROUND INFORMATION

This section provides basic information related to the Disposal Site, including a description of the release, and a disposal site history; a summary of Site geology and hydrogeology; a summary of investigations and remedial actions, and a risk characterization summary.

A Site Location Map, provided as Figure 1, illustrates the general Site vicinity within the NBHS in the City of New Bedford, Massachusetts. The NBHS building was constructed between 1970 and 1972 on land that was previously occupied by wetlands and that was filled by historical filling activities in association with the PSWS Disposal Site activities prior to construction of the school building. The building construction includes a network of 6-inch, polyvinyl chloride (PVC) sub-slab underdrains located principally under the Mechanical Room and adjacent building areas. The underdrains are connected to the storm sewer system, which discharges to the municipal sanitary sewer system.

The subject Disposal Site is located beneath the Mechanical Room (room number B-114) and a small portion of the adjacent Cafeteria Storage Room within the NBHS building. The Disposal Site includes an approximately 4,700 square-foot area and extends to approximately 12 feet below grade. The Mechanical Room is situated on the bottom floor of the NBHS building in the vicinity of an elevator, a Cafeteria Storage Room, and rooms used for storage and building maintenance purposes. The Mechanical Room contains a pit associated with a former waste incinerator, a “chiller deck”, as well as numerous air ducts, fans and air handling equipment associated with the building’s heating and cooling systems. A Disposal Site Plan is provided as Figure 2A.

Additional details regarding history of both the PSWS and the Mechanical Room are provided in the Phase II CSA report (TRC, 2017a).

2.1 **Site Geology and Hydrogeology**

The following subsections describe the geologic and hydrogeologic conditions at the Disposal Site based on Disposal Site and surrounding area subsurface investigations in the PSWS. Investigations prior to 2018 are described in the Phase II CSA report and the IRA status reports submitted to date. The 2018 investigations are described in Section 2.5 of this Phase III report.

Based on soil boring data collected at the NBHS campus, the PSWS Disposal Site is generally underlain by topsoil and up to approximately 8 feet of anthropogenic fill material that includes sandy material with ash that is related to both historical fill placement and PSWS Disposal Site activities. In places, the ash fill includes broken glass, brick fragments, rubber, clinkers, coal, cinders, and/or metallic fragments. Fill thickness across the PSWS Disposal Site ranges from 0 feet to 8 feet. Anthropogenic fill materials are often underlain by approximately 0.25 to 6 feet of native dark brown organic peat material, mixed with silt and clay in places from the wetland which predates the development of the area. Native soils below the organic peat layer are characterized by gray, fine, silty sands with trace gravel and/or medium sand in places. However, PSWS-related fill and historic fill material have not been encountered in soil/fill below the Mechanical Room, indicating that PSWS-related and historic fill material were removed from this area of the Site prior to construction of the building.

Soils and unconsolidated sediment at the Disposal Site consist of brown fine to coarse sand with some gravel (fill material) to a depth of approximately 5.5 to 6 feet below grade. A layer of angular crushed stone, or trap rock, about 8 to 10 inches thick immediately underlies the concrete floor and NBHS drainage system over much of the Site. A native glacial outwash layer underlies the sand and gravel fill material. The outwash ranges from 5 to 8 feet in thickness and consists of gray fine sand and silt, with shallow discontinuous peat and organic material lenses observed at 5.5 to 8 feet below grade, and deeper channel deposits consisting of discontinuous lenses of fine to coarse sand and gravel with some cobble encountered from 8-10 feet deep. The glacial outwash layer deposits are underlain by a glacial till layer approximately 12 feet below ground surface, and some boulders.

Observation of Site soils and review of historic topographic maps indicates that surficial geology at the Site consists of glacial outwash sediments. Drumlins flank the Site to the east and west. Based on a review of the United State Geological Survey (USGS) Bedrock Geologic Map of Massachusetts (Zen et al., 1983), bedrock beneath the Site is light gray, pinkish-gray to tan, mafic-poor granite known as Alaskite (Zagr).

Synoptic groundwater monitoring conducted since 2012 has indicated that groundwater flow was generally toward the south at a low gradient. The groundwater aquifer is unconfined and is present about 10 feet below ground surface. The aquifer thickness is not known and it is expected to extend down to the underlying bedrock. According to the MassDEP Priority Resources map for the area, this aquifer is not potentially productive.

The City receives approximately 50.81 inches of precipitation annually (http://www.usclimatedata.com/climate/massachusetts/united-states/3191). Infiltration of rainwater to the aquifer is expected to occur in nearby areas surrounding the Site. There are no surface water bodies at the Site. According to the MassDEP Priority Resources map for the area, the Site and surrounding area are not within the 100-year or 500-year flood plains and flooding potential appears to be low.

2.2 **Site History**

Based on review of historical aerial photographs, the Site and surrounding area was subject to land disturbance or disposal activity between and during the 1930s and 1960s; other portions of the surrounding area were subject to land disturbance and disposal activities into the 1970s. Based on review of historical USGS topographic maps from 1941 and 1949, wetlands were located at the Site prior to land disturbance and Site-related filling activities. On the 1941 (1936 survey data) map and 1949 (1948 survey data) map, the Site is still illustrated as wetland.

The chemical profile of fill materials found at locations in the vicinity of the Site are similar to those of industrial landfills indicating that the fill material is associated with dumping from industrial sources, intermixed or combined with fill material meeting the definition of historic fill under the MCP. Materials dredged from New Bedford during the construction of the "Hurricane Dike" were reportedly transported to the Site and used to stabilize the Site for construction of the NBHS building (NUS Corporation, 1985). Soil/fill displaced for construction of the building's foundation was reportedly transported across Hathaway Boulevard to what was then vacant land (the present-day location of KMS). In 1994, that location was graded to create the Former Andrea McCoy Soccer Field (Former McCoy Field) across Hathaway Boulevard from the Site (*McCoy Field PCB Approval Tech Support Document*, EPA dated August 24, 2005). During an environmental investigation of the Former McCoy Field as a possible location for a middle school in 2000, concentrations of polychlorinated biphenyls (PCBs) above regulatory reporting criteria were detected.

Following the detection of PCBs at the Former McCoy Field, additional investigations of the surrounding area, including NBHS, properties adjacent to KMS and the Paul F. Walsh Memorial Field, were undertaken by BETA Group, Incorporated (BETA) on behalf of the City in connection with a conditional approval issued by EPA (*PCB Risk-Based Cleanup and Disposal Approval*, McCoy Field [New Keith Middle School], New Bedford, MA, USEPA August 24, 2005). The additional investigations by BETA included soil sampling at the NBHS property, as documented in the Phase II CSA Report for the NBHS and Walsh Field properties (TRC, 2009). BETA observed the presence of PSWS fill in soil at the NBHS property and identified PCBs, metals, and polycyclic aromatic hydrocarbons (PAHs) as contaminants of concern at the property; however, the prior BETA investigations did not include assessment of conditions below the Mechanical Room.

The release at the Disposal Site was identified during the initial investigation of water (groundwater) that had seeped from beneath and onto the floor of the Mechanical Room in 2009 through floor slab seams and cracks. Aqueous samples of the “seep water” were collected and analyzed for VOCs in 2009 and 2010 at four locations on the lower floor of the Mechanical Room. Chlorinated VOCs (vinyl chloride [VC] and cis-1,2-dichloroethylene [cis-1,2-DCE]) were detected at concentrations above the MCP GW-2 groundwater standards in two of the samples (see Table 1 of the Phase II CSA Report). Per 310 CMR 40.0483(1)(C)(2), the source of the release, precise location of the release, date and duration of the release, and quantity of the release are not known.

The seep and impacted groundwater conditions, combined with the presence of the building’s underdrain system, resulted in a potential Substantial Release Migration (SRM) condition. Subsequent indoor air sample analytical results indicated VOCs were also present in indoor air. The detection of chlorinated VOCs in groundwater, seep water, and indoor air in the vicinity of the Mechanical Room (see Phase II CSA report) comprised a critical exposure pathway (CEP) as defined in 310 CMR 40.0006.

During development of a newly installed monitoring well in the Mechanical Room in August 2010, globules of a dense non-aqueous phase liquid (DNAPL) were observed. A DNAPL sample was analyzed for VOCs and indicated the presence of trichloroethylene (TCE); PCBs were later found to represent approximately 25% of the DNAPL and to be present in soils beneath the Mechanical Room floor.

A detailed sequence of events leading to the identification of the 72-hour reporting condition is provided in the IRA Plan filed by TRC in March 2010 (TRC, 2010a).

2.3 Previous Site Investigations

Identification of the release in 2009 triggered a series of evaluations and response actions at the Disposal Site from 2009 through 2016 under the MCP to assess conditions in the vicinity of the Mechanical Room. The SRM Evaluation included evaluation of the storm sewer and sanitary sewers on the NBHS campus to assess whether substantial migration of impacted groundwater, as defined in the MCP, had occurred or was occurring, and the characterization of groundwater, seep water, soil vapor and indoor air to assess the potential for vapor intrusion.

An Imminent Hazard (IH) Evaluation was conducted in accordance with 310 CMR 40.0426, because the release or threat of release could pose an IH to human health, safety, public welfare or the environment. The initial risk evaluation, based on modeled indoor air concentrations, concluded that an IH condition was not present, and additional evaluation of the results of subsequent indoor air sampling confirmed that conclusion. In addition, exposures to impacts in air at the sampled concentrations were not associated with chronic risks/hazards above MCP risk limits at those times.

A CEP evaluation was conducted to assess whether a CEP, as defined in 310 CMR 40.0006, existed in association with impacted soil vapors and groundwater below the Mechanical Room. The evaluation included a potential vapor intrusion pathway analysis, and sampling and analysis of seep and indoor air. Analytical results indicated the potential for chlorinated VOCs associated with subsurface groundwater impacts to be present in indoor air in the building, representing an SRM condition and a CEP. The evaluation indicated that the CEP does not present an IH, at present or for the foreseeable future, but it was not feasible to eliminate the CEP.

The extensive environmental investigation and remediation work performed to address the potential SRM condition below the Mechanical Room are summarized in the following sections and presented more fully in the Phase II CSA (TRC, 2017a) and IRA Status Reports.

2.3.1 *Groundwater Characterization*

TRC conducted activities to characterize groundwater and to determine the nature and distribution of groundwater impacts at the Disposal Site between 2010 and 2016. During this period, TRC conducted 26 groundwater sampling events from select wells and analyzed the samples for one or more of VOCs, PAHs, PCBs, TPH, and/or metals.

TRC sampled four existing monitoring wells in January 2010 and installed six new monitoring wells (including one deep well) in the Mechanical Room between August 2010 and June 2012. Two recovery wells were installed in 2012 for the total fluid extraction (TFE) events, described in Section 2.3.6, to facilitate the recovery of impacted water. In addition, temporary monitoring wells were installed in two soil borings advanced in the Mechanical Room in 2014.

The vertical extent of VOC impacts in groundwater at the Disposal Site was delineated via the installation and sampling of deep overburden well MW-27D in the Mechanical Room.

Figures depicting iso-concentration contours in shallow groundwater for cis-1,2-DCE, TCE and VC based on the most recent of samples collected from Mechanical Room and adjacent monitoring wells between 2012 and September 2016 are presented in figures 6 through 6C of the Phase II CSA report. The iso-concentration figures illustrate that concentrations of TCE, cis-1,2-DCE, and VC were above their respective CP GW-2 standards in one or more of the wells (MW-27R, MW-28, MW-41 and MW-42R) located in the central part of the Mechanical Room. Monitoring wells along the perimeter of the plume had significantly lower VOC concentrations.

Groundwater sample results from these same wells (MW-27R, MW-28, MW-41 and MW-42R) also indicated detectable concentrations of PCB Aroclors, in some instances above the MCP Method I GW-2 criterion. Select samples collected from these wells were filtered through 2.0, 0.45 and/or 0.20 micron filters to remove particulates entrained in the samples. Filtration has demonstrated that the PCB detections are primarily associated with particulates entrained in the groundwater rather than dissolved-phase PCBs.

Groundwater analytical results and monitoring well construction logs are provided in the Phase II CSA report. Information regarding monitoring and recovery well installations and groundwater sampling activities, laboratory reports, and groundwater sampling forms have been included in previous IRA reports. These prior groundwater analytical results also are included with the Phase III results in Table 1 of this report.

2.3.2 *DNAPL Characterization*

Small globules of DNAPL were observed and an odor was noted during development of well MW-27 on August 30, 2010. A sample of the DNAPL submitted for laboratory fingerprint analysis was determined to be a mixture composed of petroleum (approximately 50% lubricating oil range hydrocarbons), PCB Aroclor 1254 (approximately 25%) and TCE (approximately 25%). DNAPL was not measurable in monitoring well MW-27 following well development. Detail regarding the DNAPL characterization is presented in the IRA Status Report dated November 2011 (TRC, 2011c).

2.3.3 *Storm Drain Sampling and Results*

TRC personnel collected aqueous samples for VOC analysis from ten storm drain manholes at the NBHS campus on February 3, 2010, to evaluate whether the underdrains beneath the NBHS campus had directed impacted groundwater into the storm sewer via the footing drains. VOCs were not detected in any of the storm sewer manholes located proximate to the underdrains or the footing drains of the NBHS building. VOCs were detected in the sample collected from the one manhole that serves both the storm sewer system and the sanitary sewer system (HS-D-5) at the NBHS campus. Refer to the IRA Plan dated March 2010 (TRC, 2010a) for more detailed information.

2.3.4 *Sanitary Sewer Sampling and Results*

In February 2010, TRC collected aqueous samples from five selected sanitary sewer manholes in the NBHS sanitary sewer system for analysis of VOCs to identify the potential source of the concentrations of chlorinated VOCs observed in the February 2010 sample collected from the combined sanitary/storm sewer manhole (HS-D-5). VOCs were detected in four of the five sanitary sewer manholes. VOCs detected during the sampling of sanitary and storm water sewer systems leading to HS-D-5 indicated that the VOC detections were related to discharges to the sewer system from regular operations and activities at NBHS. Analytical results are presented in to the Phase II CSA report and in the IRA Plan dated March 2010 (TRC, 2010a).

2.3.5 *HVAC, Air Flow and Pressure Evaluations*

Based on data collected in February 2010, TRC determined that the Mechanical Room is under strong negative pressure relative to adjacent halls and rooms when all air handling equipment is operating, and under reduced, but still negative pressure with the air handling units off. Operating fans and air handling equipment in the room are the primary sources of the negative pressure, with the chimney effect induced by the former incinerator stack being a secondary source. Mitigation measures implemented as a result of this evaluation, described in Section 2.4, included sealing of cracks and plugging selected drains. More detailed information is provided in the IRA Plan dated March 2010 (TRC, 2010a).

2.3.6 *Total Fluid Extraction Events*

Based on the October and November 2010 groundwater sampling results, the lateral and vertical extent of VOC impacts in the vicinity of the Mechanical Room became more defined. Because significant concentrations of chlorinated VOCs were not measured in samples collected from any of the surrounding monitoring wells, the mass of chlorinated VOCs was judged to be relatively small, and targeted source-area multi-phase extraction (also known as total fluids extraction or TFE) was selected to achieve contaminant mass reduction in the short-term. In a series of five TFE events conducted between February and July 2011, a total of 2,599 gallons of impacted groundwater was removed from monitoring wells MW-27R and MW-32. Detail regarding the TFE events is provided in the IRA Status Report submitted November 22, 2011 (TRC, 2011c).

2.3.7 *Hydraulic Containment System and Sub-slab Venting System*

In February 2012, TRC installed a hydraulic containment system in the Mechanical Room that extracted and treated impacted groundwater to prevent it from migrating and entering the underdrain system beneath NBHS during high water table periods. The system began operating on March 19, 2012. Groundwater pumped from two recovery wells (MW-27R and W-42R) was treated and discharged to the New Bedford publicly owned treatment works (POTW) under permit. Quarterly Discharge Self-Monitoring Reports were submitted to the POTW in accordance with the discharge permit from 2012 through 2016. No exceedances of constituents of concern listed on the permit were detected in the effluent groundwater discharge.

TRC installed a sub-slab vapor recovery system in conjunction with the hydraulic containment system in the vicinity of the recovery wells to mitigate potential migration of impacted vapors to the dewatered underdrain system. A vacuum blower extracted vapor from well monitoring MW-27R. The extracted vapors then passed through vapor-phase carbon to remove organic contaminants from the exhaust stream and were then discharged, as depicted on the process and instrumentation diagram showing the hydraulic containment system (Figure 3).

The hydraulic containment system was shut down on March 15, 2016 to assess potential groundwater, soil gas, and indoor air contaminant rebound conditions. As of March 15, 2016, the system had operated for a total of approximately 30,884 hours and treated a total of approximately 1,715,800 gallons of groundwater since start-up in March 2012. Detail regarding the hydraulic containment system is provided in the IRA Status Report submitted in May 2016 (TRC, 2016a).

2.3.8 *Soil Characterization*

TRC conducted six soil sampling events in the vicinity of and within the Mechanical Room (B-114) and adjacent Cafeteria Storage Room (B-155) from April 2012 through July 2014 to evaluate the nature and extent of PCB impacts in soil. TRC advanced 47 borings and collected and submitted 182 soil samples for laboratory analysis of PCBs. Select samples were also analyzed for VOCs, TPH, and/or total organic carbon (TOC). As part of the soil investigation work, TRC used a membrane interface probe system (MIPS) to measure solvent contamination and soil electrical conductance.

Chemicals detected above MCP Method 1 standards in soil at the Disposal Site included VOCs and PCBs. The VOC concentrations detected in soil were relatively low and likely had been decreased from their initial concentrations due to operation of the sub-slab venting system and hydraulic containment system. PCB-impacted soil appeared to be present in a relatively limited area beneath the Mechanical Room and a small portion of the adjacent Cafeteria Storage Room, and the extent of PCB concentrations above 4 milligrams per kilogram (mg/kg) was understood to have been adequately delineated. A figure depicting sample locations, analytical results and PCB iso-concentration contours developed by kriging the soil analytical results through 2016 is provided as Figure 4. Soil analytical results for PCBs and soil boring logs are provided in the Phase II CSA report and in previous IRA Status Reports. These prior soil analytical results also are included with the Phase III results in Table 2 of this report.

2.3.9 *Sub-Slab Soil Vapor Characterization*

TRC installed 11 temporary sub-slab soil gas sampling points (TVP-1 through TVP-11) during February 2010 in NBHS surrounding the Mechanical Room (in Houses 1 through 4 and D-Block – shown on Figure 2 of Appendix D in the Phase II CSA report), and collected and submitted 11 soil gas samples for laboratory analysis of VOCs. VOCs were detected in soil gas beneath the Mechanical Room. Samples collected from points TVP-1, TVP-3, TVP-10 and TVP-11 exceeded a screening level threshold equal to 10-times the Indoor Air Threshold Values (IATVs) (MassDEP, 2008), consistent with guidance provided by MassDEP at the time (MassDEP, 2009).

TRC installed eight permanent soil vapor sampling points (PVP-1 though PVP-8) in NBHS during February 2010. PVP-6 is located in the Mechanical Room and the remaining seven points are located in Houses 1 through 4 and D-Block. A total of 14 soil gas samples were collected and submitted for laboratory analysis of VOCs[1] between 2010 and 2016 (including seven from PVP-6

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[1] The sample collected in January 2016 was also analyzed for APH.

in the Mechanical Room). VOCs were detected in the samples; however, the concentrations did not exceed the soil gas screening values with the exception of the samples from PVP-6.

Soil gas sampling results for samples collected from PVP-6 are summarized in the Phase II CSA report, and analytical reports were submitted in previous IRA Status Reports (TRC, 2010b – TRC, 2016b; TRC, 2017b – TRC, 2019).

2.3.10 *Indoor Air Characterization*

Indoor air samples collected over a 24-hour period from five locations in the vicinity of the Mechanical Room in January 2010 were submitted for laboratory analysis of VOCs. TCE was detected above the MassDEP IATV in the sample collected from the Mechanical Room.

A sub-slab vapor mitigation system and hydraulic containment system subsequently were installed in the Mechanical Room and began operating in March 2012, as described in Section 2.3.7. In August 2014, periodic temporary shutdowns of the sub-slab depressurization system and hydraulic containment system were initiated during periods of school vacation to assess whether the systems could be shut down permanently.

TRC collected multiple rounds of indoor air samples from the Mechanical Room and adjacent Cafeteria Storage Room in accordance with the Closure Sampling procedures described in MassDEP Public Vapor Intrusion Guidance WSC-14-435 (MassDEP, 2014a) and WSC-14-435 (MassDEP, 2015a), following, in each instance, a minimum seven-day shutdown of the system, as follows:

- The first system shutdown/indoor air sampling event for the sub-slab depressurization system was conducted in September 2014; VOC concentrations were below MassDEP residential IATVs for Disposal Site compounds of concern, and significantly below the indoor air concentrations observed in prior sampling events..
- The second system shutdown/indoor air sampling event was conducted during the winter school vacation period in December 2014 and January 2015;.
- The third system shutdown/indoor air sampling event was conducted during the summer school vacation period in June and July 2015;
- The fourth system shutdown/indoor air sampling event was conducted during the winter school vacation period in January 2016;
- The fifth system shutdown/indoor air sampling event was conducted in September 2016 during school holiday closure;
- The sixth system shutdown/indoor air sampling event was conducted in March 2017 during school vacation closure.

For the second through sixth post-shutdown sampling events, indoor air concentrations did not exceed MassDEP IATVs, and Disposal Site compounds of concern (i.e., chlorinated ethenes) were not detected above the laboratory reporting limits. Indoor air monitoring data from the vicinity of the Mechanical Room are provided in the Phase II CSA report and in previous IRA Status Reports. These prior indoor air analytical results also are included with the Phase III results in Table 3 of this report.

2.3.11 *Potential Contaminant Rebound Monitoring*

The hydraulic containment system was shut down on March 15, 2016 and remains shut down. TRC conducted quarterly groundwater sampling events to monitor potential contaminant rebound in June 2016, September 2016, December 2016 through February 2017 (three rounds), and March 2017. TRC also conducted sub slab soil gas and indoor air monitoring in September 2016, as discussed below. Laboratory analytical reports and groundwater sampling forms have been submitted in previous IRA Status Reports.

June 2016

On June 14 and 15, 2016, groundwater samples were collected from five monitoring wells at the Disposal Site (MW-27R, MW-28, MW-32, MW-41 and MW-42R) in accordance with EPA Region 1 low-flow sampling techniques and submitted for laboratory analysis of VOCs and PCBs. Filtered aliquots (0.45 micron filters) from monitoring wells MW-27R, MW-28, MW-41 and MW-42R were also analyzed for PCBs.

Chlorinated VOCs (TCE, cis-1,2-DCE, and/or VC) were detected in monitoring wells MW-28 and MW-41 at concentrations above the MCP GW-2 standards. Chlorinated VOCs were detected in monitoring wells MW-27R and MW-42R at concentrations below the GW-2 standards. The unfiltered samples from wells MW-27R, MW-28, MW-41 and MW-42R exhibited concentrations of PCB Aroclors above MCP GW-2 criteria; however, PCB concentrations were reduced to concentrations well below the GW-2 standard when the samples were filtered through 0.45 micron filters[2].

September 2016

Quarterly groundwater sampling activities on September 14 and 15, 2016 were conducted as described above for the June 2016 sampling event.

Chlorinated VOCs (TCE, cis-1,2-DCE, and/or VC) were detected in monitoring wells MW-27R, MW-28, MW-41 and MW-42R at concentrations slightly exceeding the GW-2 standards, with monitoring well MW-MW-32 exhibiting detectable concentrations of cis-1,2-DCE below the GW-2 standard. The unfiltered samples from wells MW-27R, MW-28, MW-41 and MW-42R exhibited concentrations of PCB Aroclors above MCP GW-2 criteria, which were reduced to concentrations well below the GW-2 standard when the samples were filtered through 0.45 micron filters.

December 2016 – February 2017

December 2016. On December 21 and 22, 2016, groundwater samples were collected from five monitoring wells at the Disposal Site (MW-27R, MW-28, MW-32, MW-41 and MW-42R) as described above for the June 2016 and September sampling events and submitted for laboratory

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[2] Filtering of groundwater samples is discussed in *Implementation of the MADEP VPH/EPH Approach,* Massachusetts Department of Environmental Protection Policy #WSC-02-411, October 31, 2002, Page 45.

analysis of VOCs and PCBs. Chlorinated VOCs (cis-1,2-DCE, TCE and/or VC) were detected in MW-27R, MW-28, MW-41 and MW-42R at concentrations at or exceeding the GW-2 standards. Chlorinated VOCs were detected in monitoring wells MW-27R, MW-28, MW-41 and MW-42R at concentrations below the GW-2 standards. TCE was detected in MW-32 at a concentration below the GW-2 standard; no other VOCs were detected.

Unfiltered and field-filtered (0.45 micron) PCB samples were submitted from wells MW-28 and MW-42R, and the laboratory was asked to filter aliquots of the samples from wells MW-27R and MW-41 for PCB analysis. The laboratory incorrectly filtered PCB samples from wells MW-27R and MW-41 and the filtered samples were considered compromised[3]. TRC resampled wells MW-27R and MW-41 for PCBs on January 17, 2017 for PCB analysis, as described below.

Though turbidity levels in the samples were observed to be normal during sample collection, after the samples were stored on ice in coolers following sampling, a precipitate formed in the sample bottles.

The unfiltered samples from wells MW-27R, MW-28, and MW-42R exhibited concentrations of PCB Aroclors above MCP GW-2 criteria; however, PCB concentrations were below the GW-2 standard in the filtered samples.

January 2017. Two aliquots (unfiltered and 0.45 micron field-filtered) were submitted for analysis of PCBs from each of the resampled wells (MW-27R and MW-41). The results for samples collected from MW-27R did not indicate that detection of PCBs. The unfiltered sample results from MW-41 indicated a PCB concentration (1.6 µg/L) below the MCP GW-2 standard; the filtered aliquot results did not indicate the detection of PCBs.

February 2017. In order to assess the occurrence and effects of precipitate forming in the sample containers as they chilled following sampling in December 2016, TRC collected both filtered and unfiltered samples from wells MW-27R, MW-28, MW-41, and MW-42R and submitted them for laboratory analysis of PCBs using a 0.45 micron, 1.0 micron, and 0.2 micron filters in various combinations, and with turbidity measurements at various stages throughout the collection and transport process.

PCBs were detected at concentrations above the MCP GW-2 standard in the unfiltered samples from wells MW-27R, MW-28 and MW-41 and MW-42R; however, concentrations in the filtered samples did not exceed the GW-2 standard.

March 2017

On March 28, 2017 groundwater samples were collected from five monitoring wells at the Disposal Site (MW-27R, MW-28, MW-32, MW-41 and MW-42R) as described above for the June 2016 sampling event and submitted for laboratory analysis of VOCs and PCBs. Chlorinated VOCs (cis-1,2-DCE, TCE and/or VC) were detected in samples at concentrations exceeding the GW-2 standards in MW-27R, MW-28, MW-41 and MW-42R. Chlorinated VOCs also were detected in

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[3] Analytical results for the MW-27R and MW-41 samples incorrectly filtered by the laboratory were considered invalid by the laboratory and are not included in Table 2.

monitoring wells MW-27R, MW-28, MW-41 and MW-42R at concentrations below the GW-2 standards. No VOCs were detected in the sample collected from MW-32

Unfiltered, field-filtered, and chilled and re-filtered samples were collected from MW-27R, MW-28, MW-41 and MW-42R for laboratory analysis of PCBs. PCB concentrations were detected above the MCP GW-2 standard in the unfiltered samples from wells MW-27R, MW-41 and MW-42R; however, the filtered sample results did not indicate concentrations exceeding the GW-2 standard (with the exception of the field-filtered result from MW-28, which results did not indicate the detection of PCBs when the laboratory re-filtered an additional aliquot). Analytical results of the sample collected from MW-28 after re-filtering at the laboratory indicated results did not indicate the detection of PCBs.

The results of investigations completed through 2016 and summarized in the Phase II CSA report indicated that impacts at the Disposal Site were the result of a localized DNAPL mixture of PCBs, TCE, and petroleum that has come to be located in construction soil or fill material installed below the Mechanical Room floor prior to construction of the NBHS. PSWS-related fill material and historic fill, as defined by the MCP, were not observed beneath the Mechanical Room in the area impacted by the release.

These investigations generally defined the nature and distribution of impacts in the vicinity of the Mechanical Room, including the extent of PCB impacts above the MCP Method 1 S-2/3 soil standard of 4 mg/kg. Groundwater impacts from VOCs and PCBs appeared to be limited primarily to the central part of the Mechanical Room, in the vicinity of wells MW-27R, MW-28, MW-41, and MW-42R, with lower concentrations away from these wells.

These findings indicated that a Condition of No Significant Risk had been achieved for current building occupants at NBHS (students, staff, workers, etc.) exposed to potentially-impacted indoor air. However, MassDEP Risk Limits were exceeded for future residential and commercial exposure, and future construction worker exposure to soil and/or groundwater, associated primarily with PCBs, and with residential exposure to indoor air. In addition, based on a recalculation of the risk to the emergency utility worker, MassDEP Risk Limits were exceeded for current emergency utility worker exposure to groundwater and soil.

2.4 Phase III Investigations

Based on the findings of the Phase II CSA, additional information was required to understand the potential extent of soil, groundwater, and air impacts to better characterize current and future exposures, particularly for the emergency utility worker, and to evaluate the feasibility of comprehensive remedial actions to achieve a Permanent or Temporary Solution. Between June 20 2018 and January 16, 2019, TRC conducted extensive investigative activities to address these information needs in support of further site characterization for risk characterization and development of remedial alternatives.

2.4.1 *Infrastructure Investigations*

From June 20 through 22, 2018, TRC conducted a survey of the Mechanical Room and adjacent food storage pantry using ground penetrating radar (GPR). The survey was designed to assess the locations of column footings and to supplement existing information regarding the locations and depths of buried utilities present within the Disposal Site boundary. The GPR survey was conducted by Hager GeoScience, Inc. of Woburn, Massachusetts under the oversight of TRC personnel.

Knowledge of the locations of utilities and footings is important for properly evaluating risk at the Site, as well as for designing remedial alternatives to address that potential risk. Subsurface utility corridors within the release area are the locations where emergency utility workers potentially could be exposed to PCBs in soil and shallow groundwater. For purposes of the Phase III and supplemental risk characterization, utility corridors are defined as the area within 2.5 feet from the centerline of a subsurface utility (see Figure 2B), to the depth of the base of the utility. This emergency utility worker exposure presents the only unacceptable risk at the site under current use, based on data collected prior to 2017 from locations primarily beyond the existing utility corridors. Subsurface utility corridors also have the potential to affect shallow groundwater flow. The concrete footers supporting the structural columns in the release area affect the distribution of soil contamination. The presence of subsurface utilities and footers may also constrain the implementation and effectiveness of potential soil and groundwater remedial alternatives.

The results of the survey were used, along with other investigation results described below, to update the Disposal Site Plan (Figure 2A). This Plan includes both pre-2018 and 2018 investigation locations and will be used in the evaluation of potential remedial options for the Site.

2.4.2 *Soil Investigations*

From July 10 through August 10, 2018, TRC completed a soil boring program in the Mechanical Room and adjacent food storage pantry to supplement the existing information regarding the nature and distribution of impacts in soil (both within and beyond existing utility corridors), and to provide additional groundwater sampling data. TRC advanced a total of 44 borings and collected 283 soil samples. Monitoring wells were constructed in 13 of the 44 borings. TRC selected both the boring locations and the target sample depths to refine the distribution of contamination as understood from prior investigations, and to provide additional soil and groundwater data to evaluate the emergency utility worker exposure scenario. Initially, approximately half of the soil samples were extracted for PCBs and held, with their release for analysis pending results from shallower or deeper samples in the same boring, or results from adjacent borings. Ultimately, TRC submitted one hundred eighty-five (185) of the 283 soil samples for laboratory analysis of PCBs. Select samples were also submitted for the laboratory analysis of lead, VOCs, TPH, TOC, COD, and pH. Results of soil analysis are summarized in Table 2. Laboratory data packages, and soil boring logs, and monitoring well construction logs were included in prior submittals.

Chemicals detected above MCP Method 1 soil cleanup standards in the samples collected during August 2018 include VOCs (1,4-Dichlorobenzene and 1,2,4-Trichlorobenzene) and PCBs. Fewer VOCs were detected and generally at lower concentrations than during investigations prior to 2018. For VOCs detected to date, concentrations were higher in pre-2018 samples except for total 1,2-DCE. This reduction in VOC concentrations is most likely attributable the operation of the hydraulic containment and sub-slab venting system that was operated from March 2012 until March 2016.

For PCBs, the maximum total PCB concentration was detected in a sample collected in 2018. Boring locations for the 2018 investigation program selectively targeted high PCB concentrations identified in pre-2018 investigations to define the nature and extent of those high concentrations. PCBs are present in soil beneath the Mechanical Room and the southern part of the adjacent Cafeteria Storage Room. Figure 5 presents PCB sample locations, PCB soil concentrations, and isopleths of PCB soil concentrations for soil data through 2018.

2.4.3 *Groundwater Investigation*

Groundwater sampling has been conducted from wells in the vicinity of the Mechanical Room on a periodic basis between 2010 and 2018. The results of these sampling events are tabulated in Table 1 (2010 through 2018 groundwater samples), Table 4 (2016 VPH [volatile petroleum hydrocarbons]/EPH [extractable petroleum hydrocarbons] groundwater samples), and Table 5 (2018 groundwater filter and filtrate [wipe] samples).

August 2018

Between August 21, 2018 and August 23, 2018, TRC collected 24 groundwater samples and three duplicate samples from 22 monitoring wells, including nine wells constructed prior to 2018 (MW-27D, MW-27R, MW-28, MW-31, MW-32, MW-33, MW-40, MW-41 and MW-42R) and 13 wells constructed in 2018 (MW43 through MW-55), in accordance with EPA Region 1 low-flow sampling techniques. Monitoring well construction information for the wells installed during the 2018 Phase III investigation and 2018 groundwater elevations for pre-2018 and 2018 monitoring wells in the Mechanical Room is included in Table 6.The groundwater samples were submitted to Alpha Analytical Laboratory in Westborough, Massachusetts for laboratory analysis of VOCs (SW-846 Method 8260B) (10 samples) and PCB Aroclors (SW-846 Method 8082) (24 samples). Filtered aliquots (0.45 micron filters) collected from all 22 monitoring wells also were analyzed for PCB Aroclors. The filters and the filtrate from eight of the samples were submitted for PCB Aroclor analysis as wipe samples. To provide data to evaluate the effect of turbidity and colloids on PCB concentration, aliquots from four wells - three existing monitoring wells (MW-27R, MW-41, MW-42R) and one new monitoring well (MW-53) - were filtered using 0.10 micron filters and analyzed for PCB Aroclors. Laboratory data packages, groundwater sampling forms, and equipment calibration sheets were included in prior submittals.

VOCs

Monitoring wells MW-27R, MW-28, MW-41, MW-42R, MW-45, MW-46, MW-50, and MW-53 exhibited detectable concentrations of VOCs, as shown in the summary below. Three compounds were detected at concentrations above their respective MCP GW-2 standards, as follows:

- VC was detected above the GW-2 standard of 2 µg/L in samples collected from monitoring wells MW-27R, MW-28, MW-41 and MW-46;
- TCE was detected above the GW-2 standard of 5 µg/L in wells MW-27R and MW-28;

- Cis-1,2-DCE was detected above the GW-2 standard of 20 µg/L in samples collected from monitoring well MW-41.

Well	**August 2018 VOC Concentrations (µg/L)**			
	TCE	**Cis-1,2-DCE**	**Vinyl Chloride**	**Total VOCs**
GW-2 Standard	*5*	*20*	*2*	
MW-27R	*5.9*	*9.6*	*5.6*	41.3
MW-28	12	10	4.2	42
MW-32	ND	ND	ND	ND
MW-41	1.2	47	59	150.4
MW-42R / Duplicate	ND/ND	2.6/3.3	ND/ND	5.9/8.2
MW-43	ND	ND	ND	ND
MW-45 4-5' Depth	ND	1.7	ND	9.3
MW-46	2.9	19	4.6	42.9
MW-50	ND	ND	ND	3.7
MW-53	ND	ND	ND	1.7

ND = Not detected

Isoconcentration plots of the three VOCs detected above GW-2 standards are presented in Figures 6, 7, and, 8.

- The interpreted TCE plume (Figure 6) based on the prior sampling showed a narrow plume extending from the vicinity of MW-27R toward location BC-3. The TCE isocontours based on August 2018 data suggest the presence of two separate sources, one in the vicinity of MW-27R and a second, in the vicinity of MW-55.
- The interpreted cis-1,2-DCE plume (Figure 7 based on the prior sampling showed a narrow plume extending from MW-27R on the north to MW-28 on the south, with the highest concentration detected in the middle of the plume at MW-41. The cis-1,2-DCE isocontours based on August 2018 data suggest a broader plume of the same general character interpreted based on the prior data.
- The interpreted VC plume (Figure 8) based on the prior sampling showed a broad plume extending from the vicinity of MW-27R toward location BC-3, with the highest concentration detected in the middle of the plume at MW-41. The VC isocontours based on August 2018 data suggest a narrower plume of the same general character interpreted based on the prior data, with the highest concentration detected in the middle of the plume at MW-41.

PCBs

Seventeen unfiltered samples from 15 monitoring wells exhibited detectable concentrations of PCB Aroclors, including nine samples that exceeded the GW-2 and GW-3 standards. PCB concentrations in the aliquots filtered through the 0.45 micron filters[4] were reduced from the unfiltered concentrations by an average of 50 percent. PCB concentrations in the aliquots filtered through the 0.1 micron filters were reduced from the unfiltered concentrations by an average of 80 percent. The decrease in PCB concentration with decreasing filter pore size supports the conclusion that PCBs are associated with particulate matter given that as particulates are removed from the groundwater samples the PCB concentrations decreases. Analytical results for each sample analyzed for PCBs are listed below:

WELL DETAILS	**PCB Analyses - Groundwater and Filters**			
Well ID	**August 2018 PCBS Concentrations (µg/L)**			
	Unfiltered	**Dissolved (0.45 µ Filter)**	**Dissolved (0.1 µ Filter)**	**0.45 µ Filter - Wipe**
	PCBs, Total	**PCBs, Total**	**PCBs, Total**	**PCBs, Total**
GW-2 Standard	*5*	*5*	*5*	*NA*
MW-27R	11.0	5.59	1.98	3.11
MW-27D	ND	ND	-	-
MW-28	32.3	11.3	-	9.38
MW-31	ND	ND	-	-
MW-32	ND	ND	-	-
MW-33	ND	ND	-	-
MW-40	ND	ND	-	-
MW-41	10.7	6.84	3.06	1.28
MW-42R	9.89	6.86	2.25	2.3
Duplicate	11.4	5.88	-	-
MW-43	ND	ND	-	-
MW-44	6.44	4.05	-	-
MW-45 4-5'	2.23	1.02	-	-
7'	2.37	1.21	-	-
Duplicate (7')	2.56	1.19	-	-
MW-46	0.271	ND	-	-
MW-47	0.384	ND	-	-
MW-48	1.55	0.274	-	-
MW-49	ND	ND	-	ND
MW-50	21.8	8.66	-	-
MW-51	39	25.3	-	5.14
Duplicate	40.7	28.9	-	NA
MW-52	2.66	1.75	-	2.96
MW-53	7.59	1.87	0.764	-
MW-54	0.618	0.264	-	-

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[4] Filtering of groundwater samples is discussed in *Implementation of the MADEP VPH/EPH Approach*, Massachusetts Department of Environmental Protection Policy #WSC-02-411, October 31, 2002, Page 45.

<u>**WELL DETAILS**</u>		**PCB Analyses - Groundwater and Filters**			
Well ID		**August 2018 PCBS Concentrations (μg/L)**			
		Unfiltered	**Dissolved (0.45 μ Filter)**	**Dissolved (0.1 μ Filter)**	**0.45 μ Filter - Wipe**
		PCBs, Total	**PCBs, Total**	**PCBs, Total**	**PCBs, Total**
GW-2 Standard		*5*	*5*	*5*	*NA*
MW-55	3.5'	1.09	0.596	-	-
	6'	0.498	0.284	-	ND

- = Not sampled

Isoconcentration plots for August 2018 data are presented in Figure 9A for total (unfiltered) PCBs and Figure 10A for dissolved (0.45m) PCBs. The isocontours show a lobe of PCB concentrations above the Method 1 GW-2 Standard trending south-southeastward from the vicinity of monitoring wells MW-50 and MW-27R on the north toward MW-28 on the south. Based on the lack of detections in groundwater in the storage room, the PCB plume is interpreted to truncate at the wall between the Mechanical Room and the storage room, which is the approximate location of the drain line situated five feet below the top of the slab.

Depth to water was measured at each well within the Mechanical Room and immediate surrounding area during the monitoring event conducted during August. Depths to groundwater measured during August were larger than typically have been measured, and the associated groundwater elevations were among the lowest that have been observed at the Disposal Site. Based on those gauging data, groundwater is interpreted to flow southward beneath the storage room toward the drain line at the north end of the Mechanical Room, and then toward the east-southeast, as shown on the groundwater contour plan provided as Figure 11.

<u>December 2018</u>

Between December 11, 2018 and December 13, 2018, TRC collected 24 groundwater samples and three duplicate samples from 22 monitoring wells, including nine wells constructed prior to 2018 (MW-27D, MW-27R, MW-28, MW-31, MW-32, MW-33, MW-40, MW-41 and MW-42R) and 13 wells constructed in 2018 (MW43 through MW-55), in accordance with EPA Region 1 low-flow sampling techniques. The groundwater samples were submitted to Alpha Analytical Laboratory in Westborough, Massachusetts for laboratory analysis of VOCs (SW-846 Method 8260B) (16 samples) and PCB Aroclors (SW-846 Method 8082) (24 samples). Filtered aliquots (0.45 micron filters) collected from all 22 monitoring wells also were analyzed for PCB Aroclors.

<u>VOCs</u>

Monitoring wells MW-28, MW-41, MW-44, MW-45, MW-46, MW-47, MW-48, MW-49, MW-50, MW-51, MW-52, MW-54, and MW-55 exhibited detectable concentrations of VOCs, as shown in the summary below. Two compounds were detected at concentrations above their respective MCP GW-2 standards, as follows:

- VC was detected above the GW-2 standard of 2 µg/L in samples collected from monitoring wells MW-41, MW-46, MW-51 and MW-55; and
- TCE was detected above the GW-2 standard of 5 µg/L in wells MW-28, MW-52, MW-54, and MW-55.

Well		**December 2018 VOC Concentrations (µg/L)**			
		TCE	**Cis-1,2-DCE**	**Vinyl Chloride**	**Total VOCs**
GW-2 Standard		*5*	*20*	*2*	
MW-27R		-	-	-	-
MW-28		7.7	1.0	ND	10.3
MW-32		-	-	-	-
MW-41		2.9	4.5	4.2	13.4
MW-42R		ND	ND	ND	ND
MW-43		ND	ND	ND	ND
MW-44		ND	ND	ND	8.5
MW-45	4-5' Depth	2.9	6.1	ND	12.3
MW-46	/ Duplicate	1.6/1.4	7.0/7.0	5.6/5.8	20.8/20.6
MW-47		ND	3.4	1.8	11.9
MW-48		ND	4.6	ND	8.9
MW-49		ND	3.4	ND	3.4
MW-50		ND	2.8	ND	3.8
MW-51		1.8	ND	4.2	9.8
MW-52		16	3.2	ND	19.2
MW-53	/ Duplicate	ND/ND	ND/ND	ND/ND	ND/ND
MW-54		9.7	5.5	ND	19.2
MW-55	4' Depth	5.5	5.5	1.3	15.7

ND = Not detected
- = Not sampled

Isoconcentration plots of the three VOCs detected above GW-2 standards are presented in Figures 6, 7, and 8.

- Similar to the August sampling, TCE isocontours (Figure 6) based on December 2018 data suggest the presence of two separate sources, one in the vicinity of MW-27R and a second, in the vicinity of MW-55. TCE was detected in the new wells MW-51, MW-52, MW-54, and MW-55 in the southwestern part of the Mechanical Room; concentrations in wells immediately north, east, and south of the boiler were above the Method 1 GW-2 standard.
- Cis-1,2-DCE (Figure 7) also was detected further west and southwest than previously detected because of the locations of some the new wells; however, the highest concentration detected was an order of magnitude less than the Method 1 GW-2 standard.

- Vinyl chloride (Figure 8) was detected in an area that lies within the area of detection from pre-2018 sampling, and generally similar to the interpreted plume based on August sampling, but deflected slightly to the west and with the highest concentration detected in the middle of the plume at MW-41. Concentrations in the new wells not previously sampled were below the Method 1 GW-2 Standard.

PCBs

Eighteen unfiltered samples from 16 monitoring wells exhibited detectable concentrations of PCB Aroclors, including nine samples that exceeded the GW-2 and GW-3 standards. PCB concentrations in the aliquots filtered through the 0.45 micron filters[5] were reduced from the unfiltered concentrations by an average of 46 percent. Analytical results for each sample analyzed for PCBs are listed below:

WELL DETAILS		**PCB Analyses - Groundwater**	
Well ID		**December 2018 PCBS Concentrations (μg/L)**	
		Unfiltered	**Dissolved (0.45 μ Filter)**
		PCBs, Total	**PCBs, Total**
GW-2 Standard		*5*	*5*
MW-27R		12.3	4.52
MW-27D		ND	ND
MW-28		20.9	12.2
MW-31		ND	ND
MW-32		ND	ND
MW-33		ND	ND
MW-40		0.390	ND
MW-41		5.54	1.22
MW-42R		9.89	3.22
MW-43		ND	ND
MW-44		14.4	11.9
MW-45	4-5'	2.80	1.3
	7'	2.53	1.11
MW-46	/ Duplicate	0.331/0.251	ND/ND
MW-47		0.464	0.276
MW-48		2.53	1.99
MW-49		ND	ND
MW-50		11.9	4.73
MW-51		29.9	20.1

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[5] Filtering of groundwater samples is discussed in *Implementation of the MADEP VPH/EPH Approach*, Massachusetts Department of Environmental Protection Policy #WSC-02-411, October 31, 2002, Page 45.

MW-52	3.93	3.03
MW-53 / Duplicate	12.8/12.7	5.84/5.70
MW-54	8.29	6.08
MW-55 4'	16.5	10.6
6'	13.9	8.17

Isoconcentration plots for December 2018 data are presented in Figure 9B for total (unfiltered) PCBs and Figure 10B for dissolved (0.45m) PCBs. Interpretive PCB isocontours indicate that the overall area of PCB detection during December sampling is approximately the same as the area detected during August; however, it has shifted slightly to the west. The area of PCB concentrations above the Method 1 GW-2 standard during December is interpreted to have enlarged and shifted west, and to underlie part of the area occupied by two boilers on the western part of the Disposal Area (see Figures 9A and B and 10A and B).

Depth to water was measured at each well within the Mechanical Room and immediate surrounding area during the monitoring event conducted during December 2018. The measured depths to water were on average about 1.8 feet less than the depths measured during August, and the associated water elevations on average 1.8 feet higher. Based on those gauging data, a groundwater high is interpreted to exist at the Disposal Site between the boilers and the incinerator pit. Groundwater in the Mechanical Room is interpreted to flow toward the southwest, west, and north from this divide. The limited data in the storage room north of the Mechanical Room are consistent with an interpretation of southward flow toward the drain line. The groundwater contour plan for the December gauging event is provided as Figure 12.

2.4.4 *Indoor Air Investigation*

Concentrations of TCE in groundwater above the Method 1 GW-2 Standard south of the boilers on the upper deck during the December 2018 sampling event and the suggestion of groundwater flow toward the west and southwest based on groundwater elevation data indicate the potential for detection of VOCs in indoor air to the southwest of the Mechanical Room. To evaluate this potential exposure pathway, TRC collected indoor air samples from the Mechanical Room and adjacent Switch Gear room over a 24-hour period during January 15-16, 2019 and submitted the samples for laboratory analysis of VOCs. Evacuated stainless steel summa canisters were deployed on January 15, 2019 (1,037 days after system shutdown) at one location within the Mechanical Room (IAQ MC collected on the floor at PVP-6, previously labelled as TRC-IA-16) and one location within the adjacent Switch Gear room (IAQ ESG). The two 2019 indoor air sampling locations are shown on Figure 13, along with previous indoor air, soil gas, groundwater seep and wipe sample locations in the vicinity of the Mechanical Room.

The indoor air results (see Table 3) indicate that post-shutdown indoor air concentrations during January 2019 did not exceed MassDEP IATVs.

2.5 Updated Site Conceptual Model

Prior to construction of NBHS in the early 1970s, most of the PSWS was occupied by a wetland. From the 1930s into the 1970s, portions of the PSWS were subject to land disturbance and disposal activities.

During the construction of NBHS, organic wetland materials and much of the historical fill and intermixed PSWS Disposal Site fill materials that had come to be located in the footprint of the present day NBHS building were removed from the building footprint and replaced with a construction-suitable fill material. Materials dredged from New Bedford Harbor during the construction of the "Hurricane Dike" were reportedly transported to the NBHS construction site and used to stabilize the site for construction of the school building (NUS Corporation, 1985). Chemicals of concern identified in the soil in the vicinity of the Site are consistent with those attributable to industrial wastes (PCBs, antimony, arsenic, barium, cadmium, chromium, lead, mercury, nickel, vanadium, zinc, various PAHs, and dioxin-like compounds) and historic fill (e.g., coal, coal ash, wood ash and vehicle emission related PAHs, lead, and metals associated with coal). Groundwater monitoring has indicated that these chemicals have generally not migrated from soil to groundwater in the areas studied.

PSWS-related fill material was not observed at the subject Disposal Site, indicating that either the Mechanical Room area was not filled when other portions of the PSWS were, or that PSWS-related fill was removed from the Disposal Site area prior to construction of the NBHS building/Mechanical Room. The release at the Disposal Site appears to be a result of a spill of a DNAPL mixture of PCBs, TCE and petroleum into construction soil/fill emplaced below the Mechanical Room prior to construction of the building.

Figure 17 presents a schematic representation of potential migration pathways at the Site.

2.6 Updated Nature and Extent

PCBs are present in Disposal Site soils throughout the entire soil column, but concentration are higher at depths ranging from 6 to 12 feet below grade. Data from 62 samples collected prior to 2018 from 0 to 6 feet below grade showed a mean PCB concentration of less than 3 mg/kg, including non-detects, with a maximum value of 80 mg/kg from 4 to 6 feet below grade. Data from 110 samples collected prior to 2018 from 6 to 12 feet below grade showed a mean PCB concentration of approximately 38, with a maximum value of 1,240 mg/kg from 6 to 8 feet below grade. PCBs exceeded the MCP Upper Concentration Limit (UCL) of 100 mg/kg in four soil samples from the deepest interval (10 to 12 feet) sampled prior to 2018, with a maximum PCB concentration of 556 mg/kg detected in the interval. Figure 14 shows the mean and maximum soil PCB concentrations by depth interval for the pre-2018 data.

The 2018 investigation program was designed to delineate, both horizontally and vertically, the areas of higher PCB concentrations identified during the previous investigations, as well as to assess the distribution of PCBs in soil beneath the Mechanical Room. Data from the 2018 investigation confirmed the increase in Soil PCB concentration deeper than 6 feet below grade. The mean PCB concentration in the 66 samples collected in 2018 from 0 to 6 feet below grade was approximately 4.8 mg/kg, including non-detects at the reported detection limit for each sample, with a maximum value of 151 mg/kg from 5 to 6 feet below grade. Data from 85 samples collected from 6 to 12 feet below grade showed a mean PCB concentration of approximately 120 mg/kg, with concentrations exceeding 1,000 mg/kg from 6 to 9 feet, and a maximum value of 3,050 mg/kg from 6 to 7 feet below grade. PCB concentrations decreased from 9 to 12 feet below grade, although the maximum value in the 11 to 12 foot interval exceeded the MCP UCL of 100 mg/kg. Borings completed during the 2018 investigations provided soil samples from depths to 15 feet that demonstrated a decrease of Soil PCB concentration below 12 feet. The maximum concentration detected in samples deeper than 12 feet was an order of magnitude below the UCL. Figure 15 shows the mean and maximum soil PCB concentrations by depth interval for the 2018 data.

Figures 16A through 16 G show 1-, 4-, 10-, 25-, 50-, 100-, 500-, and 1,000-mg/kg isoconcentration contours of PCBs in soil in two-foot layers from the concrete floor surface downward. The isocontours were developed from the soil PCB concentration data through 2018 using an interpolation method called kriging, which predicts the soil PCB concentration by computing a weighted average of values in the vicinity of the estimated point. This series of figures complements and augments the information on mean and maximum PCB soil concentration with depth provided in figures 14 and 15 by providing the spatial distribution of concentrations within a depth interval.

The PCB isoconcentration contours show the following:

0 to 2 feet (Figure 16A) – Soil in a localized area in the vicinity of boring SB-31/32 Alt in the 0 to 2 foot layer, immediately beneath the slab, exceeds the MCP S-1 standard of 1 mg/kg.

2 to 4 feet (Figure 16B)- In the 2 to 4 foot layer, an area exceeding the MCP S-1 mg/kg standard is located beneath the area exceeding the MCP S-1 mg/kg standard in the 0 to 2 foot interval and extends north along the incinerator pit from that area. A small area of soil centered at boring SB-31/32 Alt exceeds the soil S2/S-3 standard of 4 mg/kg.

4 to 6 feet (Figure 16C) – The area of PCB detections extends outward in all directions from the area in the overlying 2 to 4 foot layer. A separate, closed isoconcentration contour exceeding the soil S2/S-3 standard of 4 mg/kg is located north of the primary area of contamination, beneath the food storage area. An area exceeding 50 mg/kg is present in the vicinity of boring PSB-22. Two relatively small areas of contamination exceeding the MCP soil UCL of 100 mg/kg are present west of the pit, at PSB-35, and southwest of the pit, at PSB-30.

6 to 8 feet (Figure 16D) – Consistent with the information in figures 14 and 15, significantly higher soil PCB concentrations are present in this layer than in the overlying or underlying layers. Two broad areas of concentrations in excess of the MCP soil UCL of 100 mg/kg are present. The southern of the two areas is at PSB-35 west of the vicinity of the pit. The northern of the two extends northward and westward from the PSB-22 area. Three localized concentrations in excess of 500 mg/kg or 1,000 mg/kg are present within the northern 100 mg/kg isoconcentration contour. A broad area in excess of 500 mg/kg or 1,000 mg/kg is present within the southern 100 mg/kg isoconcentration contour. A third, small area with concentrations greater than 100 mg/kg at PSB-30 in the 4 to 6 foot layer continues into this layer. The separate, closed isoconcentration contour exceeding the soil S2/S-3 standard of 4 mg/kg beneath the food storage area is smaller in this layer than in the overlying layer, and concentrations do not exceed 4 mg/kg.

8 to 10 feet (Figure 16E) – The overall area of contamination is similar to the area in the 6 to 8 foot layer; however, maximum concentrations are lower. The northern broad area of concentrations in excess of the MCP soil UCL of 100 mg/kg continues into this layer, whereas the south area of concentrations in excess of the MCP soil UCL of 100 mg/kg has reduced significantly in area and is centered west of its location in the 6 to 8 foot layer. One of the localized concentrations in excess of 500 mg/kg and 1,000 mg/kg noted in the 6 to 8 foot layer is present within the northern 100 mg/kg isoconcentration contour in this layer.

10 to 12 feet (Figure 16F) - The overall area of contamination is generally similar to the area in the 8 to 10 foot layer, but it does not extend as far in the southwest part of the Disposal Site. Both the northern southern areas of concentrations in excess of the MCP soil UCL of 100 mg/kg continue into this 10 to 12 foot layer. The south area of concentrations in excess of the MCP soil UCL of 100 mg/kg is interpreted to have increased in size and to extend east of its location in the 8 to 10 foot layer. Depth profile information and individual sample information (see figures 14 and 15 and Table 2) indicates that PCB concentrations decrease with depth within this layer. No concentrations in excess of 500 mg/kg and 1,000 mg/kg were detected in this layer.

12 to 14 feet (Figure 16G) – Two small areas with PCB concentrations exceeding the MCP S-1 standard of 1 mg/kg ae interpreted to be present in the 12 to 14 foot layer at the locations shown on Figure 16G. A small area of soil centered at boring SB-21 exceeds the soil S2/S-3 standard of 4 mg/kg.

PCBS are present in soils at concentrations exceeding the MCP UCL of 100 mg/kg in some part of the soil column over approximately 20 percent of the Disposal Area, as described in Section 2.4.2 and shown in figures 16A through 16G. PCB soil concentrations exceed 1000 mg/kg in four areas. Concentrations greater than 1,000 mg/kg near B-SW-1, BF-2, and the inferred source MW-27R, are interpreted to be localized based on the results of kriging of PCB soil data. The detection at PSB-35 is interpreted to be more areally extensive based on kriging of PCB soil data; the location of overhead and subsurface utilities did not allow the UCL exceedance to be more closely constrained. The PCBs detected in deeper soils located farther from the presumed source area suggest the dispersion of PCB impacts may have been affected by preferential pathways created by the glacial channel deposits present at the Disposal Site.

The chlorinated VOCs TCE, cis-1,2-DCE, and trans-1,2-DCE were detected in pre-2018 soil samples from 6 to 10 feet below grade at concentrations exceeding MCP Method 1 Standards; however, no VOC concentrations were detected above MCP UCLs . The chlorobenzenes 1,4-Dichlorobenzene and 1,2,4-Trichlorobenzene also were detected in pre-2018 soil samples at concentrations exceeding MCP Method 1 Standards. Operation of the sub-slab ventilation system in conjunction with the hydraulic containment system appears to have successfully mitigated the concentrations of chlorinated VOCs in soil. Chlorinated VOCS were not detected at concentrations exceeding MCP Method 1 Standards in the 2018 soil samples.

Based on data collected prior to the 2018 investigations, the extent of the chlorinated VOC groundwater plume in the vicinity of the Mechanical Room was understood to be limited to the vicinity of wells MW-27R, MW-28, MW-41 and MW-42R. Installation of additional wells during 2018 investigations allowed the distribution of the plume to be refined. As discussed above in Section 2.4.3 the extents of the chlorinated VOC groundwater plumes vary by contaminant. The VC groundwater plume has decreased from its pre-2018 configuration both in extent and in area exceeding the Method 1 GW-2 Standard; the cis-1,2-DCE groundwater plume decreased in area exceeding the Method 1 GW-2 Standard, but it is difficult to determine if the overall extent has changed; and the TCE groundwater plume increased in both concentration, and areal extent. VOC impacts in groundwater in the vicinity of the Mechanical Room were defined vertically by the installation and sampling of deep overburden monitoring well MW-27D.

Groundwater samples from wells MW-27R, MW-28, MW-41 and MW-42R have exhibited detectable concentrations of PCBs; however, sample filtration has demonstrated the PCB detections in groundwater are primarily attributable to particulate entrained in the samples rather than dissolved phase PCBs.

VOCs present in soil and groundwater have volatilized and migrated into soil vapors and indoor air at the Disposal Site. The implementation of the sub-slab ventilation system in conjunction with the hydraulic containment system was successful in mitigating the presence of VOCs in groundwater and indoor air. TCE concentrations above MassDEP screening values are still present in soil gas below the Mechanical Room in the vicinity sample location PVP-6. However, no VOC concentrations have been detected above MassDEP IATVs in indoor air samples collected from the Disposal Site from January 2015 through January2019.

2.7 Risk Characterization Summary

A Method 3 Risk Characterization was performed for the Site as part of the Phase II CSA, and supplemental risk characterization for the emergency utility worker scenario was performed based on additional data collected in the Phase III investigations. This section presents the conclusions from the Risk Characterization.

2.7.1 *Human Health Risk Characterization – Phase II CSA*

Table 7 presents the summary of receptor risks and hazards from the risk assessment provided in the Phase II CSA report (TRC, 2017a). The risk assessment concluded that no IH condition exists at the Disposal Site because soil and groundwater impacts are located below the existing NBHS building. In addition, MassDEP Risk Limits were not exceeded for building occupants (students, staff, daycare children, etc.) exposed to potentially-impacted indoor air, or for 1-day emergency utility workers exposed to surface/subsurface soil, shallow groundwater, and trench air.[6] These findings indicated that a Condition of No Significant Risk has been achieved for current exposures at the Disposal Site, reinforcing that an IH condition does not exist at the Disposal Site.

For future exposures, under the assumption that the NBHS building would be demolished and soils currently located below the building become exposed, calculated Hazard Indices (HIs) and Excess

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[6] Comments received by MassDEP on the emergency utility worker calculations resulted in a recalculation of the risks and a conclusion of Significant Risk for this receptor, based on data collected prior to 2017.

Lifetime Cancer Risks (ELCRs) are less than MassDEP Risk Limits for residential and commercial direct contact exposures to surface soil (0 to 3-foot interval). Although MassDEP Risk Limits are not exceeded for residential direct contact exposures to surface soil, fruits and vegetables grown in Disposal Site surface soil (the produce intake pathway) would be associated with unacceptable risk due to PCBs.

MassDEP Risk Limits are exceeded for future residential and commercial exposure to 0 to 12 foot interval soil and future construction worker exposure to 0 to 12 foot interval soil and groundwater. The unacceptable risk and hazard are primarily associated with PCBs in soil and groundwater. MassDEP Risk Limits are also exceeded for the inhalation of indoor air pathway based on air samples collected up to 2016, assuming the existing NBHS building is converted to residential use.

Future residential and commercial receptors may be exposed to contaminants in indoor air following subsurface migration from soil and groundwater if the existing building were to be demolished and a new one constructed; however, this exposure pathway was not quantitatively evaluated. This exposure pathway will require either quantitative evaluation in the future, or installation of a vapor mitigation system to mitigate exposures to future building occupants.

2.7.2 *Human Health Risk Characterization – Supplemental Characterization*

Subsequent to the submittal of the Phase II report, MassDEP provided comments on the calculations for the emergency utility worker exposure scenario, necessitating a recalculation of risk associated with this scenario, and a conclusion of significant risk for the emergency utility worker, based on data collected prior to 2017 which were largely collected from areas outside existing utility corridors. As described in Section 2.4.1, Phase III investigations targeted the utility corridors at the depths of potential exposure to gather data necessary to refine the risk calculations for the scenario. Based on calculations using data from the utility corridors, MassDEP risk limits for the emergency utility worker are not exceeded. The supplemental health evaluation is included in the Temporary Solution Statement (TRC, 2019b). The summary of receptor risk and hazards for current exposures to soil, trench air, and groundwater for the emergency utility worker scenario is presented in Table 8.

Indoor air concentrations have decreased since the Phase II risk calculations were completed in 2016 and current concentrations no longer are above IATVs (see Table 3).

2.7.3 *Public Welfare*

No community in the vicinity of the Disposal Site experiences Site-specific adverse impacts to public welfare. However, because the total PCB exposure point concentrations (EPC) for the 0 to 12 foot soil interval exceeds its MCP UCL, a condition of No Significant Risk of harm to public welfare does not exist at the Disposal Site.

2.7.4 *Safety*

Qualitative observations did not reveal hazards associated with the COPC release likely to pose a threat of physical harm or bodily injury to people, and consequently, a Condition of No Significant Risk of harm to safety exists at the Disposal Site. Evaluation of risk of harm to safety through comparison of conditions to applicable or suitably analogous safety standards (e.g., LELs) was not considered applicable to this Disposal Site.

2.7.5 *Environment – Phase II CSA*

The Phase II CSA concluded that site-specific information indicated that no significant soil exposure pathways exist at the Disposal Site, that groundwater data indicate a Condition of No Significant Risk to aquatic receptors based on a comparison of groundwater EPCs to MCP Method 1 GW-3 standards, and that the Disposal Site represents a Condition of No Significant Risk to the environment. As a consequence of these conclusions a Stage II Environmental Risk Characterization was not required as part of the Phase II.

2.7.6 *Ecological Substantial Hazard Evaluation – Phase III*

As described in Section 2.4.3, dissolved PCB concentrations that exceed the GW-3 standard (10 ug/L) were detected at four of 22 monitoring wells sampled at the Site during 2018. Based on these detections, TRC conducted an Ecological Substantial Hazard Evaluation (SHE) at Site in accordance with the requirements of the Massachusetts Contingency Plan (MCP) 310 CMR 40.0956(2). There are no endangered species habitats, Areas of Critical Environmental Concern (ACECs) and/or certified vernal pools within 500 feet of the Site. The SHE focused on the wetland/open water area located west of the Keith Middle School, which represents the nearest sensitive and downgradient habitats for environmental receptors in the vicinity of the Site.

The SHE concluded that the occurrence of any of the six conditions listed at 310 CMR 40.0956(2) as affecting ecological resources is not substantiated:

1. To TRC's knowledge, fish or wildlife kills have not been previously reported for any nearby surface waters including the wetland/open water area near the KMS;
2. The presence of oil, tar or other non-aqueous phase hazardous material has not been observed in the wetland/open water areas in the vicinity of the Site;
3. Discharge of impacted groundwater to downgradient aquatic habitats is not occurring, and previous sampling of the wetland/open water area indicates this surface water is not impacted by PCBs;
4. Downgradient groundwater samples indicate that discharge of impacted groundwater from the Site to impacted surface water/sediment does not occur;
5. The migration of contaminants from the Site is not anticipated based on the lack of detected PCBs in surface water and groundwater samples collected at the wetland/open water area; and,
6. Based on the low concentrations of dissolved PCBs in groundwater samples from downgradient wells and the absence of total PCBs in groundwater and surface water samples collected from the nearest downgradient aquatic habitat, the Site is not causing impacts to environmental receptors that would necessitate remedial measures.

Overall, a condition of No Significant Risk to environmental receptors exists at the Site, and a condition of No Substantial Hazard also is present for environmental receptors located downgradient of the Site.

3.0 PHASE III REMEDIAL ACTION ALTERNATIVES

The purpose of this Phase III Remedial Action Plan is to document the results of the Identification, Evaluation, and Selection of Comprehensive Remedial Action Alternatives process performed for the Site. This section satisfies MassDEP requirements for the selection and design of remedial response actions in accordance with 310 CMR 40.0850. The certifications required per 310 CMR 40.0862(3) are provided on the MassDEP transmittal form (BWSC-108) submitted electronically via eDEP concurrent with this document.

3.1 Scope

The scope of the identification and evaluation of the remedial action alternatives process includes:

1. **Screening -** An initial screening to identify those remedial technologies that are reasonably likely to be feasible and effective.

2. **Alternative Development -** Assembly of feasible remedial technologies into remedial action alternatives that are reasonably likely to achieve a level of No Significant Risk under the MCP.

3. **Comparison -** A detailed, comparative evaluation of the selected remedial action alternatives with respect to effectiveness, reliability, difficulty of implementation, cost, risk, benefits, and timeliness. Additional details are provided for a selection of conceptual potential remedial approaches.

4. **Selection -** Selection of remedial action based on the aforementioned process.

3.2 Alternatives Analysis

3.2.1 *Remedial Action Objectives and Cleanup Goals*

The objective of remediation at the Site is to address the requirements of TSCA as related to PCB impacts in soil and groundwater, and to support a future use for the Site that benefits the surrounding community. If feasible, remediation seeks to eliminate the risks identified in the Phase II CSA and Phase III supplemental Risk Characterization, as presently applicable. Elimination of significant risks and the achievement of a Permanent Solution would require the demonstration that a condition of No Significant Risk has been achieved at the Site under current conditions, and will be maintained in the future under possible Site use scenarios. Achievement of a Temporary Solution would require the demonstration that No Substantial Hazard has been achieved.

The remedial goals for the Site are:

- To restrict Site uses to eliminate and/or control exposures to soil and groundwater that would exceed applicable MassDEP risk thresholds;
- Achieving and maintaining a condition of No Significant Risk to human health, safety, public welfare, and the environment at the Site that does not rely on the existing access controls to the Site; and
- Allowing for future Site uses that benefit the surrounding community and pose No Significant Risk to users of the Site.

A Permanent Solution must conform to the requirements set forth in 40 CFR §761 for the components of the Site that are regulated under TSCA. The remediation work discussed herein has been developed in accordance with 40 CFR §761.61(c), which outlines performance standards for a "risk-based" cleanup approach. A separate site-specific cleanup plan will be developed for regulatory review and concurrence by EPA Region 1.

3.2.2 *Areas Requiring Response Actions*

The Site occupies an approximately 4,700 square-foot area beneath the floor of the Mechanical Room (B-114) and a small portion of the adjacent Cafeterias Storage Room within the NBHS building. The MCP Method 3 Risk Characterization concluded that MassDEP risk limits are not exceeded for current emergency utility worker soil and groundwater exposures at the Site and for current building occupants potentially exposed to impacted indoor air. A condition of No Significant Risk does not exist for the Site under potential unrestricted future Site use scenarios. The remedial alternatives discussed herein address soil and groundwater impacts throughout the Site.

3.2.3 *Proposed Development Plans*

The City has no plans to transfer the property and no change is anticipated in the use of the NBHS building or the Mechanical Room in the future. Potential future conversion of the NBHS building to residential use or demolition of the existing building and construction of a new one were considered in the risk characterization summarized in Section 2.

The remedy selected as a result of the Phase III process must restrict exposures to a degree consistent with the future use of the Site as a public school building and its eventual demolition or repurposing. Other than the no action alternative that is included for comparison purposes, and the limited action alternative that provides a Temporary Solution, the remedial alternatives that achieve MCP Permanent Solution closures for the Mechanical Room are based on combinations of different technologies for remediation after or as a task of demolition. Future annual maintenance costs would vary for the Permanent Solution alternatives and are thus relevant to the comparative evaluation of remedial alternatives in this Phase III Remedial Action Plan.

3.2.4 *Identification and Initial Screening of Potential Remedial Action Technologies*

Identification of Potential Remedial Action Technologies

The identification process focused on technologies that exhibited the potential to eliminate or significantly reduce exposure to the PCBs and VOCs detected in soil and groundwater at the Site. The range of technologies includes:

No Action

No Action assumes no additional efforts are undertaken to eliminate potential future exposures to soil and groundwater impacts at the Site. This alternative would achieve neither a Permanent Solution nor a Temporary Solution at the Site; however, it has been retained for further detailed evaluation to establish a baseline for comparison of the other remedial actions evaluated.

Use Restrictions/Institutional Controls

Institutional controls such as an Activity and Use Limitation (AUL) establish restrictions on the use of a site that could otherwise potentially result in exposure to the soil or groundwater impacts that remain.

Institutional controls are commonly used to maintain a condition of No Substantial Hazard or No Significant Risk at sites and are appropriate, where necessary, to control risks associated with potentially accessible soils.

An institutional control in the form of an AUL would not by definition allow for unrestricted future use of this Site. An AUL may be used in conjunction with other remedial alternatives to maintain a condition of No Significant Risk of harm to human health and the environment.

Institutional controls have been retained for consideration in the development of a comprehensive remedial scenario for the Site.

Soil Technologies

In-situ Soil Treatment

In-situ treatment is an option that involves "in-place" treatment of soil by physical, biological, or chemical processes. The purpose of in-situ treatment is to transfer chemicals to another medium, transform contaminants to less toxic substances, or destroy them without the need to first excavate the soil. In-situ treatment eliminates the need to excavate, transport, and dispose of soil off Site and thus does not require fuel consumption for such purposes. The particular technological process selected is usually dictated by the targeted chemical and soil/groundwater conditions.

Thermal in-situ treatment of soils is an effective method of mitigating some organic chemicals, typically by increasing their volatilization. By raising the temperature of the soil with heat, organic chemicals will more readily volatilize, and can then be captured and treated as necessary. This is an energy intensive technology. Thermal desorption is not a TSCA-approved method for PCB remediation waste. Therefore, this method of treatment cannot address all chemicals of concern (COCs) at the Site.

Vitrification utilizes electrodes inserted into the ground to heat the soil to a liquid state. This technology is energy intensive due to the high electrical power demand. As the soil cools, it will vitrify to a glass-like solid block trapping any and all chemicals. In order to safely perform vitrification, surrounding soils must be dried to prevent the release of steam during the vitrification process. Remedial cost becomes incrementally higher where the water table is close to grade/zone of treatment, such as at this Site. Generally, vitrification has the potential to be unsafe, has a limited history of practical applications, and may result in future land use limitations because the vitrified soil block must be left intact to contain the chemicals.

In-situ chemical oxidation treatment may be an effective method of mitigating organic chemicals. Chemicals with oxidizing properties are introduced to the soil via direct push drilling methods or application with soil augers, then they react with and subsequently degrade the chemicals. Chemical oxidation treatment offers little benefit to this Site because of the persistence of PCBs, the potential for large organic load in peat in the soil, and the fact that it would not address inorganic COCs, if that became necessary.

Physical stabilization of soil by mixing with a stabilization agent like cement can physically bind the COCs into a low permeability solid mass and render them less available for exposure. This technology is less effective for organic compounds.

Due to the lack of any single, practical technology that could potentially treat all co-located, targeted chemicals on Site, in-situ treatment of soil was not retained for further evaluation.

Ex-situ Soil Treatment/Reclamation/Recovery

Ex-situ treatment is an option that involves excavation of soil for treatment by physical, biological, or chemical processes. Ex-situ treatment transfers chemicals to another medium, transforms contaminants to less toxic substances, or destroys them. The specific technological process selected is usually dictated by the targeted chemical. Ex-situ treatment may be conducted on Site or off Site. Following treatment, the excavated soil may be returned to the place of origin, or transported to a disposal facility, depending on the success of the treatment in reducing or destroying chemical concentrations.

At this site, excavated soils with chemical concentrations lower than an identified cleanup standard may be amended with an adsorptive agent, such as activated carbon, or with a chemically reactive agent, such as zero valent iron, prior to being used as backfill in the excavation. Similarly, clean backfill brought from a tested, off-site source may be amended with an adsorptive agent or with a chemically reactive agent. In addition to the beneficial effect these amendments to the backfill may have on sequestering or immobilizing soil contaminants, they also could serve to reduce the concentrations of COCs in groundwater. Absorptive or reactive soil amendments are retained as a technology to treat groundwater.

Treatment of some metals in soils at this Site may be appropriate prior to disposal, depending on disposal characterization sampling results for toxicity characteristics leaching procedure (TCLP) analysis, and MassDEP requirements listed in *Policy #COMM-97-001: Reuse & Disposal of*

Contaminated Soil at Massachusetts Landfills. For its potential use either on backfill or prior to disposal, this technology was retained for future consideration.

In addition, some waste materials from the Site could require incineration. The need for this process will depend on facility acceptance requirements for soils targeted for off-site disposal.

Reclamation and recovery is a process of soil washing that scrubs soil to remove and separate the portion of the impacted soil. Contaminants tend to sorb to certain soils such as fine-grained silt and clay. Silt and clay in turn stick to larger-grained sand and gravel. Soil washing is a process to separate the silt and clay from the larger-grained (clean) soils, which may decrease the overall soil volume requiring disposal. Before soil washing occurs, soil is excavated from the impacted area and the material is sifted to remove large objects such as rocks and debris. The soil is then placed in a scrubbing unit with wash water and sometimes detergent. Output includes wash water that must be treated, impacted soil that must undergo additional treatment or landfilling, and clean soil. There is a potential need for emissions controls as part of the soil washing process.

An alternative ex-situ method is utilizing a solvent-based solution to extract soil-bound compounds. This technology has proven successful with PCBs, but is not designed to treat metals or PAHs.

Commercialization of washing and solvent extraction processes is not yet extensive. The presence of a complex mixture of chemicals such as metals, non-volatile organics, and PAHs present in a heterogeneous matrix makes it difficult to formulate single washing solutions.

The soil washing/solvent extraction technology was not retained for further consideration.

Containment (Soil)

Containment is an option that involves covering impacted soils in place to prevent direct contact (exposure barrier), erosion at the soil surface, and in some cases water infiltration. Excavating soil can be difficult depending on site conditions and expensive, particularly when the volume of impacted soil is large. Capping provides an effective and proven alternative for containment. Capping is generally considered a cost-effective method for managing large volumes of impacted soil and for reducing the energy cost and air emissions associated with equipment and vehicle fuel consumption. Containment measures are designed to isolate chemicals to prevent direct contact, erosion, and depending on the chemicals, leaching.

A containment remedy would utilize a layer of any medium, adequately designed to limit exposures for the given use scenario, and may consist of soil, asphalt, concrete, or synthetic products. A containment remedy, properly designed, installed and maintained, will eliminate or mitigate direct contact with the underlying soils and will address all chemicals. An engineered barrier, as described in MassDEP's 2002 guidance document *Guidance on the Use, Design, Construction, and Monitoring of Engineered Barriers*, could also be an effective method of minimizing exposure risks at the Site, depending on the particular Site characteristics. Generally, an engineered cap is chosen when implementation of other remedial options becomes unfeasible, after evaluation through a cost-benefit analysis. When containment is selected for a remedial solution, it is typically implemented in conjunction with an institutional control.

Although the soils at the Site are at present beneath a concrete slab that serves as an exposure barrier preventing direct contact, the building will be demolished at some time in the future. As a consequence, containment was retained as a technology for further consideration in the detailed evaluation.

Soil Removal

Physical removal addresses COCs in soil by physically removing impacted media from the Site for disposal at an off-site facility.

Excavation and off-site disposal is a proven and commonly used method that addresses all soil impacts. To meet requirements of some disposal facilities, pretreatment of the impacted media may be required. Screening of fill material is sometimes required to remove garbage and other debris. Associated with soil excavation and off-site transportation and disposal is the energy consumption due to the use of fuel for equipment and vehicles and the associated air emissions.

This alternative typically targets smaller soil volumes, because costs associated with excavation, transportation, and disposal fees increase as the soil volume increases. In addition, Site restoration typically would be necessary, thereby further increasing costs. The Mechanical Room Site is relatively small; however, because of the location of the Site within the school building, excavation of soil contamination while the building is extant would not be practical.

Impacted soil could be excavated by readily available excavation equipment. However, treatment of excavated soil may be required where concentrations are incompatible with disposal facility acceptance requirements. Pretreatment may be performed on Site, either in-situ or at an adjacent stockpile or staging area, or at the receiving disposal facility.

In addition to addressing soil impacts, physical removal of soil also removes source material causing or contributing to groundwater contamination. By removing source mass, both the contaminant concentration and the duration or persistence of the associated groundwater plume may be reduced.

Removal, on-site treatment, and off-site reuse, recycling, and/or disposal are common methods of soil remediation, with the additional potential benefit of reducing groundwater contaminant concentrations. Given the proven performance of excavation as a remedial technology at similar sites, this technology has been retained for further evaluation.

Groundwater Technologies

Groundwater remediation technologies include physical treatment, chemical treatment, and biological treatment technologies. These technologies may be employed on groundwater in situ, or after the water has been extracted. Typically, more than one remedial technology is necessary to handle and treat groundwater at a site.

In Situ Biological Treatment

Bioremediation techniques are destructive technologies that create favorable environmental conditions for indigenous or augmented microorganisms to metabolize or biodegrade contaminants in situ. In situ treatment technologies do not require extraction to treat impacted groundwater. The concentration of nutrients and electron acceptors in the groundwater is increased to enhance the biodegradation rate, either through injection of air or solutions (e.g., peroxide or solubilized nitrate) or through the emplacement of solid-phase products that will release oxygen.

In situ bioremediation technologies are most effective on fuels and nonhalogenated VOCs and SVOCs. They generally require a long period of time, up to years, to achieve satisfactory destruction. Because the technologies will not treat PCBs and are not very effective for halogenated VOCS, the primary contaminants in groundwater at the Site, in-situ biological treatment of groundwater was not retained for further evaluation.

In Situ Physical/Chemical Treatment

Physical/chemical treatment technologies use physical or chemical properties of the contaminants to remove, immobilize, or destroy the contaminants. Technologies using wells include air sparging, in which air is injected into groundwater to strip VOCs from the groundwater; dual phase extraction, in which a high vacuum system is employed to remove impacted groundwater, separate phase product, and hydrocarbon vapor; chemical oxidation, in which chemical oxidants such as peroxide or permanganate are used to degrade or destroy contamination; and thermal treatment, in which steam or hot water is injected into groundwater to vaporize contaminants. Passive or reactive treatment walls consist of a permeable barrier (wall) emplaced across a contaminant plume. These walls allow groundwater to move through the wall, but they destroy or degrade contaminants.

The period of operation of in situ physical/chemical treatment technologies varies, but in general they are shorter duration than biological treatment technologies. Air sparging typically is employed for a period of years. In situ chemical oxidation can occur rapidly; however, multiple applications may be necessary. Steam or water injection typically requires several months. Passive treatment walls typically are constructed to provide long-term control migration of impacted in groundwater over a period of years.

These technologies include a range of processes and consequently applicability to contaminants varies between technologies. Volatile organic compounds, including halogenated VOCs, and SVOCs generally can be successfully remediated in groundwater using physical and chemical treatment technologies. Although PCBs are not readily destroyed by in situ physical or chemical treatment, the presence of VOCs may increase the co-solvency of PCBs. Consequently, reducing the concentrations of VOCS in groundwater may also reduce the concentrations of PCBs by making them less mobile.

One method of treating VOC groundwater contamination in areas of residual soil contamination is to amend clean backfill with an adsorptive agent or with a chemically reactive agent. Coupled with soil removal to reduce source mass, this technology can be effective for groundwater concentration reduction and has been retained for further evaluation.

Ex Situ Biological Treatment

Ex situ bioremediation is comprised of a group of technologies used to treat extracted groundwater through bioreactors. Configurations vary, but divide generally into attached or suspended biological systems. Attached growth systems include rotating biological contactors, fixed-film bioreactors, and trickling filters, in which a microbial population aerobically degrades groundwater contaminants. Suspended growth systems include sequencing batch reactors, activated sludge, or fluidized bed reactors.

These treatment technologies build upon well-established municipal wastewater treatment technologies and can be effective in reducing concentrations of halogenated and non-halogenated VOCs, non-halogenated SVOCs, and petroleum, especially residual contamination. Biological processes typically are long-term and may require several years of operation. Because of the availability of other technologies of equal or superior effectiveness, ex situ biological technologies have not been retained for further evaluation.

Ex Situ Physical/Chemical Treatment

Ex situ physical/chemical treatment processes include a group of technologies that use the contaminant properties to treat extracted groundwater. Commonly used physical/chemical treatment technologies include adsorption, typically using granular activated carbon (GAC)/liquid carbon phase adsorption; oxidation methods; and air stripping.

In carbon adsorption technologies, following pretreatment to remove particulates, groundwater is pumped through vessels of activated carbon. Organic contaminants in the groundwater adsorb to the carbon, thereby reducing the groundwater concentrations.

Oxidation technologies use an oxidant, such as ozone or hydrogen peroxide to destroy rather than adsorb contaminants in groundwater. Ultraviolet (UV) radiation may be used to act synergistically with the oxidizer.

In air stripping, VOCs are transferred from groundwater to air by spraying groundwater onto a packed tower or multiple trays against which air is being blown. Alternatively, air may be bubbled into one or more baffled tanks of impacted groundwater. The resulting air may require emission control and treatment to prevent discharge of VOCs above applicable standards.

Ex situ physical/chemical treatment processes require infrastructure and long-term operation to remediate groundwater from ongoing contaminant sources, such as at the Site. They are not efficient at reducing source mass. For these reasons, Ex situ physical/chemical process have not been retained for further evaluation.

Containment

Containment of groundwater can be achieved through construction of physical barriers, hydraulic containment through pumping, or deep well injection. Containment is undertaken to reduce exposure to groundwater contamination by decreasing groundwater migration. Because containment of groundwater does not reduce source concentrations and because exposure to impacted soils accounts for much of the risk at the Ste, containment is not retained for further evaluation as a groundwater treatment technology.

3.2.5 *Remedial Action Alternatives for Further Evaluation*

Through the initial technology screening evaluation, a limited number of practicable remedial action technologies were identified as potentially viable remedy components based on available Site data and TRC experience. Using the retained technologies, TRC developed conceptual remedial alternatives for further evaluation. Alternatives Nos. 3, 4, and 5 would result in a Permanent Solution based on the potential future use of the Site as a public building, or commercial or residential property.

The remedial action alternatives developed from the initial technology screening are as follows:

- **Alternative No. 1 – No Action –** This alternative serves as a baseline for comparison to the other remedial alternatives and would not achieve either a Temporary or Permanent Solution under the MCP.
- **Alternative No. 2** – **Limited Action** – This alternative involves no additional remedial actions. No Site controls exist at present other than administrative access control to the building, and so implementation of an AUL would not be required. This alternative would potentially achieve a Temporary Solution under the MCP and would support the continued use of the Site as a public school; however, it would not support unrestricted future use of the Site.
- **Alternative No. 3A – Targeted Excavation/Disposal of Source Soil with PCB Concentrations Greater than 100 mg/kg, Backfilling with Clean Backfill, and Institutional Controls –** This alternative involves the targeted excavation and off-site disposal of soils that exceed the UCL (PCB concentrations greater than 100 mg/kg), importation of clean fill, and implementation of an AUL. This alternative would achieve a Permanent Solution with Conditions under the MCP and would support the continued use of the Site as a public school until demolition. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.
- **Alternative No. 3B – Targeted Excavation/Disposal of Source Soil with PCB Concentrations Greater than 100 mg/kg, Backfilling with Amended Backfill, and Institutional Controls –** This alternative involves the targeted excavation and off-site disposal of soils that exceed the UCL (PCB concentrations greater than 100 milligrams mg/kg), backfilling with an amended backfill that includes an adsorptive agent (e.g., activated carbon) and a reactive agent (e.g., zero valent iron) to decrease residual groundwater concentrations and implementation of an AUL. This alternative would achieve a Permanent Solution with Conditions under the MCP and would support the

continued use of the Site as a public school until demolition. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

- **Alternative No. 4A – Targeted Excavation/Disposal of Source Soil with PCB Concentrations greater than 4 mg/kg, Backfilling with Clean Backfill, and Institutional Controls** – This alternative involves the targeted excavation and off-site disposal of soils that exhibit PCB concentrations greater than 4 mg/kg (the MCP S-2/S-3 standard), importation of clean fill, and implementation of an AUL. This alternative would achieve a Permanent Solution with Conditions under the MCP and would support the continued use of the Site as a public school until demolition. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

- **Alternative No. 4B – Targeted Excavation/Disposal of Source Soil with PCB Concentrations Greater than 4 mg/kg, Backfilling with Amended Backfill, and Institutional Controls –** This alternative involves the targeted excavation and off-site disposal of soils above the MCP S-2/S-3 standard (PCB concentrations greater than 4 mg/kg), backfilling with an amended backfill that includes an adsorptive agent (e.g., activated carbon) to decrease residual groundwater concentrations, and a reactive agent (e.g., zero valent iron), and implementation of an AUL. This alternative would achieve a Permanent Solution with Conditions under the MCP and would support the continued use of the Site as a public school until demolition. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

- **Alternative No. 5A – Targeted Excavation/Disposal of Source Soil with PCB Concentrations greater than 1 mg/kg, and Backfilling with Clean Backfill–** This alternative involves the targeted excavation and off-site disposal of soils above the MCP S-1 standard (PCB concentrations greater than 1 mg/kg), and importation of clean fill. This alternative would achieve a Permanent Solution under the MCP and would support the continued use of the Site as a public school until demolition. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

- **Alternative No. 5B – Targeted Excavation/Disposal of Source Soil with PCB Concentrations Greater than 1 mg/kg, and Backfilling with Amended Backfill–** This alternative involves the targeted excavation and off-site disposal of soils above the MCP S-1 standard (PCB concentrations greater than 1 mg/kg), backfilling with an amended backfill that includes an adsorptive agent (e.g., activated carbon) and a reactive agent (e.g., zero valent iron) to decrease residual groundwater concentrations, if any. This alternative would achieve a Permanent Solution under the MCP and would support the continued use of the Site as a public school until demolition. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

3.3 Evaluation and Comparison of Comprehensive Remedial Action Alternatives

Descriptions and comparisons of the remedial alternatives are provided below. Table 9 presents a comparison of key features of each alternative, and Table 10 presents a summary of approximate remedial costs of the alternatives.

Remedial action Alternatives Nos. 2, 3A/B, 4A/B and 5A/B could each be advanced to the Phase IV Implementation of the Selected Comprehensive Remedial Alternative (Phase IV) stage of the MCP to support achieving a Permanent Solution with Conditions at the property.

In accordance with 310 CMR 40.0858, remedial action alternatives are evaluated using the following MCP criteria as further described in the notes of Table 9:

- Effectiveness,
- Short-term and long-term reliability,
- Difficulty in implementing,
- Cost,
- Risk,
- Benefits,
- Timeliness, and
- Effects on non-pecuniary interests.

3.3.1 *Alternative No.1 – No Action*

The No Action Remedial Alternative involves no additional remedial actions and represents a baseline for comparison of the other remedial alternatives. The No Action alternative would not result in a Permanent or Temporary Solution under the MCP and may not prevent potential future exposures to impacted media. No Action alternative will not meet remedial action objectives and cleanup goals in the future due to reliability concerns. This alternative will not be evaluated further with respect to the comparative evaluation criteria.

3.3.2 *Alternative No.2 – Limited Action*

This alternative files a Temporary Solution Statement for the Site to achieve a Temporary Solution under the MCP. The alternative would support the continued use of the Site as public school; however, it would not support unrestricted future use of the Site. Monitoring would be conducted to confirm that the Temporary Solution remains protective for building occupants and emergency utility workers, the current potential receptors. An AUL is not required for the Site, as all substantial hazards have been eliminated and requirements for a Temporary Solution have been met. However, implementation of an AUL may be considered given the likelihood that a Permanent Solution will not be achieved in the near term.

3.3.2.1 Permit Requirements

Implementation of the Limited Action alternative is not anticipated to require any permits, as the activity associated with this remedial alternative is a continuation of environmental monitoring that would occur entirely within the NBHS building.

3.3.2.2 Environmental Monitoring

Groundwater monitoring would be conducted every five years for the duration of the Temporary Solution to confirm the continued protectiveness of the remedy. Groundwater PCB concentrations in the utility corridors would be monitored to confirm that they are not increasing to concentrations that would increase risk to emergency utility workers to unacceptable levels. Groundwater VOC concentrations would be monitored to confirm that concentrations are not increasing from the current concentrations, which are associated with acceptable risk to building occupants from exposure to indoor air.

3.3.2.3 Implementation of an AUL

An AUL is not required for the Site, as all substantial hazards have been eliminated and requirements for a Temporary Solution have been met. Although an AUL is not required for the Site, one could be considered to restrict exposure to Site soil and groundwater until a Permanent Solution is achieved in the future.

3.3.2.4 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have poor effectiveness per 310 CMR 40.0858(1) because:

1. It would result only in a Temporary Solution under the MCP and although it would support the continued future use of the Site, it would not support beneficial property reuse;
2. Soil impacts in the Disposal Site would not be removed; and
3. Overall chemical concentrations at the property would not be reduced.

A high degree of certainty exists that this alternative would be successful at limiting current exposures to chemicals in soil and groundwater. The location of the Mechanical Room limits access to the area, and the existing concrete slab provides a barrier to contact with the underlying soil and groundwater. As demonstrated through measured soil and groundwater concentrations in the utility corridors, potential risk to emergency utility workers would represent a condition of No Substantial Hazard. As demonstrated through measured indoor air concentrations in the Disposal Site and adjacent switchgear room, potential risk to building occupants would represent a condition of No Substantial Hazard. Construction work would be performed under a Health and Safety Plan, further limiting potential exposure.

This alternative would be straightforward to implement. Lower implementation risk is associated with this alternative than with alternatives Nos. 3A through 5B, as groundwater monitoring of existing wells is the only ongoing activity conducted under the alternative.

Groundwater monitoring would be conducted every five years for the duration of the Temporary Solution to confirm the continued protectiveness of the remedy. Low risk would be associated with impacted soil and groundwater left in place at the Site, due to the current property use and the barrier to contact imposed by the existing concrete slab.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly lower with this remedial alternative than with Alternatives 3A through 5B, as no impacted soil would be excavated and transported off-site for disposal and replaced with backfill transported to the property. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be lower than with Alternatives 3A through 5B, given the lack of excavation and the small amount of remedial waste that would be generated from monitoring and transported off-site for disposal under this alternative.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not being degraded.

This alternative is protective of the current potential receptors and achieves a Temporary Solution while allowing for continued use of the property as public high school. This is the lowest cost of the alternatives. The estimated cost of this alternative is approximately $39,000. Annual monitoring costs would be approximately $9,000 per year following site closure. This alternative would likely take three months to implement, permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.3 *Alternative No. 3A - Targeted Excavation/Disposal of Soil with PCB Concentrations greater than the Upper Concentration Limit (100 mg/kg), Installation of Clean Backfill, and Institutional Controls*

Alternative No. 3A consists of targeted excavation and off-site disposal of soils from those areas beneath the Site where the soils exceed the UCL (PCB concentrations greater than 100 mg/kg). The Mechanical Room is located at ground level in the center of the B Block, the hexagonal core of the school (see Figure 1), where several shared services are administered and from which classroom wings emanate. The Mechanical Room itself houses the boilers as well as numerous air ducts, fans and air handling equipment associated with the building's heating and cooling systems. An elevator, a Cafeteria Storage Room, and rooms used for storage and building maintenance purposes including a switchgear room are located in the immediate vicinity. The Mechanical Room also contains a pit associated with a former waste incinerator. Because of the Disposal Site's location beneath the Mechanical Room and the structural support the Mechanical Room provides to the B Block, this alternative would be implemented only if and when the school building is being demolished.

In addition to excavation of PCB-impacted soil, Alternative No. 3A includes importation of clean backfill, restoration of the Disposal Site consistent with the area of the larger site, and implementation of an AUL. The building would no longer be present, and future use of the Site consistent with limitations in the AUL would be allowed once remediation is complete. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

3.3.3.1 Permit Requirements

Work associated with this remedial alternative would occur in an approximately 0.11-acre area entirely within the previously developed New Bedford High School property and within the footprint of the school building. As a consequence, although stormwater discharges from demolition activities on the property would need to be permitted under a National Pollutant Discharge Elimination System (NPDES) permit through EPA's General Permit for Stormwater Discharges from Construction Activities, remedial activities for the Mechanical Room would not themselves trigger such a permit requirement. It is assumed that in order to comply with the NPDES regulations a Stormwater Pollution Prevention Plan (SWPPP) would be prepared for the larger demolition on the property prior to submitting a Notice of Intent (NOI), which would be filed at least 14 days prior to initiation of activities, pursuant to requirements.

In addition, it does not appear that demolition of the school building would require work in a wetland or wetland buffer. Because work associated with this remedial alternative would occur entirely within the former building footprint, no remedial activities would occur within a wetland area or within the 100-foot buffer zone of a wetland, and no wetland area would be filled or dredged. As a consequence, the remedial work will not fall under the jurisdiction of the United States Army Corps of Engineers (USACOE) or be subject to review by the New Bedford Conservation Commission.

Therefore, the work is not anticipated to require any permits beyond those required by the City of New Bedford. A discharge permit would need to be obtained from the City's Department of Public Infrastructure (DPI) to discharge treated groundwater to the municipal sewer system. Groundwater characteristics would be evaluated prior to initiation of remediation and an appropriate treatment train designed based on that information, if required.

The New Bedford High School building and property at present are managed by New Bedford Public Schools. Access to the school building and site would be controlled by and subject to approval from the New Bedford School Committee or other agency, as assigned. As remediation described here is premised upon being generally coincident with demolition of the building, the timing of activities would need to be coordinated with the demolition contractor to maintain safety of Site personnel and to promote efficiency of the operations.

3.3.3.2 Site Preparation

The Disposal Site consists of an approximately 4,700 square-foot area situated on the ground floor of the NBHS building and located primarily in the Mechanical Room, but also extending into the adjacent Cafeteria Storage Room, and rooms used for storage and building maintenance purposes.

As the larger school demolition proceeds, the concrete slab over the Disposal Site would be left intact, along with an apron extending outward from the identified Disposal Site boundary up to about 50 feet to help maintain sidewall stability of the remedial excavations and prevent potential vehicle contact with PCB impacted soil.

Initial site preparation would include the installation of fencing around the Disposal Site and concrete apron, installation of erosion controls, and installation of signage segregating the remedial excavation from the school demolition activities. Temporary barriers would be utilized as needed to segregate traffic flow for the remedial activities from the general demolition. A temporary storage trailer for hand tools, portable toilet facilities, and a dumpster for construction materials waste may be staged at a location to be identified by the liaison designated by the New Bedford Public Schools.

3.3.3.3 Soil Removal

1. Removal of Concrete for Site Preparation

Portions of the concrete floor requiring removal to expose the impacted soils and to allow installation of the shoring system would be marked for saw cutting. The concrete slab would be wet-sawed using a floor saw, broken up, and removed to provide access to the underlying soil. It is anticipated that after confirmation testing, the waste concrete would be consolidated with other concrete from building demolition and disposed of off-site as demolition debris. PCB concentrations in soil immediately beneath the slab are less than 1 mg/kg and the concrete is not anticipated to be impacted by PCBs.

2. Soil Excavation for Site Preparation

Exposed soil would be staked to indicate areas requiring different handling methods. Soil with PCB concentrations greater than the UCL are present starting at a depth of four (4) feet below the top of the concrete slab. Soils with PCB concentrations less than the UCL from above the targeted areas would be removed and segregated onto plastic sheeting on the concrete apron as space permits, or on adjacent soil, for subsequent reuse on-Site or disposal off-site.

3. Targeted Soil Excavation

Soil at depths of 4 feet to 12 feet within the Mechanical Room exhibits PCB concentrations greater than the UCL in the targeted areas, as delineated previously by survey based on the soil sample locations (Figure 2A) and as described in Section 2.5. Soil would be excavated in the areas indicated on figures 16A through 16F, to the depths necessary to remove soil with PCB concentrations above the UCL. Excavated soil would be stockpiled on poly or HDPE sheeting to drain by gravity prior to loading into trucks for transport off-site to the disposal facility.

Geophysical investigations were conducted during June 2018 to identify locations of utilities and footers (see Section 2.4.1), which are shown of Figure 2B. Information about utility and footer locations and depths would be used to select the appropriate excavation method or excavator specifications for the area and depth interval. It is anticipated that lengths of utilities beyond the

UCL soil footprint will be exposed and removed during remedial activities so that removal of utilities as part of the building demolition will not have to re-excavate recently backfilled soil.

Following excavation of soil adjacent to concrete footers in the target soil areas, the footers will be removed to facilitate excavation of underlying target soils. The footers themselves will be broken up for disposal. Although it is likely that the concrete will be a bulk PCB remediation waste with a concentration of less than 50 ppm based on the depth of footers relative to the depth of highly-impacted soils, the material will be characterized prior to disposal.

The estimated total volume of soil that would be excavated and disposed of off-site under Alternative No. 3A is approximately 350 cubic yards. The estimated total volume of concrete that would be disposed of off-site is approximately 180 cubic yards.

4. Shoring and De-Watering

Shoring would be employed during excavation, as necessary, to maintain the integrity of the excavation until it is backfilled. Interlocking or overlapping steel sheet piles will be driven to below the anticipated depth of excavation around the excavation perimeter using an excavator-mounted vibratory piling unit. A hydraulic or mechanical bracing system would be connected within the sheet pile to reduce potential deflection of the sheet piles and to create a steel box within which excavation can be conducted safely.

Groundwater typically has been encountered from between one and four feet below the top of the concrete slab. Dewatering will be used in conjunction with shoring to reduce the potential for sloughing of sidewalls into the excavation. Dewatering is anticipated to be implemented through installation of a series of well points outside the perimeter of the shoring and connected through a header system. The system would discharge extracted groundwater to a fractionation (frac) tank from which it would be pumped to a temporary groundwater treatment system and, once treated, discharged to the municipal sewer system.

5. Backfilling

The space from which soil had been excavated above the UCL would be backfilled with clean granular fill. Shoring would be removed as the fill is emplaced and compacted. Because utilities will have been previously removed, no separate fill or special precautions will be required around former utility locations. Soil will be placed and compacted in lifts not exceeding one foot, unless other requirements are specified to be consistent with the larger demolition. Soil from between 0 and 4 feet in the excavation with PCB concentrations less than 1 mg/kg may be used for backfill to a depth no shallower than three feet, above which clean backfill that has been characterized by analytical testing will be emplaced.

3.3.3.4 Soil Stabilization Treatment

Although concentrations of lead observed in soil samples collected at the property suggest that soil will not need to be stabilized prior to disposal, disposal characterization soil samples would be collected and analyzed by the TCLP method prior to off-site disposal in accordance with the receiving facilities requirements. Soils exhibiting concentrations greater than 20 times the regulatory limit listed in 310 CMR 30.125 Table 3-1 would be analyzed by the TCLP method. Treatment of the soils may be appropriate prior to off-site disposal based upon the TCLP results and would consist of manually mixing the soil with a stabilizing agent using an excavator or similar means. Certain waste receiving facilities can perform this treatment at their facilities. Other requirements may apply depending upon available off-site facilities and associated facility acceptance processes.

3.3.3.5 Environmental Monitoring

The concrete apron being left in place around the excavation and the presence of shallow groundwater make it unlikely that nuisance dust conditions would arise. However, dust monitoring will be performed to ensure that dust from demolition activities are not exceeding the appropriate dust level standard. If necessary, dust suppression consisting of water sprays will be implemented. . Although VOC concentrations above OSHA action levels are not anticipated, a photoionization detector (PID) would be utilized as a precaution to monitor VOC concentrations during remedy implementation.

Groundwater monitoring would be conducted semi-annually for one year following completion of the remedy to confirm that groundwater PCB and VOC concentrations have decreased to acceptable levels following removal of PCB source mass and associated collocated VOCs.

3.3.3.6 Implementation of an AUL

An AUL would be required because soil with PCB concentrations between the UCL and the MCP S-1 standard will remain onsite at depths less than 15 feet. Because the AUL associated with this remedial alternative would be implemented at an undetermined future date, the details are not known at this time. The AUL's purpose may be to restrict exposure to Site soil and groundwater, to restrict future land uses, or to specify the nature and amount of future monitoring if the groundwater data indicates that monitoring is warranted..

3.3.3.7 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have good effectiveness per 310 CMR 40.0858(1) because:

1. It would result in a Permanent Solution under the MCP and support beneficial property reuse;
2. Soil impacts in select areas of the Disposal Site would be removed; and
3. Overall chemical concentrations at the property would be greatly reduced.

A high degree of certainty exists that this alternative would be successful at limiting exposures to chemicals in soil. Soil with PCB concentrations greater than the UCL would be removed and disposed of off-site. Consequently, the potential for future risk associated with exposure to these soils would be eliminated, and the potential for risk associated with indoor air concentrations would be reduced or eliminated if a new building were to be erected over the Disposal Site.

This alternative would be moderately difficult to implement. Much higher implementation risk is associated with this alternative than with Alternative No. 2, because of the volume of soil that would be excavated for off-site disposal with this alternative. Lower implementation risk is associated with this alternative than with alternatives No. 3B, which entails use of an amended backfill. Lower implementation risk is associated with this alternative than with alternatives No. 4A through 5B, given the lower volume of soil excavated for off-site disposal with this alternative, and the lower likelihood that some of the soil would have to be transported large distances to properly licensed out-of-state landfills or incineration facilities.

Monitoring would be conducted during remedy implementation to mitigate potential risks during implementation due to chemical migration (dust, erosion, vehicles, etc.). During non-working hours, a security fence would prevent unauthorized access to exposed soils in open excavation areas. Upon completion of the remedial alternative, low risk would be associated with remaining impacted soil, due to the property use and the restrictions imposed by the AUL. Future risks related to construction work also could be mitigated by adherence to a Soil Management Plan and Health and Safety Plan.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly higher with this remedial alternative than with Alternative 2, since a volume of impacted soil would be excavated and transported off-site for disposal and replaced with backfill transported to the property. Consumption of resources would be lower than with alternatives 4A through 5B because of the lower volume of soil. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be higher than with Alternative 2, given the excavation that would be conducted, but lower than with alternatives 3B through 5B because of the smaller volume of soil that would be excavated and the smaller amount of remedial waste that would be transported off-site for disposal under this alternative.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not degraded by this alternative.

This alternative provides the benefit of achieving a Permanent Solution and providing for unrestricted use once remediation is complete. The estimated cost of this alternative is approximately $780,000. Annual monitoring costs would be approximately $15,000 per year following site closure. This alternative would likely take two months to implement, permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.4 *Alternative No.3B – Targeted Excavation/Disposal of Soil with PCB Concentrations greater than the Upper Concentration Limit (100 mg/kg), Installation of Amended Backfill that includes an Adsorption Agent and Reactive Agent, and Institutional Controls*

Alternative No. 3B consists of targeted excavation and off-site disposal of soils from those areas beneath the Site where the soils exceed the UCL (PCB concentrations greater than 100 mg/kg). It differs from Alternative No. 3B in that it includes backfilling with an amended backfill in addition to clean backfill to reduce the potential for groundwater contamination associated with residual PCB soil concentrations between 1 mg/kg and the UCL.

The Mechanical Room is located at ground level in the center of the B Block, the hexagonal core of the school (see Figure 1), where several shared services are administered and from which classroom wings emanate. As described for Alternative 3A, because of the Disposal Site's location beneath the Mechanical Room and the structural support the Mechanical Room provides to the B Block, this alternative would be implemented only if and when the school building is being demolished.

In addition to excavation of PCB-impacted soil, importation and amendment of clean backfill, Alternative No. 3B includes restoration of the Disposal Site consistent with the area of the larger site, and implementation of an AUL. The building would no longer be present, and future use of the Site consistent with limitations in the AUL would be allowed once remediation is complete. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information.

3.3.4.1 Permit Requirements

Work associated with this remedial alternative would occur in an approximately 0.11-acre area entirely within the previously developed New Bedford High School property and within the footprint of the school building. As a consequence, although stormwater discharges from demolition activities on the property would need to be permitted under a NPDES permit through EPA's General Permit for Stormwater Discharges from Construction Activities, remedial activities for the Mechanical Room would not themselves trigger such a permit requirement. It is assumed that in order to comply with the NPDES regulations a SWPPP would be prepared for the larger demolition on the property and would be filed pursuant to requirements.

In addition, it does not appear that demolition of the school building would require work in a wetland or wetland buffer. Because work associated with this remedial alternative would occur entirely within the former building footprint, no remedial activities would occur within a wetland area or within the 100-foot buffer zone of a wetland, and no wetland area would be filled or dredged. As a consequence, the remedial work will not fall under the jurisdiction of the USACOE or be subject to review by the New Bedford Conservation Commission.

Therefore, the work is not anticipated to require any permits beyond those required by the City of New Bedford. A discharge permit would need to be obtained from the City's DPI to discharge treated groundwater to the municipal sewer system. Groundwater characteristics would be evaluated prior to initiation of remediation and an appropriate treatment train designed based on that information, if necessary.

The New Bedford High School building and property at present are managed by New Bedford Public Schools. Access to the school building and site would be controlled by and subject to approval from the New Bedford School Committee or other agency, as assigned. As remediation described here is premised upon being generally coincident with demolition of the building, the timing of activities would need to be coordinated with the demolition contractor to maintain safety of Site personnel and to promote efficiency of the operations.

3.3.4.2 Site Preparation

The Disposal Site consists of an approximately 4,700 square-foot area situated on the ground floor of the NBHS building and located primarily in the Mechanical Room, but also extending into the adjacent Cafeteria Storage Room, and rooms used for storage and building maintenance purposes. As the larger school demolition proceeds, the concrete slab over the Disposal Site would be left intact, along with an apron extending outward from the identified Disposal Site boundary up to about 50 feet to help maintain sidewall stability of the remedial excavations and prevent potential vehicle contact with PCB impacted soil.

Initial site preparation would include the installation of fencing around the Disposal Site and concrete apron, installation of erosion controls, and installation of signage segregating the remedial excavation from the school demolition activities. Temporary barriers would be utilized as needed to segregate traffic flow for the remedial activities from the general demolition. A temporary storage trailer for hand tools, portable toilet facilities, and a dumpster for construction materials waste may be staged at a location to be identified by the liaison designated by the New Bedford Public Schools.

3.3.4.3 Soil Removal

1. Removal of Concrete for Site Preparation

Portions of the concrete floor requiring removal to expose the impacted soils and to allow installation of the shoring system would be marked for saw cutting. The concrete slab would be wet-sawed using a floor saw, broken up, and removed to provide access to the underlying soil. It is anticipated that after testing, the waste concrete would be consolidated with other concrete from building demolition and disposed of off-site as demolition debris. PCB concentrations in soil immediately beneath the slab are less than 1 mg/kg and the concrete is not anticipated to be impacted by PCBs.

2. Soil Excavation for Site Preparation

Exposed soil would be staked to indicate areas requiring different handling methods. Soil with PCB concentrations greater than the UCL are present starting at a depth of four (4) feet below the top of the concrete slab. Soils with PCB concentrations less than the UCL from above the targeted areas would be removed and segregated onto plastic sheeting on the concrete apron as space permits, or on adjacent soil, for subsequent reuse on-Site or disposal off-site.

3. Targeted Soil Excavation

Soil at depths of 4 feet to 12 feet within the Mechanical Room exhibits PCB concentrations greater than the UCL in the targeted areas, as delineated previously by survey based on the soil sample locations (Figure 2A) and as described in Section 2.5. Soil would be excavated in the areas indicated on figures 16A through 16F, to the depths necessary to remove soil with PCB concentrations above the UCL, and the soil will be disposed of off-site.

Geophysical investigations were conducted during June 2018 to identify locations of utilities and footers (see Section 2.4.1), which are shown of Figure 2B. Information about utility and footer locations and depths would be used to select the appropriate excavation method or excavator specifications for the area and depth interval. It is anticipated that lengths of utilities beyond the soil with PCB concentrations above the UCL footprint will be exposed and removed during remedial activities so that removal of utilities as part of the building demolition will not have to re-excavate recently backfilled soil.

Following excavation of soil adjacent to concrete footers in the target soil areas, the footers will be removed to facilitate excavation of underlying target soils. The footers themselves will be broken up for disposal. Although it is likely that the concrete will be a bulk PCB remediation waste with a concentration of less than 50 ppm based on the depth of footers relative to the depth of highly-impacted soils, the material will be characterized prior to disposal.

The estimated total volume of soil that would be excavated and disposed of off-site under Alternative No. 3B is approximately 575 cubic yards. The estimated total volume of concrete that would be disposed of off-site is approximately 180 cubic yards.

4. Shoring and De-Watering

Shoring would be employed during excavation, as necessary, to maintain the integrity of the excavation until it is backfilled. Interlocking or overlapping steel sheet piles will be driven to below the anticipated depth of excavation around the excavation perimeter using an excavator-mounted vibratory piling unit. A hydraulic or mechanical bracing system would be connected within the sheet pile to reduce potential deflection of the sheet piles and to create a steel box within which excavation can be conducted safely.

Groundwater typically has been encountered from between one and four feet below the top of the concrete slab. Dewatering will be used in conjunction with shoring to reduce the potential for sloughing of sidewalls into the excavation. Dewatering is anticipated to be implemented through installation of a series of well points outside the perimeter of the shoring and connected through a header system. Extracted groundwater would be pumped to a temporary groundwater treatment system and, once treated, discharged to the municipal sewer system.

5. Backfilling

The space from which soil had been excavated above the UCL would be backfilled with amended granular fill to reduce the potential for groundwater contamination associated with residual PCB soil concentrations between 1 mg/kg and the UCL. Three amendments were identified for evaluation of their potential effectiveness to reduce VOC and PCB groundwater concentrations after emplacement, as follows:

- Zero Valent Iron (ZVI) (nano-scale ZVI from single supplier) - ZVIs have been shown to be effective in breaking down a range of chlorinated organic compounds in aqueous solution, including chlorinated methanes, ethanes, benzenes, and potentially, PCBs, principally by abiotic means, with zero-valent iron serving as the bulk reducing agent.
- Trap & Treat ® - Trap & Treat is a proprietary product developed for the purpose of degrading chlorinated solvents. The product consists of activated carbon that adsorbs organic contaminants, which then react chemically with the impregnated metallic iron to degrade.
- Granular Activated Carbon - Activated carbon is a material with high porosity and large surface area that is used commonly in drinking water treatment to adsorb both natural and synthetic organic chemicals.

Prior to the beginning of remedial activities, bench-scale testing of these soil amendments to reduce VOC and PCB groundwater concentrations would be conducted using soil and groundwater from the Disposal Site. Based on the results of the bench-scale testing one amendment would be selected for use in the backfill material.

Clean backfill that has been characterized by analytical testing will be brought to the site to create the amended soil. Clean backfill will be placed in a truck to which the selected amendment will be added. The amendment will be mixed with the clean backfill using an excavator and will be emplaced into the excavation. Shoring would be removed as the fill is emplaced and compacted. Because utilities will have been removed prior to excavation, no separate fill or special precautions will be required around former utility locations. Soil will be placed and compacted in lifts not exceeding one foot, unless other requirements are specified to be consistent with the larger demolition. Soil from between 0 and 4 feet in the excavation with PCB concentrations less than 1 mg/kg may be used for backfill to a depth no shallower than three feet, above which clean backfill will be emplaced.

3.3.4.4 Soil Stabilization Treatment

Although concentrations of lead observed in soil samples collected at the property suggest that soil will not need to be stabilized prior to disposal, disposal characterization soil samples would be collected and analyzed by the TCLP method prior to off-site disposal in accordance with the receiving facilities requirements. Soils exhibiting concentrations greater than 20 times the regulatory limit listed in 310 CMR 30.125 Table 3-1 would be analyzed by the TCLP method. Treatment of the soils may be appropriate prior to off-site disposal based upon the TCLP results and would consist of manually mixing the soil with a stabilizing agent using an excavator or similar means. Certain waste receiving facilities can perform this treatment at their facilities. Other requirements may apply depending upon available off-site facilities and associated facility acceptance processes.

3.3.4.5 Environmental Monitoring

The concrete apron being left in place around the excavation and the presence of shallow groundwater make it unlikely that nuisance dust conditions would arise. However, dust monitoring will be performed to ensure that dust from demolition activities are not exceeding the appropriate dust level standard. If necessary, dust suppression consisting of water sprays will be implemented.. Although VOC concentrations above OSHA action levels are not anticipated, a PID would be utilized as a precaution to monitor VOC concentrations during remedy implementation.

Groundwater monitoring would be conducted semi-annually for one year following completion of the remedy to confirm that groundwater PCB and VOC concentrations have decreased to acceptable levels following removal of PCB source mass and associated collocated VOCs.

3.3.4.6 Implementation of an AUL

An AUL would be required because soil with PCB concentrations between the UCL and the MCP S-1 standard will remain onsite at depths less than 15 feet. Because the AUL associated with this remedial alternative would be implemented at an undetermined future date, the details are not known at this time. The AUL's purpose may be to restrict exposure to Site soil and groundwater, to restrict future land uses, or to specify the nature and amount of future monitoring if the groundwater data indicates that monitoring is warranted

3.3.4.7 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have good effectiveness per 310 CMR 40.0858(1) because:

1. It would result in a Permanent Solution under the MCP and support beneficial property reuse;
2. Soil impacts in select areas of the Disposal Site would be removed;
3. Amended backfill may decrease future groundwater VOC concentrations; and
4. Overall chemical concentrations at the property would be greatly reduced.

A high degree of certainty exists that this alternative would be successful at limiting exposures to chemicals in soil. Soil with PCB concentrations greater than the UCL would be removed and disposed of off-site. Consequently, the potential for future risk associated with exposure to these soils would be eliminated, and the potential for risk associated with indoor air concentrations would be reduced or eliminated if a new building were to be erected over the Disposal Site.

This alternative would be moderately difficult to implement. Much higher implementation risk is associated with this alternative than with Alternative No. 2, because of the volume of soil that would be excavated for off-site disposal with this alternative. Higher implementation risk is associated with this alternative than with Alternative No. 3A, which does not entail use of an amended backfill. Lower implementation risk is associated with this alternative than with alternatives No. 4A through 5B, given the lower volume of soil excavated for off-site disposal with this alternative, and the lower likelihood that some of the soil would have to be transported large distances to properly licensed out-of-state landfills or incineration facilities.

Monitoring would be conducted during remedy implementation to mitigate potential risks during implementation due to chemical migration (dust, erosion, vehicles, etc.). During non-working hours, a security fence would prevent unauthorized access to potentially exposed soils in open excavation areas. Upon completion of the remedial alternative, low risk would be associated with remaining impacted soil, due to the property use and the restrictions imposed by the AUL. Future risks related to construction work also could be mitigated by adherence to a Soil Management Plan and Health and Safety Plan.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly higher with this remedial alternative than with Alternative 2, since a volume of impacted soil would be excavated and transported off-site for disposal and replaced with backfill transported to the property, and with Alternative 3A because of the equipment and fuel required to amend the backfill.. Consumption of resources would be lower than with alternatives 4A through 5B because of the lower volume of soil. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be higher than with Alternative 2, given the excavation that would be conducted, but lower than with alternatives 4A through 5B because of the smaller volume of soil that would be excavated and the smaller amount of remedial waste that would be transported off-site for disposal under this alternative.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not degraded by this alternative.

This alternative provides the benefit of achieving a Permanent Solution and providing for unrestricted use once remediation is complete. The estimated cost of this alternative is approximately $995,000. Annual monitoring costs would be approximately $15,000 per year following site closure. This alternative would likely take two months to implement, permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.5 *Alternative No.4A – Targeted Excavation/Disposal of Soil with PCB Concentrations greater than the Soil S-2/S-3 Standard (4 mg/kg), Installation of Clean Backfill, and Institutional Controls*

Alternative 4A is similar to Alternative 3A, but with a more restrictive soil criterion. Alternative No. 4A consists of targeted excavation and off-site disposal of soils from those areas beneath the Site where the soils exceed the soil S-2/S-3 standard (PCB concentrations greater than 4 mg/kg). It includes importation of clean backfill, restoration of the concrete floor to pre-remediation conditions, and implementation of an AUL. Future use of the building is anticipated to remain as a public school, but be unrestricted once remediation is complete. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information

3.3.5.1 Permit Requirements

Work associated with this remedial alternative would occur in an approximately 0.11-acre area entirely within the previously developed New Bedford High School property and within the footprint of the school building. As a consequence, although stormwater discharges from demolition activities on the property would need to be permitted under a NPDES permit through EPA's General Permit for Stormwater Discharges from Construction Activities, remedial activities for the Mechanical Room would not themselves trigger such a permit requirement. It is assumed that in order to comply with the NPDES regulations a SWPPP would be prepared for the larger demolition on the property and would be filed pursuant to requirements.

In addition, it does not appear that demolition of the school building would require work in a wetland or wetland buffer. Because work associated with this remedial alternative would occur entirely within the former building footprint, no remedial activities would occur within a wetland area or within the 100-foot buffer zone of a wetland, and no wetland area would be filled or dredged. As a consequence, the remedial work will not fall under the jurisdiction of the USACOE or be subject to review by the New Bedford Conservation Commission.

Therefore, the work is not anticipated to require any permits beyond those required by the City of New Bedford. A discharge permit would need to be obtained from the City's DPI to discharge treated groundwater to the municipal sewer system. Groundwater characteristics would be evaluated prior to initiation of remediation and an appropriate treatment train designed based on that information, if required.

The New Bedford High School building and property at present are managed by New Bedford Public Schools. Access to the school building and site would be controlled by and subject to approval from the New Bedford School Committee or other agency, as assigned. As remediation described here is premised upon being generally coincident with demolition of the building, the timing of activities would need to be coordinated with the demolition contractor to maintain safety of Site personnel and to promote efficiency of the operations.

3.3.5.2 Site Preparation

The Disposal Site consists of an approximately 4,700 square-foot area situated on the ground floor of the NBHS building and located primarily in the Mechanical Room, but also extending into the adjacent Cafeteria Storage Room, and rooms used for storage and building maintenance purposes. As the larger school demolition proceeds, the concrete slab over the Disposal Site would be left intact, along with an apron extending outward from the identified Disposal Site boundary up to about 50 feet to help maintain sidewall stability of the remedial excavations and prevent potential vehicle contact with PCB impacted soil.

Initial site preparation would include the installation of fencing around the Disposal Site and concrete apron, installation of erosion controls, and installation of signage segregating the remedial excavation from the school demolition activities. Temporary barriers would be utilized as needed to segregate traffic flow for the remedial activities from the general demolition. A temporary storage trailer for hand tools, portable toilet facilities, and a dumpster for construction materials waste may be staged at a location to be identified by the liaison designated by the New Bedford Public Schools.

3.3.5.3 Soil Removal

1. Removal of Concrete for Site Preparation

Portions of the concrete floor requiring removal to expose the impacted soils and to allow installation of the shoring system would be marked for saw cutting. The concrete slab would be wet-sawed using a floor saw, broken up, and removed to provide access to the underlying soil. It is anticipated that after confirmation testing, the waste concrete would be consolidated with other concrete from building demolition and disposed of off-site as demolition debris. PCB concentrations in soil immediately beneath the slab are less than 1 mg/kg and the concrete is not anticipated to be impacted by PCBs.

2. Soil Excavation for Site Preparation

Exposed soil would be staked to indicate areas requiring different handling methods. Soil with PCB concentrations greater than the S-2/S-3 standard are present starting at a depth of two (2) feet below the top of the concrete slab. Soils with PCB concentrations less than the S-2/S-3 standard from above the targeted areas would be removed and segregated onto plastic sheeting on the concrete apron as space permits, or on adjacent soil, for subsequent reuse on-Site or disposal off-site.

3. Targeted Soil Excavation

Soil at depths of two feet to 12 feet within the Mechanical Room exhibits PCB concentrations greater than the S-2/S-3 standard in the targeted areas, as delineated previously by survey based on the soil sample locations (Figure 2A) and as described in Section 2.5. Soil would be excavated in the areas indicated on figures 16A through 16G, to the depths necessary to remove soil above the S-2/S-3 standard, and the soil disposed of off-site.

Geophysical investigations were conducted during June 2018 to identify locations of utilities and footers (see Section 2.4.1), which are shown of Figure 2B. Information about utility and footer locations and depths would be used to select the appropriate excavation method or excavator specifications for the area and depth interval. It is anticipated that lengths of utilities beyond the S-2/S-3 soil footprint will be exposed and removed during remedial activities so that removal of utilities as part of the building demolition will not have to re-excavate recently backfilled soil.

Following excavation of soil adjacent to concrete footers in the target soil areas, the footers will be removed to facilitate excavation of underlying target soils. The footers themselves will be broken up for disposal. Although it is likely that the concrete will be a bulk PCB remediation waste with a concentration of less than 50 ppm based on the depth of footers relative to the depth of highly-impacted soils, the material will be characterized prior to disposal.

The estimated total volume of soil that would be excavated and disposed of off-site under Alternative No. 4A is approximately 630 cubic yards. The estimated total volume of concrete that would be disposed of off-site is approximately 180 cubic yards.

4. Shoring and De-Watering

Shoring would be employed during excavation, as necessary, to maintain the integrity of the excavation until it is backfilled. Interlocking or overlapping steel sheet piles will be driven to below the anticipated depth of excavation around the excavation perimeter using an excavator-mounted vibratory piling unit. A hydraulic or mechanical bracing system would be connected within the sheet pile to reduce potential deflection of the sheet piles and to create a steel box within which excavation can be conducted safely.

Groundwater typically has been encountered from between one and four feet below the top of the concrete slab. Dewatering will be used in conjunction with shoring to reduce the potential for sloughing of sidewalls into the excavation. Dewatering is anticipated to be implemented through installation of a series of well points outside the perimeter of the shoring and connected through a header system. Extracted groundwater would be pumped to a temporary groundwater treatment system and, once treated, discharged to the municipal sewer system.

5. Backfilling

The space from which soil had been excavated above the S-2/S-3 standard would be backfilled with clean granular fill. Shoring would be removed as the fill is emplaced and compacted. Because utilities will have been previously removed, no separate fill or special precautions will be required around former utility locations. Soil will be placed and compacted in lifts not exceeding one foot, unless other requirements are specified to be consistent with the larger demolition. Soil from between 0 and 4 feet in the excavation with PCB concentrations less than 1 mg/kg may be used for backfill to a depth no shallower than three feet, above which clean backfill that has been characterized by analytical testing will be emplaced.

3.3.5.4 Soil Stabilization Treatment

Although concentrations of lead observed in soil samples collected at the property suggest that soil will not need to be stabilized prior to disposal, disposal characterization soil samples would be collected and analyzed by the TCLP method prior to off-site disposal in accordance with the receiving facilities requirements. Soils exhibiting concentrations greater than 20 times the regulatory limit listed in 310 CMR 30.125 Table 3-1 would be analyzed by the TCLP method. Treatment of the soils may be appropriate prior to off-site disposal based upon the TCLP results and would consist of manually mixing the soil with a stabilizing agent using an excavator or similar means. Certain waste receiving facilities can perform this treatment at their facilities. Other requirements may apply depending upon available off-site facilities and associated facility acceptance processes.

3.3.5.5 Environmental Monitoring

The concrete apron being left in place around the excavation and the presence of shallow groundwater make it unlikely that nuisance dust conditions would arise. However, dust monitoring will be performed to ensure that dust from demolition activities are not exceeding the appropriate dust level standard. If necessary, dust suppression consisting of water sprays will be implemented. Although VOC concentrations above OSHA action levels are not anticipated, a PID would be utilized as a precaution to monitor VOC concentrations during remedy implementation.

Groundwater monitoring would be conducted semi-annually for one year following completion of the remedy to confirm that groundwater PCB and VOC concentrations have decreased to acceptable levels following removal of PCB source mass and associated collocated VOCs.

3.3.5.6 Implementation of an AUL

An AUL would be required because soil with PCB concentrations between the MCP S-2/S-3 standard and the MCP S-1 standard will remain onsite at depths less than 15 feet. Because the AUL associated with this remedial alternative would be implemented at an undetermined future date, the details are not known at this time. The AUL's purpose may be to restrict exposure to Site soil and groundwater, to restrict future land uses, or to specify the nature and amount of future monitoring if the groundwater data indicates that monitoring is warranted..

3.3.5.7 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have good effectiveness per 310 CMR 40.0858(1) because:

1. It would result in a Permanent Solution under the MCP and support beneficial property reuse;
2. Soil impacts in select areas of the Disposal Site would be removed; and
3. Overall chemical concentrations at the property would be greatly reduced.

A high degree of certainty exists that this alternative would be successful at limiting exposures to chemicals in soil. Soil with PCB concentrations greater than the S-2/S-3 standard would be removed and disposed of off-site. Consequently, the potential for future risk associated with exposure to these soils would be eliminated, and the potential for risk associated with indoor air concentrations would be reduced or eliminated if a new building were to be erected over the Disposal Site.

This alternative would be difficult to implement. Much higher implementation risk is associated with this alternative than with Alternative No. 2, and a higher implementation risk is associated with this alternative than with Alternative No. 3A because of the volume of soil that would be excavated for off-site disposal with this alternative. Lower implementation risk is associated with this alternative than with alternatives No. 3B, 4B, and 5B, all of which entail use of an amended backfill. Lower implementation risk is associated with this alternative than with alternatives No. 5A and 5B, given the lower volume of soil excavated for off-site disposal with this alternative, and the lower likelihood that some of the soil would have to be transported large distances to properly licensed out-of-state landfills or incineration facilities.

Monitoring would be conducted during remedy implementation to mitigate potential risks during implementation due to chemical migration (dust, erosion, vehicles, etc.). During non-working hours, a security fence would prevent unauthorized access to potentially exposed soils in open excavation areas. Upon completion of the remedial alternative, low risk would be associated with remaining impacted soil, due to the property use and the restrictions imposed by the AUL. Future risks related to construction work also could be mitigated by adherence to a Soil Management Plan and Health and Safety Plan.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly higher with this remedial alternative than with Alternative 2, and higher than with Alternative 3A, since the volume of impacted soil that would be excavated and transported off-site for disposal and replaced with backfill transported to the property is larger. Consumption of resources would be similar to Alternative 3B because it does not entail soil amendment, and lower than with alternatives 5A and 5B because of the lower volume of soil. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be higher than with Alternative 2 and Alternative 3A, given the excavation that would be conducted. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would be lower than with Alternative 4B because soil is not amended, and lower than alternatives 5A and 5B because of the smaller volume of soil that would be excavated and the smaller amount of remedial waste that would be transported off-site for disposal under this alternative.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not degraded by this alternative.

This alternative provides the benefit of achieving a Permanent Solution and providing for unrestricted use once remediation is complete. The estimated cost of this alternative is approximately $950,000. Annual monitoring costs would be approximately $15,000 per year following site closure. This alternative would likely take two and a half months to implement permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.6 *Alternative No.4B – Targeted Excavation/Disposal of Soil with PCB Concentrations greater than the Soil S-2/S-3 Standard (4 mg/kg), Installation of Amended Backfill that includes an Adsorption Agent and Reactive Agent, and Institutional Controls*

Alternative No. 4B consists of targeted excavation and off-site disposal of soils from those areas beneath the Site where the soils exceed the S-2/S-3 standard (PCB concentrations greater than 4 mg/kg). It includes importation of clean backfill, amendment of backfill, restoration of the Disposal Site area consistent with the area of the larger site, and implementation of an AUL. Alternative No. 4B differs from Alternative No. 4A in that it includes backfilling with an amended backfill instead of clean fill to reduce the potential for groundwater contamination associated with residual PCB soil concentrations between 1 mg/kg and the S-2/S-3 standard. The building would no longer be present, and future use of the Site consistent with limitations in the AUL would be allowed once remediation is complete. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information

3.3.6.1 Permit Requirements

Work associated with this remedial alternative would occur in an approximately 0.11-acre area entirely within the previously developed NBHS property and within the footprint of the school building. Consequently, although stormwater discharges from demolition activities on the property would need to be permitted under a NPDES permit through EPA's General Permit for Stormwater Discharges from Construction Activities, remedial activities for the Mechanical Room would not themselves trigger such a permit requirement. It is assumed that in order to comply with the NPDES regulations a SWPPP would be prepared for the larger demolition on the property and would be filed pursuant to requirements.

In addition, it does not appear that demolition of the school building would require work in a wetland or wetland buffer. Because work associated with this remedial alternative would occur entirely within the former building footprint, no remedial activities would occur within a wetland area or within the 100-foot buffer zone of a wetland, and no wetland area would be filled or dredged. Therefore, the remedial work will not fall under the jurisdiction of the USACOE or be subject to review by the New Bedford Conservation Commission.

Therefore, the work is not anticipated to require any permits beyond those required by the City of New Bedford. A discharge permit would need to be obtained from the City's DPI to discharge treated groundwater to the municipal sewer system. Groundwater characteristics would be evaluated prior to initiation of remediation and an appropriate treatment train designed based on that information.

The NBHS building and property at present are managed by New Bedford Public Schools. Access to the school building and site would be controlled by and subject to approval from the New Bedford School Committee or other agency, as assigned. As remediation described here is premised upon being generally coincident with demolition of the building, the timing of activities would need to be coordinated with the demolition contractor to maintain safety of Site personnel and to promote efficiency of the operations.

3.3.6.2 Site Preparation

The Disposal Site consists of an approximately 4,700 square-foot area situated on the ground floor of the NBHS building and located primarily in the Mechanical Room, but also extending into the adjacent Cafeteria Storage Room, and rooms used for storage and building maintenance purposes. As the larger school demolition proceeds, the concrete slab over the Disposal Site would be left intact, along with an apron extending outward from the identified Disposal Site boundary up to about 50 feet to help maintain sidewall stability of the remedial excavations and prevent potential vehicle contact with PCB impacted soil.

Initial site preparation would include the installation of fencing around the Disposal Site and concrete apron, installation of erosion controls, and installation of signage segregating the remedial excavation from the school demolition activities. Temporary barriers would be utilized as needed to segregate traffic flow for the remedial activities from the general demolition. A temporary storage trailer for hand tools, portable toilet facilities, and a dumpster for construction materials waste may be staged at a location to be identified by the liaison designated by the New Bedford Public Schools.

3.3.6.3 Soil Removal

1. Removal of Concrete for Site Preparation

Portions of the concrete floor requiring removal to expose the impacted soils and to allow installation of the shoring system would be marked for saw cutting. The concrete slab would be wet-sawed using a floor saw, broken up, and removed to provide access to the underlying soil. It is anticipated that after confirmation testing, the waste concrete would be consolidated with other concrete from building demolition and disposed of off-site as demolition debris. PCB concentrations in soil immediately beneath the slab are less than 1 mg/kg and the concrete is not anticipated to be impacted by PCBs.

2. Soil Excavation for Site Preparation

Exposed soil would be staked to indicate areas requiring different handling methods. Soil with PCB concentrations greater than the S-2/S-3 standard are present starting at a depth of two (2) feet below the top of the concrete slab. Soils with PCB concentrations less than the S-2/S-3 standard from above the targeted areas would be removed and segregated onto plastic sheeting on the concrete apron as space permits, or on adjacent soil, for subsequent reuse on-Site or disposal off-site.

3. Targeted Soil Excavation

Soil at depths of two feet to 12 feet within the Mechanical Room exhibits PCB concentrations greater than the S-2/S-3 standard in the targeted areas, as delineated previously by survey based on the soil sample locations (Figure 2A) and as described in Section 2.5. Soil would be excavated in the areas indicated on figures 16A through 16G, to the depths necessary to remove soil above the S-2/S-3 standard, and the soil disposed of off-site.

Geophysical investigations were conducted during June 2018 to identify locations of utilities and footers (see Section 2.4.1), which are shown of Figure 2B. Information about utility and footer locations and depths would be used to select the appropriate excavation method or excavator specifications for the area and depth interval. It is anticipated that lengths of utilities beyond the S-2/S-3 soil footprint will be exposed and removed during remedial activities so that removal of utilities as part of the building demolition will not have to re-excavate recently backfilled soil.

Following excavation of soil adjacent to concrete footers in the target soil areas, the footers will be removed to facilitate excavation of underlying target soils. The footers themselves will be broken up for disposal. Although it is likely that the concrete will be a bulk PCB remediation waste with a concentration of less than 50 ppm based on the depth of footers relative to the depth of highly-impacted soils, the material will be characterized prior to disposal.

The estimated total volume of soil that would be excavated and disposed of off-site under Alternative No. 4B is approximately 1130 cubic yards. The estimated total volume of concrete that would be disposed of off-site is approximately 180 cubic yards.

4. Shoring and De-Watering

Shoring would be employed during excavation, as necessary, to maintain the integrity of the excavation until it is backfilled. Interlocking or overlapping steel sheet piles will be driven to below the anticipated depth of excavation around the excavation perimeter using an excavator-mounted vibratory piling unit. A hydraulic or mechanical bracing system would be connected within the sheet pile to reduce potential deflection of the sheet piles and to create a steel box within which excavation can be conducted safely.

Groundwater typically has been encountered from between one and four feet below the top of the concrete slab. Dewatering will be used in conjunction with shoring to reduce the potential for sloughing of sidewalls into the excavation. Dewatering is anticipated to be implemented through installation of a series of well points outside the perimeter of the shoring and connected through a header system. Extracted groundwater would be pumped to a temporary groundwater treatment system and, once treated, discharged to the municipal sewer system.

5. Backfilling

The space from which soil had been excavated above the S-2/S-3 standard would be backfilled with amended granular fill to reduce the potential for groundwater contamination associated with residual PCB soil concentrations between 1 mg/kg and 4 mg/kg. Three amendments were identified for evaluation of their potential effectiveness to reduce VOC and PCB groundwater concentrations after emplacement, as follows:

- Zero Valent Iron (ZVI) (nano-scale ZVI from single supplier) - ZVIs have been shown to be effective in breaking down a range of chlorinated organic compounds in aqueous solution, including chlorinated methanes, ethanes, benzenes, and potentially, PCBs, principally by abiotic means, with zero-valent iron serving as the bulk reducing agent.
- Trap & Treat ® - Trap & Treat is a proprietary product developed for the purpose of degrading chlorinated solvents. The product consists of activated carbon that adsorbs organic contaminants, which then react chemically with the impregnated metallic iron to degrade.
- Granular Activated Carbon - Activated carbon is a material with high porosity and large surface area that is used commonly in drinking water treatment to adsorb both natural and synthetic organic chemicals.

Prior to the beginning of remedial activities, bench-scale testing of these soil amendments to reduce VOC and PCB groundwater concentrations would be conducted using soil and groundwater from the Disposal Site. Based on the results of the bench-scale testing one amendment would be selected for use in the backfill material.

Clean backfill that has been characterized by analytical testing will be brought to the site to create the amended soil. Clean backfill will be placed in a truck to which the selected amendment will be added. The amendment will be mixed with the clean backfill using an excavator and will be emplaced into the excavation. Shoring would be removed as the fill is emplaced and compacted. Because utilities will have been removed prior to excavation, no separate fill or special precautions will be required around former utility locations. Soil will be placed and compacted in lifts not exceeding one foot, unless other requirements are specified to be consistent with the larger demolition. Soil from between 0 and 4 feet in the excavation with PCB concentrations less than 1 mg/kg may be used for backfill to a depth no shallower than three feet, above which clean backfill will be emplaced.

3.3.6.4 Soil Stabilization Treatment

Although concentrations of lead observed in soil samples collected at the property suggest that soil will not need to be stabilized prior to disposal, disposal characterization soil samples would be collected and analyzed by the TCLP method prior to off-site disposal in accordance with the receiving facilities requirements. Soils exhibiting concentrations greater than 20 times the regulatory limit listed in 310 CMR 30.125 Table 3-1 would be analyzed by the TCLP method. Treatment of the soils may be appropriate prior to off-site disposal based upon the TCLP results and would consist of manually mixing the soil with a stabilizing agent using an excavator or similar means. Certain waste receiving facilities can perform this treatment at their facilities. Other requirements may apply depending upon available off-site facilities and associated facility acceptance processes.

3.3.6.5 Environmental Monitoring

The concrete apron being left in place around the excavation and the presence of shallow groundwater make it unlikely that nuisance dust conditions would arise. However, dust monitoring will be performed to ensure that dust from demolition activities are not exceeding the appropriate dust level standard. If necessary, dust suppression consisting of water sprays will be implemented.. Although VOC concentrations above OSHA action levels are not anticipated, a PID would be utilized as a precaution to monitor VOC concentrations during remedy implementation.

Groundwater monitoring would be conducted semi-annually for one year following completion of the remedy to confirm that groundwater PCB and VOC concentrations have decreased to acceptable levels following removal of PCB source mass and associated collocated VOCs.

3.3.6.6 Implementation of an AUL

An AUL would be required because soil with PCB concentrations between the UCL and the MCP S-1 standard will remain onsite at depths less than 15 feet. Because the AUL associated with this remedial alternative would be implemented at an undetermined future date, the details are not known at this time. The AUL's purpose may be to restrict exposure to Site soil and groundwater, to restrict future land uses, or to specify the nature and amount of future monitoring if the groundwater data indicates that monitoring is warranted.

3.3.6.7 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have good effectiveness per 310 CMR 40.0858(1) because:

1. It would result in a Permanent Solution under the MCP and support beneficial property reuse;
2. Soil impacts in select areas of the Disposal Site would be removed;
3. Amended backfill may decrease future groundwater VOC concentrations; and
4. Overall chemical concentrations at the property would be greatly reduced.

A high degree of certainty exists that this alternative would be successful at limiting exposures to chemicals in soil. Soil with PCB concentrations greater than the S-2/S-3 standard would be removed and disposed of off-site. Consequently, the potential for future risk associated with exposure to these soils would be eliminated, and the potential for risk associated with indoor air concentrations would be reduced or eliminated if a new building were to be erected over the Disposal Site.

This alternative would be difficult to implement. Much higher implementation risk is associated with this alternative than with Alternative No. 2, because of the volume of soil that would be excavated for off-site disposal with this alternative. Implementation risk associated with this alternative is higher than with Alternative No. 3A and 3B because of the higher volume of soil that would be excavated, and higher than with Alternatives No. 3A and 4A, which do not entail use of an amended backfill. Lower implementation risk is associated with this alternative than with alternatives No. 5A and 5B, given the lower volume of soil excavated for off-site disposal with this alternative, and the lower likelihood that some of the soil would have to be transported large distances to properly licensed out-of-state landfills or incineration facilities.

Monitoring would be conducted during remedy implementation to mitigate potential risks during implementation due to chemical migration (dust, erosion, vehicles, etc.). During non-working hours, a security fence would prevent unauthorized access to potentially exposed soils in open excavation areas. Upon completion of the remedial alternative, low risk would be associated with remaining impacted soil, due to the property use and the restrictions imposed by the AUL. Future risks related to construction work also could be mitigated by adherence to a Soil Management Plan and Health and Safety Plan.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly higher with this remedial alternative than with Alternative 2, and higher than with alternative 3A and 3B, since a larger volume of impacted soil would be excavated and transported off-site for disposal and replaced with backfill transported to the property. Consumption of energy resources would be lower than with alternatives 5A and 5B because of the lower volume of soil. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be higher than with alternatives 2, 3A, and 3B given the excavation that would be conducted. Consumption of resources would be lower than lower than with alternatives 5A and 5B because of the smaller volume of soil that would be excavated and the smaller amount of remedial waste that would be transported off-site for disposal under this alternative.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not degraded by this alternative.

This alternative provides the benefit of achieving a Permanent Solution and providing for unrestricted use once remediation is complete. The estimated cost of this alternative is approximately $1,420,000. Annual monitoring costs would be approximately $15,000 per year following site closure. This alternative would likely take two and a half months to implement, permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.7 *Alternative No.5A – Targeted Excavation/Disposal of Soil with PCB Concentrations greater than the Soil S-1 Standard (1 mg/kg), and Installation of Clean Backfill*

Alternative No. 5A consists of targeted excavation and off-site disposal of soils from those areas beneath the Site where the soils exceed the MCP soil S-1 standard (PCB concentrations greater than 1 mg/kg). It includes importation of clean backfill and restoration of the Disposal Site area consistent with the area of the larger site. The building would no longer be present, and future use of the Site would be unrestricted once remediation is complete. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information

3.3.7.1 Permit Requirements

Work associated with this remedial alternative would occur in an approximately 0.11-acre area entirely within the previously developed New Bedford High School property and within the footprint of the school building. As a consequence, although stormwater discharges from demolition activities on the property would need to be permitted under a NPDES permit through EPA's General Permit for Stormwater Discharges from Construction Activities, remedial activities for the Mechanical Room would not themselves trigger such a permit requirement. It is assumed that in order to comply with the NPDES regulations a SWPPP would be prepared for the larger demolition on the property and would be filed pursuant to requirements.

In addition, it does not appear that demolition of the school building would require work in a wetland or wetland buffer. Because work associated with this remedial alternative would occur entirely within the former building footprint, no remedial activities would occur within a wetland area or within the 100-foot buffer zone of a wetland, and no wetland area would be filled or dredged. As a consequence, the remedial work will not fall under the jurisdiction of the USACOE or be subject to review by the New Bedford Conservation Commission.

Therefore, the work is not anticipated to require any permits beyond those required by the City of New Bedford. A discharge permit would need to be obtained from the City's DPI to discharge treated groundwater to the municipal sewer system. Groundwater characteristics would be evaluated prior to initiation of remediation and an appropriate treatment train designed based on that information, if required.

The New Bedford High School building and property at present are managed by New Bedford Public Schools. Access to the school building and site would be controlled by and subject to approval from the New Bedford School Committee or other agency, as assigned. As remediation described here is premised upon being generally coincident with demolition of the building, the timing of activities would need to be coordinated with the demolition contractor to maintain safety of Site personnel and to promote efficiency of the operations.

3.3.7.2 Site Preparation

The Disposal Site consists of an approximately 4,700 square-foot area situated on the ground floor of the NBHS building and located primarily in the Mechanical Room, but also extending into the adjacent Cafeteria Storage Room, and rooms used for storage and building maintenance purposes. As the larger school demolition proceeds, the concrete slab over the Disposal Site would be left intact, along with an apron extending outward from the identified Disposal Site boundary up to about 50 feet to help maintain sidewall stability of the remedial excavations and prevent potential vehicle contact with PCB impacted soil.

Initial site preparation would include the installation of fencing around the Disposal Site and concrete apron, installation of erosion controls, and installation of signage segregating the remedial excavation from the school demolition activities. Temporary barriers would be utilized as needed to segregate traffic flow for the remedial activities from the general demolition. A temporary storage trailer for hand tools, portable toilet facilities, and a dumpster for construction materials waste may be staged at a location to be identified by the liaison designated by the New Bedford Public Schools.

3.3.7.3 Soil Removal

1. Removal of Concrete for Site Preparation

Portions of the concrete floor requiring removal to expose the impacted soils and to allow installation of the shoring system would be marked for saw cutting. The concrete slab would be wet-sawed using a floor saw, broken up, and removed to provide access to the underlying soil. It is anticipated that after confirmation testing, the waste concrete would be consolidated with other concrete from building demolition and disposed of off-site as demolition debris. PCB concentrations in soil immediately beneath the slab are less than 1 mg/kg in most areas and the concrete is not anticipated to be impacted by PCBs.

2. Soil Excavation for Site Preparation

Exposed soil would be staked to indicate areas requiring different handling methods. Soil with PCB concentrations greater than the soil S-1 standard are present starting immediately below the top of the concrete slab. Soils with PCB concentrations less than the soil S-1 standard from above the targeted areas would be removed and segregated onto plastic sheeting on the concrete apron as space permits, or on adjacent soil, for subsequent disposal off-site.

3. Targeted Soil Excavation

Soil at depths to 12 feet within the Mechanical Room exhibits PCB concentrations greater than the soil S-1 standard in the targeted areas, as delineated previously by survey based on the soil sample locations (Figure 2A) and as described in Section 2.5. Soil would be excavated in the areas indicated on figures 16A through 16G, to the depths necessary to remove soil above the S-1 standard, and the soil disposed of off-site.

Geophysical investigations were conducted during June 2018 to identify locations of utilities and footers (see Section 2.4.1), which are shown of Figure 2B. Information about utility and footer locations and depths would be used to select the appropriate excavation method or excavator specifications for the area and depth interval. It is anticipated that lengths of utilities beyond the S-1 soil footprint will be exposed and removed during remedial activities so that removal of utilities as part of the building demolition will not have to re-excavate recently backfilled soil.

Following excavation of soil adjacent to concrete footers in the target soil areas, the footers will be removed to facilitate excavation of underlying target soils. The footers themselves will be broken up for disposal. Although it is likely that the concrete will be a bulk PCB remediation waste with a concentration of less than 50 ppm based on the depth of footers relative to the depth of highly-impacted soils, the material will be characterized prior to disposal.

The estimated total volume of soil that would be excavated and disposed of off-site under Alternative No. 5A is approximately 1,200 cubic yards. The estimated total volume of concrete that would be disposed of off-site is approximately 180 cubic yards.

4. Shoring and De-Watering

Shoring would be employed during excavation, as necessary, to maintain the integrity of the excavation until it is backfilled. Interlocking or overlapping steel sheet piles will be driven to below the anticipated depth of excavation around the excavation perimeter using an excavator-mounted vibratory piling unit. A hydraulic or mechanical bracing system would be connected within the sheet pile to reduce potential deflection of the sheet piles and to create a steel box within which excavation can be conducted safely.

Groundwater typically has been encountered from between one and four feet below the top of the concrete slab. Dewatering will be used in conjunction with shoring to reduce the potential for sloughing of sidewalls into the excavation. Dewatering is anticipated to be implemented through installation of a series of well points outside the perimeter of the shoring and connected through a header system. Extracted groundwater would be pumped to a temporary groundwater treatment system and, once treated, discharged to the municipal sewer system.

5. Backfilling

The space from which soil had been excavated above the soil S-1 standard would be backfilled with clean granular fill that has been characterized by analytical testing. Shoring would be removed as the fill is emplaced and compacted. Because utilities will have been previously removed, no separate fill or special precautions will be required around former utility locations. Soil will be placed and compacted in lifts not exceeding one foot, unless other requirements are specified to be consistent with the larger demolition. Excavated soil will not be reused as fill in the excavation.

3.3.7.4 Soil Stabilization Treatment

Although concentrations of lead observed in soil samples collected at the property suggest that soil will not need to be stabilized prior to disposal, disposal characterization soil samples would be collected and analyzed by the TCLP method prior to off-site disposal in accordance with the receiving facilities requirements. Soils exhibiting concentrations greater than 20 times the regulatory limit listed in 310 CMR 30.125 Table 3-1 would be analyzed by the TCLP method. Treatment of the soils may be appropriate prior to off-site disposal based upon the TCLP results and would consist of manually mixing the soil with a stabilizing agent using an excavator or similar means. Certain waste receiving facilities can perform this treatment at their facilities. Other requirements may apply depending upon available off-site facilities and associated facility acceptance processes.

3.3.7.5 Environmental Monitoring

The concrete apron being left in place around the excavation and the presence of shallow groundwater make it unlikely that nuisance dust conditions would arise. However, dust monitoring will be performed to ensure that dust from demolition activities are not exceeding the appropriate dust level standard. If necessary, dust suppression consisting of water sprays will be implemented.. Although VOC concentrations above OSHA action levels are not anticipated, a PID would be utilized as a precaution to monitor VOC concentrations during remedy implementation.

3.3.7.6 Implementation of an AUL

Soil with PCB concentrations between the UCL and the MCP S-1 standard will be removed to depths of 15 feet. Consequently, an AUL would not be required.

3.3.7.7 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have good effectiveness per 310 CMR 40.0858(1) because:

1. It would result in a Permanent Solution under the MCP and support beneficial property reuse;
2. Soil impacts in select areas of the Disposal Site would be removed; and
3. Overall chemical concentrations at the property would be greatly reduced.

A high degree of certainty exists that this alternative would be successful at limiting exposures to chemicals in soil. Soil with PCB concentrations greater than the soil S-1 standard would be removed and disposed of off-site. Consequently, the potential for future risk associated with exposure to these soils would be eliminated, and the potential for risk associated with indoor air concentrations would be eliminated if a new building were to be erected over the Disposal Site.

This alternative would be difficult to implement. Much higher implementation risk is associated with this alternative than with Alternative No. 2, and a higher implementation risk is associated with this alternative than with alternatives No. 3A through 4B because of the volume of soil that would be excavated for off-site disposal with this alternative. Lower implementation risk is associated with this alternative than with alternatives No. 3B, 4B and 5B, which entail use of an amended backfill.

Monitoring would be conducted during remedy implementation to mitigate potential risks during implementation due to chemical migration (dust, erosion, vehicles, etc.). During non-working hours, a security fence would prevent unauthorized access to potentially exposed soils in open excavation areas. Upon completion of the remedial alternative, a condition of no significant risk would be achieved at the Site.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly higher with this remedial alternative than with Alternative 2, and higher than with alternatives 3A and 4A, since a volume of impacted soil would be excavated and transported off-site for disposal and replaced with backfill transported to the property. Consumption of energy resources would be lower than with Alternatives 5B which requires fuel for equipment to amend backfill. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be higher than with alternative 2, and 3A through 4B given the excavation that would be conducted, but lower than with Alternative 5B because soil would be amended.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not degraded by this alternative.

This alternative provides the benefit of achieving a Permanent Solution and providing for unrestricted use once remediation is complete. The estimated cost of this alternative is approximately $1,225,000. Annual monitoring costs would be approximately $4,000 per year following site closure. This alternative would likely take three months to implement, permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.8 *Alternative No.5B – Targeted Excavation/Disposal of Soil with PCB Concentrations greater than the Soil S-1 Standard (1 mg/kg), Installation of Amended Backfill that includes an Adsorption Agent and Reactive Agent*

Alternative No. 5B consists of targeted excavation and off-site disposal of soils from those areas beneath the Site where the soils exceed the soil S-1 standard (PCB concentrations greater than 1 mg/kg). It includes importation of clean backfill, amendment of backfill, and restoration of the Disposal Site area consistent with the area of the larger site. Alternative No. 5B differs from Alternative No. 5A in that it includes backfilling with an amended backfill instead of clean fill to reduce the potential for groundwater contamination, if any, associated with soil or groundwater migrating from outside the Site. The building would no longer be present, and future use of the Site would be unrestricted once remediation is complete. This alternative would employ a §761.61(c) approach under TSCA regulations, documentation of which would be provided to the EPA for their information

3.3.8.1 Permit Requirements

Work associated with this remedial alternative would occur in an approximately 0.11-acre area entirely within the previously developed New Bedford High School property and within the footprint of the school building. As a consequence, although stormwater discharges from demolition activities on the property would need to be permitted under a NPDES permit through EPA's General Permit for Stormwater Discharges from Construction Activities, remedial activities for the Mechanical Room would not themselves trigger such a permit requirement. It is assumed that to in order to comply with the NPDES regulations a SWPPP would be prepared for the larger demolition on the property and would be filed pursuant to requirements.

In addition, it does not appear that demolition of the school building would require work in a wetland or wetland buffer. Because work associated with this remedial alternative would occur entirely within the former building footprint, no remedial activities would occur within a wetland area or within the 100-foot buffer zone of a wetland, and no wetland area would be filled or dredged. As a consequence, the remedial work will not fall under the jurisdiction of the USACOE or be subject to review by the New Bedford Conservation Commission.

Therefore, the work is not anticipated to require any permits beyond those required by the City of New Bedford. A discharge permit would need to be obtained from the City's DPI to discharge treated groundwater to the municipal sewer system. Groundwater characteristics would be evaluated prior to initiation of remediation and an appropriate treatment train designed based on that information, if required.

The New Bedford High School building and property at present are managed by New Bedford Public Schools. Access to the school building and site would be controlled by and subject to approval from the New Bedford School Committee or other agency, as assigned. As remediation described here is premised upon being generally coincident with demolition of the building, the timing of activities would need to be coordinated with the demolition contractor to maintain safety of Site personnel and to promote efficiency of the operations.

3.3.8.2 Site Preparation

The Disposal Site consists of an approximately 4,700 square-foot area situated on the ground floor of the NBHS building and located primarily in the Mechanical Room, but also extending into the adjacent Cafeteria Storage Room, and rooms used for storage and building maintenance purposes. As the larger school demolition proceeds, the concrete slab over the Disposal Site would be left intact, along with an apron extending outward from the identified Disposal Site boundary up to about 50 feet to help maintain sidewall stability of the remedial excavations and prevent potential vehicle contact with PCB impacted soil.

Initial site preparation would include the installation of fencing around the Disposal Site and concrete apron, installation of erosion controls, and installation of signage segregating the remedial excavation from the school demolition activities. Temporary barriers would be utilized as needed to segregate traffic flow for the remedial activities from the general demolition. A temporary storage trailer for hand tools, portable toilet facilities, and a dumpster for construction materials waste may be staged at a location to be identified by the liaison designated by the New Bedford Public Schools.

3.3.8.3 Soil Removal

1. Removal of Concrete for Site Preparation

Portions of the concrete floor requiring removal to expose the impacted soils and to allow installation of the shoring system would be marked for saw cutting. The concrete slab would be wet-sawed using a floor saw, broken up, and removed to provide access to the underlying soil. It is anticipated that after confirmation testing, the waste concrete would be consolidated with other concrete from building demolition and disposed of off-site as demolition debris. PCB concentrations in soil immediately beneath the slab are less than 1 mg/kg and the concrete is not anticipated to be impacted by PCBs.

2. Soil Excavation for Site Preparation

Exposed soil would be staked to indicate areas requiring different handling methods. Soil with PCB concentrations greater than the soil S-1 standard are present starting at a depth of four (4) feet below the top of the concrete slab. Soils with PCB concentrations less than the soil S-1 standard from above the targeted areas would be removed and segregated onto plastic sheeting on the concrete apron as space permits, or on adjacent soil, for r disposal off-site.

3. Targeted Soil Excavation

Soil at depths to 12 feet within the Mechanical Room exhibits PCB concentrations greater than the soil S-1 standard in the targeted areas, as delineated previously by survey based on the soil sample locations (Figure 2A) and as described in Section 2.5. Soil would be excavated in the areas indicated on figures 16A through 16G, to the depths necessary to remove soil above the S-1 standard, and the soil disposed of off-site.

Geophysical investigations were conducted during June 2018 to identify locations of utilities and footers (see Section 2.4.1), which are shown of Figure 2B. Information about utility and footer locations and depths would be used to select the appropriate excavation method or excavator specifications for the area and depth interval. It is anticipated that lengths of utilities beyond the S-1 soil footprint will be exposed and removed during remedial activities so that removal of utilities as part of the building demolition will not have to re-excavate recently backfilled soil.

Following excavation of soil adjacent to concrete footers in the target soil areas, the footers will be removed to facilitate excavation of underlying target soils. The footers themselves will be broken up for disposal. Although it is likely that the concrete will be a bulk PCB remediation waste with a concentration of less than 50 ppm based on the depth of footers relative to the depth of highly-impacted soils, the material will be characterized prior to disposal.

The estimated total volume of soil that would be excavated and disposed of off-site under Alternative No. 5B is approximately 1,440 cubic yards. The estimated total volume of concrete that would be disposed of off-site is approximately 180 cubic yards.

4. Shoring and De-Watering

Shoring would be employed during excavation, as necessary, to maintain the integrity of the excavation until it is backfilled. Interlocking or overlapping steel sheet piles will be driven to below the anticipated depth of excavation around the excavation perimeter using an excavator-mounted vibratory piling unit. A hydraulic or mechanical bracing system would be connected within the sheet pile to reduce potential deflection of the sheet piles and to create a steel box within which excavation can be conducted safely.

Groundwater typically has been encountered from between one and four feet below the top of the concrete slab. Dewatering will be used in conjunction with shoring to reduce the potential for sloughing of sidewalls into the excavation. Dewatering is anticipated to be implemented through installation of a series of well points outside the perimeter of the shoring and connected through a header system. Extracted groundwater would be pumped to a temporary groundwater treatment system and, once treated, discharged to the municipal sewer system.

5. Backfilling

The space from which soil had been excavated above the soil S-1 standard would be backfilled with amended granular fill to provide polishing of the groundwater, if necessary. Three amendments were identified for evaluation of their potential effectiveness to reduce VOC and PCB groundwater concentrations after emplacement, as follows:

- Zero Valent Iron (ZVI) (nano-scale ZVI from single supplier) - ZVIs have been shown to be effective in breaking down a range of chlorinated organic compounds in aqueous solution, including chlorinated methanes, ethanes, benzenes, and potentially, PCBs, principally by abiotic means, with zero-valent iron serving as the bulk reducing agent.
- Trap & Treat ® - Trap & Treat is a proprietary product developed for the purpose of degrading chlorinated solvents. The product consists of activated carbon that adsorbs

organic contaminants, which then react chemically with the impregnated metallic iron to degrade.

- Granular Activated Carbon - Activated carbon is a material with high porosity and large surface area that is used commonly in drinking water treatment to adsorb both natural and synthetic organic chemicals.

Prior to the beginning of remedial activities, bench-scale testing of these soil amendments to reduce VOC and PCB groundwater concentrations would be conducted using soil and groundwater from the Disposal Site. Based on the results of the bench-scale testing one amendment would be selected for use in the backfill material.

Clean backfill that has been characterized by analytical testing will be brought to the site to create the amended soil. Clean backfill will be placed in a truck to which the selected amendment will be added. The amendment will be mixed with the clean backfill using an excavator and will be emplaced into the excavation. Shoring would be removed as the fill is emplaced and compacted. Because utilities will have been removed, no separate fill or special precautions will be required around former utility locations. Soil will be placed and compacted in lifts not exceeding one foot, unless other requirements are specified to be consistent with the larger demolition. Soil from between 0 and 4 feet in the excavation with PCB concentrations less than 1 mg/kg may be used for backfill to a depth no shallower than three feet, above which clean backfill will be emplaced.

3.3.8.4 Soil Stabilization Treatment

Although concentrations of lead observed in soil samples collected at the property suggest that soil will not need to be stabilized prior to disposal, disposal characterization soil samples would be collected and analyzed by the TCLP method prior to off-site disposal in accordance with the receiving facilities requirements. Soils exhibiting concentrations greater than 20 times the regulatory limit listed in 310 CMR 30.125 Table 3-1 would be analyzed by the TCLP method. Treatment of the soils may be appropriate prior to off-site disposal based upon the TCLP results and would consist of manually mixing the soil with a stabilizing agent using an excavator or similar means. Certain waste receiving facilities can perform this treatment at their facilities. Other requirements may apply depending upon available off-site facilities and associated facility acceptance processes.

3.3.8.5 Environmental Monitoring

The concrete apron being left in place around the excavation and the presence of shallow groundwater make it unlikely that nuisance dust conditions would arise. However, dust monitoring will be performed to ensure that dust from demolition activities are not exceeding the appropriate dust level standard. If necessary, dust suppression consisting of water sprays will be implemented.. Although VOC concentrations above OSHA action levels are not anticipated, a PID would be utilized as a precaution to monitor VOC concentrations during remedy implementation.

3.3.8.6 Implementation of an AUL

Soil with PCB concentrations between the UCL and the MCP S-1 standard will be removed to depths of 15 feet. As a consequence, an AUL would not be required.

3.3.8.7 Summary

Table 9 provides a comparative summary matrix of remedial action evaluation criteria. This remedial action alternative would have good effectiveness per 310 CMR 40.0858(1) because:

1. It would result in a Permanent Solution under the MCP and support beneficial property reuse;
2. Soil impacts in select areas of the Disposal Site would be removed;
3. Amended backfill would serve to polish groundwater, further decreasing future potential for groundwater VOC concentrations; and
4. Overall chemical concentrations at the property would be greatly reduced.

A high degree of certainty exists that this alternative would be successful at limiting exposures to chemicals in soil and groundwater. Soil with PCB concentrations greater than the soil S-1 standard would be removed and disposed of off-site. Consequently, the potential for future risk associated with exposure to these soils would be eliminated, and the potential for risk associated with indoor air concentrations would be eliminated if a new building were to be erected over the Disposal Site.

This alternative would be difficult to implement; it has the largest excavation volume and emplaces the largest volume of amended backfill. Much higher implementation risk is associated with this alternative than with Alternative No. 2, because of the volume of soil that would be excavated for off-site disposal with this alternative. Implementation risk associated with this alternative is higher than with alternatives No. 3A through 4B because of the higher volume of soil that would be excavated, and higher than with Alternatives No. 3A, 4A, and 5A, which do not entail use of an amended backfill.

Monitoring would be conducted during remedy implementation to mitigate potential risks during implementation due to chemical migration (dust, erosion, vehicles, etc.). During non-working hours, a security fence would prevent unauthorized access to potentially exposed soils in open excavation areas. Upon completion of the remedial alternative, low risk would be associated with remaining impacted soil, if any.

Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be significantly higher with this remedial alternative than with Alternative 2, since a volume of impacted soil would be excavated and transported off-site for disposal and replaced with backfill transported to the property. Consumption of energy resources and resulting emissions of air pollutants and greenhouse gases would be higher than with alternatives 3A through 4B because of the larger volume to be excavated, transported for disposal, and replaced. Water use, materials consumption, and ecosystem and water resource impacts resulting from this remedial alternative would also be higher than with alternatives 2, and 3A through 4B given the volume of excavation, and higher than alternatives 3A, 4A, and 5A because of the resource use for soil amendment.

No public resource is known to be impacted by the Mechanical Room. Public utilities are not impacted, and other public resources, such as parks, are not degraded by this alternative.

This alternative provides the benefit of achieving a Permanent Solution and providing for unrestricted use once remediation is complete. The estimated cost of this alternative is approximately $1,480,000. Annual monitoring costs would be approximately $4,000 per year following site closure. This alternative would likely take three months to implement, permitting, and regulatory review, and would require acceptance by the present owner of the property.

3.3.9 ***Selection of Remedial Action Alternative***

In addition to the No Action alternative, seven remedial alternatives were evaluated for addressing potential risks associated with impacts in soil and groundwater at the Disposal Site. One alternative (Alternative No. 2) was identified as providing a Temporary Solution and six alternatives (Alternative Nos. 3A, 3B, 4A, 4B, 5A, and 5B) were identified as being potentially able to achieve a Permanent Solution. Each alternative was evaluated with consideration given to the comparative evaluation criteria per 310 CMR 40.0858 (effectiveness, reliability, difficulty of implementation, cost, risks, benefits, and timeliness). Each remedial alternative is rated for each of the comparative evaluation criterion in the detailed remedial alternatives evaluation matrix presented in Table 9. Table 10 summarizes estimated costs associated with each alternative.

As noted in Table 9, Remedial Alternative No. 2, Limited Action, is the preferred remedy. Alternative No. 2 would achieve a Temporary Solution for the Disposal Site and support its continued use as a public building.

A condition of No Substantial Hazard exists at the Site for current exposures, with current risks acceptable for building occupants and emergency utility workers. In addition, a condition of No Substantial Hazard exists for the environment. Because of the location of impacted soil and groundwater, no other receptors are at present potentially exposed to these media.

Although each of the six excavation alternatives would provide a Permanent Solution, the Limited Action alternative is protective of human health at a significantly lower cost than alternatives numbers. 3A through 5B, and does not require the demolition of the current NBHS building. The cost of Alternative No. 2, ranges from 5% of the least expensive excavation alternative (Alternative No. 3A) to less than 3% of the most expensive excavation alternative (Alternative No. 5B).

Because of the location of the impacted soil and groundwater is beneath the New Bedford High School, excavation could not be reasonably be undertaken while the building is extant. As a consequence, the costs presented in Table 10 are based on implementation of the excavation alternatives in conjunction with overall demolition of the building at the end of its useful life. Implementation of any of the excavation alternatives with the building in place would present a significant safety issue and increase the cost several fold.

Alternative No. 2 could be implemented easily, quickly, and cost-effectively. Each of the alternatives achieving a Permanent Solution is significantly more expensive than Alternative No. 2 with minimal increased benefit. There is no planned change in property use from the current use as a public school, and Alternative No. 2 allows for that continued use at a lower cost. Therefore, Alternative No. 2 is selected as the preferred remedy.

3.3.10 *Schedule*

Per 310 CMR 40.0861(2)(i), a projected schedule for submittal of the Temporary Solution Statement for the property is as follows, pending logistical coordination with the property owner:

▪ Submit Temporary Solution Statement	Fall 2019

3.3.11 ***Feasibility Analysis***

A Feasibility Evaluation was completed in accordance with 310 CMR 40.0860 and with consideration of the guidance presented in MassDEP's document *Conducting Feasibility Assessments Under the MCP* (Policy #WSC-04-160). The longer-term goal of the MCP at 310 CMR 40.0860 is the reduction of the concentrations of OHM in the environment to levels that approach background; the reduction of concentrations of OHM to levels below applicable UCLs; eliminating, preventing or mitigating CEPs; and eliminating or controlling each source of OHM contamination, controlling migration of OHM, and removing NAPL at a disposal site. Thus, before a Comprehensive Remedial Alternative is selected as a Permanent Solution, 310 CMR 40.0860 requires an evaluation of the feasibility of achieving each of those criteria.

According to MGL c. 21E, § 3A (f), "unless …the department finds that a level of no significant risk already exists or that permanent solutions are feasible and that immediate implementation of such solutions would be more cost-effective than phased implementation of temporary and permanent solutions, one or more temporary solutions shall be implemented … ." Where a Temporary Solution is selected as the Comprehensive Remedial Alternative, 310 CMR 40.0860 (2) requires an evaluation only of the feasibility of implementing a Permanent Solution. Alternative No. 2, the Comprehensive Remedial Alternative selected for the Site, will achieve a Temporary Solution. As a consequence, evaluation of the feasibility of achieving a Permanent Solution is required in accordance with 310 CMR 40.0860 (5). MGL c. 21E § 3A (h) lists criteria for determining whether a remedial action is feasible, which forms the basis for the feasibility evaluation criteria in 310 CMR 40.0860 (5).

As described below, excavation alternatives at the Disposal Site do not meet the requirements to be considered feasible under 310 CMR 40.0860 (5) (b), in that the costs of conducting each of the alternatives and the risks resulting from the alternatives would not be justified by the benefits as determined by the benefit-cost analysis in 310 CMR 40.0860(7).

Soil impacts at the approximately 0.11-acre Mechanical Room Disposal Site are attributable to fill materials placed via historical disposal/filling practices and distributed throughout the soil column to depths of approximately 12 feet. The Disposal Site is located at ground level in the center of the structural core of the school New Bedford High School (see Figure 1). The Mechanical Room itself houses the boilers as well as numerous air ducts, fans and air handling equipment associated with the building's heating and cooling systems, and a pit associated with a former waste incinerator. Excavation could be implemented only if and when the school building is being demolished.

The Method 3 Risk Characterization performed for the Site as part of the Phase II CSA, and supplemental characterization performed based on additional data collected in the Phase III investigations have demonstrated that the Site has achieved a condition of No Substantial Hazard for soil and groundwater. Implementation of the Limited Action alternative achieving a Temporary Solution will maintain the Condition of No Substantial Risk, with periodic monitoring performed to confirm this conclusion.

As a consequence of the condition of No Substantial Hazard that exists at the Site and the increased cost associated with excavation, achieving a Permanent Solution at the Disposal Site is not feasible, consistent with 310 CMR 40.0860 (7)(a):

- **Substantial and Disproportionate Costs to the Incremental Benefit -** The costs presented in the alternatives evaluation are based on implementation of the excavation alternatives in conjunction with overall demolition of the building at the end of its useful life. In current dollars, the cost of implementing any of the excavation alternatives would be an order of magnitude higher than implementation of the Limited Action alternative.

  Because of the Disposal Site's location at ground level in the center of the structural core of the school, excavation of soils while the building is in use would require extensive engineering and specialized construction techniques that would not be necessary if excavation were to be completed after the building is demolished. The additional work may include a comprehensive load evaluation and framing study to develop a temporary structural support plan for the excavation, installation of gauges to monitor deflection during excavation and backfilling, installation of deep anchors to support the upper floors of the building while the footers in the Mechanical Room are removed, construction of a temporary bracing system using large steel beams to provide the rigidity provided by the columns currently in place, and removal of the temporary bracing and installation of new footers and columns. These additional activities associated with immediate implementation of any of the excavation alternatives would raise the costs of each of those alternatives significantly.

  As such, the costs to immediately implement a Permanent Solution are considered "substantial and disproportionate" to the incremental benefit that would be gained from conducting that immediate implementation. Phased implementation of a Temporary Solution that would allow continued use of the building and a Permanent Solution achieving No Significant Risk following demolition is a more cost-effective approach that is consistent with MGL c. 21E, § 3A (f). Therefore, the benefit-cost evaluation applied per Section 9.3.3.4 of MassDEP Policy #WSC-04-160 indicates conducting additional remedial actions can be considered infeasible.

Section 9.3 (Presumptive Certainty of Achieving or Approaching Background) of MassDEP's guidance regarding *Conducting Feasibility Assessments Under the MCP* (Policy #WSC-04-160) provides "…approaches and criteria that DEP finds acceptable for evaluating the feasibility of achieving or approaching background and/or supporting a conclusion that achieving or approaching background is infeasible." Because the criteria described in 310 CMR 40.0860(1) apply to both (a) evaluating the feasibility of implementing a Permanent Solution and (b) evaluating the feasibility of reducing the concentrations of OHM to levels that achieve or approach Background, we conclude that demonstrating that site conditions are consistent with the categorical infeasiblity criteria in Section 9.3.2 of Policy #WSC-04-160 supports the infeasibility of achieving a Permanent Solution.

- **Excavations Under Permanent Structures** – Section 9.3.2.1 states, "Any portion of remedial work required to achieve or approach background that requires excavation under the foundation of a building or other permanent structure such that the integrity of the structure would be impaired may be considered infeasible." Implementation of any of the excavation alternatives for the Mechanical Room would entail removal of the rebar-reinforced concrete slab, removal of support columns for the second and third floors of the building, and removal of the rebar-reinforced spread footers. Thus, implementation of these alternatives is considered infeasible.

  The section further states that the criterion does not apply when demolition is planned that would allow access to the contamination. This is the condition assumed for the description of the excavation alternatives in sections 3.3.3 through 3.3.8 of this Phase III.

Given that the remedy selected for the property will result in a condition of No Substantial Hazard, and consistent with the MCP's Benefit–Cost Analysis language at 310 CMR 40.0860(7)(a) and MassDEP's language regarding conditions of categorical infeasibility at Section 9.3.2 in its Policy #WSC-04-160, it is TRC's opinion that achieving a Permanent Solution for the Site is not feasible.

4.0 PUBLIC INVOLVEMENT

Per 310 CMR 40.1403(3)(e), the Mayor and the Board of Health for the City of New Bedford were provided a copy of the summary and findings and statement of conclusions of this Phase III Remedial Action Plan. Copies of the notification letters are provided in Appendix B.

5.0 PHASE III COMPLETION STATEMENT AND LSP OPINION

This Phase III Remedial Action Plan was completed in accordance with the requirements of 310 CMR 40.0850 and the performance standards of 310 CMR 40.0853. Pursuant to 310 CMR 40.0862(3), it is the opinion of the LSP overseeing this Phase III that the selected remedial action alternative is a Temporary Solution, given that a Permanent Solution is infeasible, for the Site discussed herein.

The LSP overseeing preparation of this Phase III Remedial Action Plan is:

Mr. David M. Sullivan, LSP
LSP License Number: 1488
TRC Environmental Corporation
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______________________________	September 9, 2019
David M. Sullivan, LSP	**Date**
TRC Environmental Corporation	
Licensed Site Professional No. 1488	

6.0 REFERENCES

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TABLES

FIGURES

APPENDIX A

LIMITATIONS

LIMITATIONS

1. TRC Environmental Corporation's (TRC's) study was performed in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area, and TRC observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. TRC's findings and conclusions must be considered not as scientific certainties, but rather as our professional opinion concerning the significance of the limited data gathered during the course of the study. No other warranty, express or implied is made. Specifically, TRC does not and cannot represent that the Site contains no hazardous material, oil, or other latent condition beyond that observed by TRC during its study. Additionally, TRC makes no warranty that any response action or recommended action will achieve all of its objectives or that the findings of this study will be upheld by a Massachusetts Department of Environmental Protection (MassDEP) audit.

2. This study and report have been prepared on behalf of and for the exclusive use of the MassDEP and the City of New Bedford (Client), solely for use in an environmental response actions at the New Bedford High School Mechanical Room in New Bedford, Massachusetts ("Site") under the Massachusetts Contingency Plan (MCP; 310 CMR 40.0000). This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without the prior written consent of TRC.

3. The observations described in this report were made under the conditions stated therein. The conclusions presented in the report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by Client. The work described in this report was carried out in accordance with the Terms and Conditions referenced in our proposals with the City of New Bedford.

4. In preparing this report, TRC has relied on certain information provided by state and local officials and other parties referenced therein, and on information contained in the files of state and/or local agencies available to TRC at the time of the study. Although there may have been some degree of overlap in the information provided by these various sources, TRC did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

5. In the event that the Client or others authorized to use this report obtain information on environmental or hazardous waste issues at the Site not contained in this report, such information shall be brought to TRC's attention forthwith. TRC will evaluate such information and, on the basis of that evaluation, may modify the conclusions stated in this report.

6. The purpose of this report was to assess the Site with respect to the requirements of the MCP. No specific attempt was made to check on the compliance of present or past owners or operators of the Site with federal, state, or local laws and regulations, environmental or otherwise.

7. The conclusions and recommendations contained in this report are based in part upon the data obtained from soil and groundwater samples obtained from subsurface and other explorations described herein. The nature and extent of variations between these explorations may not become evident until further exploration. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

8. The generalized soil profile and groundwater elevation/depth contours described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more gradual. The depictions of groundwater represents a snapshot in time and is based on a limited number of groundwater monitoring wells, and represents a generalized professional interpretation.

9. The conclusions and recommendations contained in this report are based in part upon various types of chemical data and are contingent upon their validity. These data have been reviewed and interpretations made in the report. As may be indicated within the report, some of these data may be preliminary "screening" level data, and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants may occur due to past disposal practices, the passage of time, and other factors. Should additional chemical data become available in the future, these data should be reviewed by TRC and the conclusions and recommendations presented herein modified accordingly.

10. Chemical analyses have been performed for specific parameters during the course of this Site assessment, as described in the text. However, it should be noted that additional chemical constituents not searched for during the current study could be present at the Site.

11. TRC's risk evaluation was performed in accordance with generally accepted practices of the Massachusetts Department of Environmental Protection and other consultants undertaking similar studies. The findings of the risk evaluation are dependent on numerous assumptions and uncertainties inherent in the risk assessment process. Sources of uncertainty may include the description of Site conditions and the nature and extent of chemical distribution and the use of toxicity information. Consequently, the findings of the risk assessment are not an absolute characterization of actual risks, but rather serve to highlight potential sources of risk at the Site. Although the range of uncertainties has not been quantified, the use of conservative assumptions and parameters throughout the assessment would be expected to err on the side of protection of human health and the environment.

APPENDIX B

PUBLIC NOTIFICATION LETTERS