**FIVE-YEAR REVIEW REPORT FOR**
**HATHEWAY & PATTERSON SUPERFUND SITE**
**BRISTOL COUNTY, MASSACHUSETTS**

**Prepared by**

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9/3/14
**Date**

SDMS Doc ID 567899

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## LIST OF ACRONYMS AND ABBREVIATIONS

| ACRONYM | DEFINITION |
|---|---|
| AAL | Allowable Ambient Air Limits |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| AST | Above Ground Storage Tank |
| AUL | Activity and Use Limitation |
| AWQC | Ambient Water Quality Criteria |
| BERA | Baseline Ecological Risk Assessment |
| BLM | Biotic Ligand Model |
| BOH | Board of Health |
| CCA | Chromated copper arsenate |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC § 9601 et seq. |
| CFR | Code of Federal Regulations |
| CIC | Community Involvement Coordinator |
| COC | Contaminant of Concern |
| COPC | Contaminant of Potential Concern |
| CWA | Clean Water Act |
| DA | Domestic Auxiliary |
| DEQE | Massachusetts Department of Environmental Quality Engineering |
| EPA | Environmental Protection Agency (U.S. EPA - Region 1) |
| EPC | Exposure Point Concentration |
| ESD | Explanation of Significant Differences |
| FCAP | Fluoro-chrome-arsenate-phenol |
| FIFRA | Federal Insecticide, Fungicide, and Rodenticide Act of 1947 |
| FS | Feasibility Study |
| GERE | Grant of Environmental Restrictions and Easements |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| ICs | Institutional Controls |
| ICA | Industrial/Commercial Auxiliary |
| IRIS | Integrated Risk Information System |
| LEL | Lowest Effect Level |
| LI | Limited Industrial |
| LNAPL | Light Non-Aqueous Phase Liquid |
| M&E | Metcalf & Eddy |
| MADEQE | Massachusetts Department of Environmental Quality Engineering |
| MassDEP | Massachusetts Department of Environmental Protection |
| MCLs | Maximum Contaminant Levels |
| MSR | Management System Review |
| NAWQC | National Ambient Water Quality Criteria |
| NCP | National Contingency Plan, 40 CFR Part 300 |
| NE | Northeast |
| NESHAPS | National Emission Standards for Hazardous Air Pollutants |

| ACRONYM | DEFINITION |
|---|---|
| NPL | National Priority List |
| NW | Northwest |
| O&M | Operation and Maintenance |
| OMEE | Ontario Ministry of Environment and Energy |
| PAHs | Polycyclic Aromatic Hydrocarbons |
| PA/SI | Preliminary Assessment/Site Investigation |
| PCP | Pentachlorophenol |
| PRP | potentially responsible party |
| RA | Remedial Action |
| RAC | Response Action Contract |
| RAFU | Reasonable Anticipated Future Land Use |
| RAO | Remedial Action Objective |
| RCRA | Resource Conservation and Recovery Act, 42 U.S.C. ' ' 6901 *et seq.* |
| RD | Remedial Design |
| RME | Reasonable Maximum Exposure |
| RfD | Reference Dose |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SDWA | Safe Drinking Water Act |
| SE | Southeast |
| SEL | Severe Effect Level |
| SF | Slope Factor |
| SVOCs | Semivolatile Organic Compounds |
| SW | Southwest |
| TBC | To Be Considered |
| TEL | Threshold Exposure Limit |
| TEQ | Toxicity Equivalent |
| TLV | Threshold Limit Value |
| TRV | Toxicity Reference Value |
| UCL | Upper Confidence Limit |
| USACE | United States Army Corps of Engineers |
| UST | Underground Storage Tank |
| VOCs | Volatile Organic Compounds |

## EXECUTIVE SUMMARY

This is the first five-year review for the Hatheway & Patterson Superfund Site (the site). This review is required by statute because the selected remedy will, upon completion, leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. The trigger date for this statutory five-year review is the initiation of the remedial actions at the site on September 2, 2009.

The site is a former wood treatment facility located at 35 County Street in Mansfield, Massachusetts. Approximately 36 acres of the 38.17-acre site are located in the Town of Mansfield. The remaining 1.77 acres are located in the Town of Foxborough, also referred to as the Foxborough parcel (see Figure 1.2 in Appendix A). The Mansfield portion of the site is divided into four quadrants by the Rumford River, which runs north to south, and by a railroad right-of-way, which runs east to west. The northeast and northwest quadrants are referred to as the "Process Area", the southeast and southwest quadrants ("SE/SW quadrants") cover the area south of the Rumford River, and the "County Street area" lies north of the site fence in the northeast and northwest quadrants (see Figure 1.2 in Appendix A).

The selected remedy identified in the 2005 Record of Decision (ROD) included demolition of buildings in and near Hatheway & Patterson's former manufacturing area; excavation of soils with contaminants exceeding cleanup levels; testing of soils containing pentachlorophenol (PCP), semi-volatile organic compounds (SVOCs), and arsenic for leachability, stabilization/solidification of the soils, if necessary, and consolidation of stabilized/solidified soils under a low-permeability cover; off-site disposal of soils containing dioxin and oily material (LNAPL) at a licensed facility; institutional controls to prohibit the use of site groundwater and restrict land uses in a manner that ensures the protectiveness of the remedy; and long-term monitoring of groundwater, surface water, fish tissue, and sediment.

The remedy was modified via an Explanation of Significant Differences (ESD) in 2011. Based on a zoning change for the Foxborough parcel from residential use to "Limited Industrial" use, and intended reuse of the parcel as a parking lot, EPA and MassDEP determined that the Foxborough parcel should be remediated to a Reasonably Anticipated Future Use of commercial/open space and changed the cleanup level accordingly. It was determined that a consolidation area for soils in Foxborough contaminated with arsenic could be built on the Foxborough parcel and designed with an asphalt cover in order to facilitate use as a parking lot. The 2011 ESD also modified the remedy for the management of PCP and arsenic-contaminated soils from consolidation on the lots in the Mansfield portion of the Site to disposal at an off-site facility. In addition, the EPA clarified the extent of institutional controls to be placed on the site properties as called for in the ROD.

### Protectiveness Statement

The remedy at the Hatheway & Patterson Superfund Site currently protects human health and the environment because remediation of the soil (soil removal and on-site consolidation) has been completed to cleanup levels that are considered protective for the anticipated future use of the property, and there is no current use of on-site groundwater which is classified as non-potable. However, in order for the remedy to be protective in the long-term, institutional controls need to be created and recorded to restrict inappropriate land uses (including use of groundwater) and protect the consolidation area cover. Operation and maintenance activities have been initiated and will ensure that the consolidation area and associated components of the remedy (e.g., groundwater monitoring wells) remain in good condition. In addition, monitoring of groundwater will continue to assess the protectiveness of the remedy.

**Five-Year Review Summary Form**

| SITE IDENTIFICATION | | |
|---|---|---|
| **Site Name:** Hatheway & Patterson Superfund Site | | |
| **EPA ID:** MAD001060805 | | |
| **Region:** 1 | **State:** MA | **City/County:** Bristol |

| SITE STATUS | |
|---|---|
| **NPL Status:** Final | |
| **Multiple OUs?**<br>No | **Has the site achieved construction completion?**<br>Yes |

| REVIEW STATUS |
|---|
| **Lead agency:** EPA<br>**If "Other Federal Agency" was selected above, enter Agency name:** Click here to enter text. |
| **Author name (Federal or State Project Manager):** Kimberly White |
| **Author affiliation:** U.S. EPA, Region 1 – New England |
| **Review period:** February 2014 to August 2014 |
| **Date of site inspection:** June 3, 2014 |
| **Type of review:** Statutory |
| **Review number:** 1 |
| **Triggering action date:** September 2, 2009 |
| **Due date *(five years after triggering action date)*:** September 2, 2014 |

**Issues/Recommendations**

**Issues and Recommendations Identified in the Five-Year Review:**

| OU(s): | Issue Category: Institutional Controls | | | |
|---|---|---|---|---|
| | **Issue:** Institutional controls restricting land uses that may impact the protectiveness of the remedy (including preventing the use of groundwater, protecting the consolidation area cover and other components of the remedy) need to be established. Also, an updated risk evaluation shows that the railroad right-of-way will also require institutional controls to protect workers who may contact soil in that area. | | | |
| | **Recommendation:** EPA, MassDEP, and the property owners should begin discussions as soon as possible and establish institutional controls by the next five-year review. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Implementing Party** | **Oversight Party** | **Milestone Date** |
| No | Yes | State | EPA | Aug 2019 |

| OU(s): | Issue Category: Monitoring | | | |
|---|---|---|---|---|
| | **Issue:** The 2012 sediment sampling event included locations which did not correspond with the historic sampling locations and the results showed lower contaminant concentrations than seen previously. As a result, it is uncertain whether the higher concentrations historically seen remain at the Site. If the historic concentrations are still present, recent changes to toxicity values and exposure parameters included in risk evaluation for sediment may result in a future change to the protectiveness determination with respect to sediment exposure. | | | |
| | **Recommendation:** If accessible, collect sediment samples from locations which correspond to historical sampling locations and assess the new data. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Implementing Party** | **Oversight Party** | **Milestone Date** |
| No | Yes | State | EPA | Dec 2018 |

| OU(s): | Issue Category: Monitoring | | | |
|---|---|---|---|---|
| | **Issue:** The fish tissue collection required by the ROD was not performed due to a lack of fish in the Rumford River. Also, surface water sampling required by the ROD was not performed due to EPA and MassDEP's agreement to continue discussions about the future operation and maintenance plan for the site. | | | |
| | **Recommendation:** Review current site information, determine the need for and, if necessary, collect any additional data. Update/ document changes in the monitoring requirements accordingly. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Implementing Party** | **Oversight Party** | **Milestone Date** |
| No | Yes | EPA/State | EPA | Dec 2018 |

| OU(s): | Issue Category: Monitoring | | | |
|---|---|---|---|---|
| | **Issue:** Determine whether a PCP detection above its MCL in a non-potable private groundwater supply well is site-related. | | | |
| | **Recommendation:** Perform evaluation which potentially includes the following: determine if detection is real (potential resampling); review well construction and any potential hydrogeologic connection to the site; and review nearby potential sources. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Implementing Party** | **Oversight Party** | **Milestone Date** |
| No | Yes | EPA | EPA | Dec 2016 |

| OU(s): | Issue Category: Monitoring | | | |
|---|---|---|---|---|
| | **Issue:** Active irrigation wells have been identified approximately 300 feet beyond the compliance boundary. Irrigation wells are not expected to create enough drawdown to induce groundwater to flow to them from the compliance boundary. An on-site monitoring well just east (upgradient) of the compliance boundary does indicate the presence of contamination at concentrations above performance standards. | | | |
| | **Recommendation:** Additional investigations should be conducted to confirm whether groundwater flow directions have been impacted by the irrigation wells. | | | |
| **Affect Current Protectiveness** | **Affect Future Protectiveness** | **Implementing Party** | **Oversight Party** | **Milestone Date** |
| No | Yes | EPA/State | EPA | Dec 2015 |

## Protectiveness Statement(s)

### Sitewide Protectiveness Statement (if applicable)

| *Protectiveness Determination:* | *Addendum Due Date (if applicable):* |
|---|---|
| Short-term Protective | Click here to enter date. |

*Protectiveness Statement:*

The remedy at the Hatheway & Patterson Superfund Site currently protects human health and the environment because remediation of the soil (soil removal and on-site consolidation) has been completed to cleanup levels that are considered protective for the anticipated future use of the property, and there is no current use of on-site groundwater which is classified as non-potable. However, in order for the remedy to be protective in the long-term, institutional controls need to be created and recorded to restrict inappropriate land uses (including use of groundwater) and protect the consolidation area cover. Operation and maintenance activities have been initiated and will ensure that the consolidation area and associated components of the remedy (e.g., groundwater monitoring wells) remain in good condition. In addition, monitoring of groundwater will continue to assess the protectiveness of the remedy.

## SECTION 1.0
## INTRODUCTION

The purpose of this five-year review is to determine whether the remedy for the Hatheway & Patterson Superfund Site continues to be protective of human health and the environment. The methods, findings, and conclusions of this review are documented in this five-year review report. In addition, five-year review reports identify issues found during the review, if any, and present recommendations to address them.

EPA Region I has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). Section 121(c) of CERCLA 42 USC § 9621(c) states:

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

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

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

This is the first five-year review for the Hatheway & Patterson Site. This review was performed by EPA Region I - New England and is required by statute because the selected remedy will, upon completion, leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. The trigger date for this initial five-year review is the initiation of the remedial actions at the site in September 2009.

## SECTION 2.0
## SITE CHRONOLOGY

The chronology of the site, including all significant events and dates is provided below in Table 1.

| Table 1: Chronology of Site Events | |
|---|---|
| **Event** | **Date** |
| Discovery of a tar seep on the banks of the Rumford River by representatives of the Town of Mansfield and Massachusetts Department of Environmental Quality Engineering (MADEQE) and subsequent request that Hatheway & Patterson contain the “oily seepage”. | 1972 |
| Hatheway & Patterson took steps to control the “oily seepage” including booms and sorbents, a collection pit and trench, and other measures including recovery of 2,500 gallons of oil through groundwater pumping operations. | 1973 – 1982 |
| Additional report of “oily seepage” in the Rumford River and soil and groundwater sampling by a prospective property buyer. | 1981 |
| MADEQE issued a Notice of Noncompliance letter to Hatheway & Patterson requiring a Phase I Initial Site Investigation. | May 1987 |
| Phase I site investigations conducted. | 1987-1988 |
| MADEQE issued a Notice of Responsibility letter to Hatheway & Patterson requiring a Phase II Site Investigation, Risk Assessment, and an alternative evaluation. | August 1988 |
| Phase II site investigations conducted. | late 1988 – early 1989 |
| The Massachusetts Department of Environmental Protection (MassDEP), formerly MADEQE, issued a Request for Short Term Measure letter to Hatheway & Patterson to address the imminent hazard to the Rumford River area based on an additional report of “oil seepage”. | June 1990 |
| Short-term measure investigation conducted and included “sampling of the worst-case visibly stained soil along the river bank.” | Fall 1990 |
| Hatheway & Patterson constructed a collection trench along the eastern bank of the Rumford River to intercept groundwater and oils migrating to the river from oil-contaminated river bank. | September 1991 |
| The collection trench was modified to include groundwater treatment with activated carbon prior to discharge to the Rumford River. | February 1992 |
| Two RCRA inspections found that drip pads were not in compliance with RCRA regulations. | March 1992 |

| Table 1: Chronology of Site Events | |
|---|---|
| **Event** | **Date** |
| MassDEP inspection and report of petroleum product flowing from the river bed into the Rumford River, a release of oil into nearby wetlands, and free-product in the wetlands. MassDEP requested that Hatheway & Patterson conduct additional assessment and plans for corrective action. | January 1993 |
| Hatheway & Patterson filed for bankruptcy protection and closed the manufacturing facility, leaving wood-treatment chemicals and sludge in ASTs, UST sumps and drums at the abandoned property. | February – May 1993 |
| EPA and MassDEP initiated a Preliminary Assessment/Site Investigation (PA/SI). | June 1993 |
| EPA initiated a Removal Action to address the presence of ASTs and USTs containing hazardous wastes located inside and outside the buildings. 100,000 gallons of liquid and solid wastes were removed and disposed off-site. Subsequently, a comprehensive surface soil investigation was conducted and several areas of the property received temporary geotextile/gravel and/or asphalt cover. Also, perimeter fencing was repaired and installed, and locks to manways of tanks and on-site buildings were installed. | December 1993 – September 1995 |
| Additional on-site reconnaissance and environmental investigation and sample collection is conducted by MassDEP and EPA. | 1998 |
| Town of Mansfield conducted environmental investigation under an EPA Brownfields Pilot Program grant. | 2000 |
| EPA contractors conducted additional groundwater, surface water, and sediment sampling. | Fall 2001 |
| The site was added to the EPA National Priorities List. | September 5, 2002 |
| Surface soil samples were analyzed from outside of the perimeter fence on both sides of County Street. | April 2003 |
| EPA initiated a Removal Action to address the arsenic-contaminated soil located outside the perimeter fence. 376 tons of contaminated soils were excavated from both sides of county road and disposed of off-site. | August 2003 |
| Completion of Remedial Investigation/Feasibility Study (RI/FS). | June 2005 |
| EPA issued the Record of Decision. | September 30, 2005 |
| Process buildings are demolished and disposed of off-site. | Spring 2006 |
| Remedial Design is (RD) completed. | September 2008 |
| Start of on-site construction. | September 2009 |

| Table 1: Chronology of Site Events | |
|---|---|
| **Event** | **Date** |
| EPA issued an Explanation of Significant Differences to document changes made to the remedy on the Foxborough, Massachusetts parcel, including changes to the anticipated future land use, design of the consolidation area, and the tax foreclosure and rezoning of the property by the Town; to document the shipment of certain pentachlorophenol and arsenic contaminated soils to an off-site facility, rather than the on-site consolidation specified in the Record of Decision (ROD); and to clarify the extent of institutional controls to be placed on portions of the site. | August 29, 2011 |
| Final Remedial Action Completion Report completed by Sevenson Environmental Services, Inc. for the U.S. Army Corps of Engineers. | September 2011 |

# SECTION 3.0
# BACKGROUND

## 3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The Hatheway & Patterson Superfund Site is located at 35 County Street in Mansfield, Massachusetts (see Figure 1.1 in Appendix A). Approximately 36 acres of the 38.17-acre site are located in the Town of Mansfield. The remaining 1.77 acres are located in the Town of Foxborough, also referred to as the Foxborough parcel (see Figure 1.2 in Appendix A). The Mansfield portion of the site is divided into four quadrants by the Rumford River, which runs north to south, and by a railroad right-of-way, which runs east to west. The northeast (NE) and northwest (NW) quadrants are referred to as the "Process Area" and are located north of the active railroad tracks operated by CSX. The southeast (SE) and southwest (SW) quadrants cover the area south of the railroad tracks. The "County Street area" lies north of the site fence in the northeast and northwest quadrants (see Figures 1.2 and B-1 in Appendix A).

The site lies within the Taunton River Basin which drains approximately 528 square miles and empties into the Narragansett Bay at Fall River, Massachusetts. The Rumford River flows north to south and is primarily fed by the Glue Factory Pond, which is located approximately 1 mile north of the site. The area to the north of the site is developed with residences and light industry.

Much of the southwestern portion of the site is covered by wetlands, and several potential vernal pool-like habitats exist in this area. The southerly section of the site is bounded by the Rumford River backwash channel. Portions of the site are located within areas of the 100-year flood zone (Zone A3) and between limits of the 100-year flood and 500-year flood zone (Zone B) for the Rumford River. The Rumford River is a Class B surface water. Class B waters are designated as habitat for fish, other aquatic life and wildlife, and for primary and secondary contact recreation. They are also designated as suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. The Rumford River backwash channel (the southern boundary of the site) was the former course of the main channel of the river until it was redirected further to the south during the 1960's (see Figure 2.1 in Appendix A). The channel presently runs in a southeasterly direction for about 450 meters until it joins with the Rumford River.

The majority of the historical operational areas and buildings were located on the northern portion of the property, north of the railroad tracks, and contained process buildings, drip pads, support buildings, an office, and a laboratory. With the exception of the office building, which was outside the remediation area, these structures have been demolished or removed (Sevenson, 2011).

The remedy selected in the ROD for the 1.77-acre Foxborough portion of the site was based on a residential future use scenario because of the residential zoning in place at the time of the 2005 ROD signature. At the time of the ROD, the parcel was unused. During Hatheway & Patterson operations, it may have been used for wood storage. Subsequent to the 2005 ROD, the Town of Foxborough foreclosed on the approximately 1.7 acres of the site located within the Town, with the intent of redeveloping the parcel as a parking lot to service the nearby MBTA commuter rail station. The Town subsequently changed the zoning of the lot from R-40 Residential and Agricultural District to Limited Industrial (LI) district. Modifications were made to the remedy based on this new information as documented in an Explanation of Significant Differences (ESD; USEPA, 2011a). .

The 36-acre Mansfield portion of the site is zoned as I-3, which is a flexible mixed-use industrial zone that allows an array of uses from heavy manufacturing to multi-family dwellings to day care. The Town of Mansfield utilizes a portion of the site north of the railroad tracks for storage of emergency vehicles and uses the one remaining building for office space. The site has been used for commercial/industrial purposes intermittently since 1927. The area of the site south of the railroad tracks has historically been used for storage, but has not been developed. During ROD development, the Town of Mansfield notified EPA that the reasonable anticipated future land use (RAFU) of the Mansfield portion of the site will be commercial use for the front parcel located on County Street (north of the railroad tracks) and Open Space or Commercial, for the back parcel (south of the railroad tracks) (USEPA, 2005).

The site and surrounding area are served by municipal drinking water. Groundwater underlying the site is designated as Class III (non-potable) by the Commonwealth of Massachusetts. The remedy outlined in the ROD was based on an assumption that groundwater at the site is not available for drinking water by future users of the site (USEPA, 2005).

### 3.2 HISTORY OF CONTAMINATION

Initially, the Hatheway & Patterson property consisted only of the land between County Street and the railroad tracks, and the land from the present eastern property boundary to approximately the Rumford River. Hatheway & Patterson reportedly began operations at the site in 1927, but did not begin wood treating until 1953. It is unknown what operations might have been conducted at the site between 1927 and 1953 (USEPA, 2005).

The land west of the Rumford River was owned by the Penn Central Railroad, who used it for bulk chemical transfer and storage of electric/utility poles and railroad ties, until the land was purchased by Hatheway & Patterson in 1978. The land south of the railroad tracks was purchased by Hatheway & Patterson in 1981 and was apparently not used between 1955 and 1971, but was reportedly used for coal storage prior to 1955 (USEPA, 2005).

Wood treatment was accomplished by a variety of methods that changed over time. From 1953 through 1958, a solution of pentachlorophenol (PCP) in fuel oil, or creosote, was used for dipping lumber. After dipping, excess chemicals were allowed to drip off of the treated wood onto the ground surface. From 1958 through 1974, solutions of PCP in fuel oil and fluoro-chrome-arsenate-phenol (FCAP) salts in water were used in a pressure treatment process. From 1960 through 1984, PCP in mineral spirits was also used to pressure-treat lumber. From 1974 to 1984, operations incorporated PCP in fuel oil and chromated copper-arsenate (CCA) salts in water. From 1984 until operations ceased in 1993, solutions of CCA salts in water and PCP in water were utilized at the property. Wood was also infused with fire retardants, including Dricon™ (boric acid and anhydrous sodium tetraborate). The various wood-treating chemicals were stored in aboveground storage tanks (ASTs), underground storage tanks (USTs), and sumps located inside and outside of the former process buildings (USEPA, 2005).

Contamination was initially discovered in 1972, when a tar seep (approximately 62 feet long and 6 inches thick) was discovered on the banks of the Rumford River on the southern portion of the property by representatives of the Town of Mansfield and the MADEQE. Additionally, “oily water and dead fowl were reported in Fulton Pond, downstream of the property” (USEPA, 2005).

### 3.3 INITIAL RESPONSE

Following the initial discovery of contamination in 1972, Hatheway & Patterson took steps to control the “oily seepage” including booms and sorbents, a collection pit and trench, and other measures including groundwater pumping operations between approximately 1973 and 1982. Under MADEQE requests, Hatheway & Patterson conducted Phase I and Phase II site investigations between 1987 and early 1989. In June 1990, MassDEP (formerly MADEQE) issued a Request for Short Term Measure letter to Hatheway & Patterson to address the imminent hazard to the Rumford River area based on an additional report of “oil seepage” and in response, soil investigation was conducted along river bank. In September 1991, Hatheway & Patterson constructed a collection trench along the eastern bank of the Rumford River to intercept groundwater and oils migrating to the river from oil-contaminated river bank. In February 1992, the collection trench was modified to include groundwater treatment with activated carbon prior to discharge to the Rumford River.

In 1993, Hatheway & Patterson declared bankruptcy, ceased operations, and left the site. In 1993, EPA conducted a PA/SI at the site and, based on the results, a Removal Action was conducted between December 1993 and September 1995. The Removal Action addressed the presence of ASTs and USTs containing hazardous wastes located inside and outside the buildings. Liquid and solid wastes were

removed and disposed off-site. Subsequently, a comprehensive surface soil investigation was conducted and several areas of the property received temporary geotextile/gravel and/or asphalt cover. Also, perimeter fencing was repaired and installed, and locks to manways of tanks and on-site buildings were installed. Following the Removal Action, MassDEP assumed oversight of the property. EPA conducted another Removal Action in 2003 to excavate and dispose off-site the arsenic-contaminated surface soil located outside the perimeter fence. Additional environmental investigations were conducted by MassDEP, EPA, and the Town of Mansfield between 1998 and 2005, when the ROD was completed.

### 3.4 BASIS FOR TAKING ACTION

Based on the Remedial Investigation (TRC, 2005), the following summarizes the affected media and contaminants:

**Surface and Subsurface Soil.** In general, surface and subsurface soils contaminated with the highest concentrations of PCP, arsenic, dioxin, and polycyclic aromatic hydrocarbons (PAHs) were located north of the railroad tracks in the Process Area (NE and NW quadrants).

**Groundwater.** Groundwater at the Site is impacted primarily by arsenic and PCP. Groundwater plumes in both overburden and bedrock flow southwesterly from the Process Area and the light non-aqueous phase liquid (LNAPL) hot spot toward the Rumford River and the Rumford River backwash channel to the south. It was concluded that the extent of contamination in overburden and bedrock groundwater appeared to be confined to the site and bounded by the Rumford River and the backwash channel.

**LNAPL.** A sizable LNAPL hot spot area was located just south of the railroad tracks in the SE/SW quadrants, near the Process Area. Isolated pockets of free product and LNAPL-saturated subsurface soils were detected throughout the site.

**Surface Water.** PCP and two PAHs (benzo(a)anthracene and benzo(a)pyrene) were detected above surface water screening criteria in on-site Rumford River surface water samples. The highest concentration of PCP in surface water was detected in an on-site vernal pool sample.

**Sediment.** Several PAHs were detected in upstream and on-site sediment samples at concentrations exceeding sediment screening criteria. Other semivolatile organic compounds (SVOCs) (2-methylphenol, dibenzofuran, diethyl phthalate, and PCP) and dioxin also exceeded sediment screening levels.

**Fish.** Fish tissue collected from the Rumford River contained concentrations of PCP and dioxin that were higher in on-site samples than upstream samples.

The baseline human health risk assessment concluded that exposure to surface and subsurface soil in the Process Area (NE and NW quadrants) containing arsenic, dioxin, and pentachlorophenol was associated with an unacceptable human health risk outside EPA's acceptable risk range under current and future exposure scenarios. On-site overburden and bedrock groundwater was also associated with an unacceptable human health risk based on a conservative assumption that the contaminant plume of PCP, arsenic, and chromium will migrate to a location outside the current site boundary and will be used by off-site residents via existing wells on their properties which are currently designated as non-potable.

The baseline ecological risk assessment concluded that benthic invertebrates, water column invertebrates, fish, piscivorous birds and mammals feeding along the Rumford River are unlikely to be at a substantial risk from exposure to site-related contaminants.

# SECTION 4.0
# REMEDIAL ACTIONS

## 4.1 REMEDY SELECTION

The EPA ROD for the site was signed on September 30, 2005. Remedial Action Objectives (RAOs) were developed for various media at the site based on the results of the RI and risk assessments. The RAOs were developed to aid in the development and screening of remedial alternatives.

The RAOs for the selected remedy for the site are:

- Surface Soil (Process Area) – Prevent current and future trespassers and future on-site residents (Foxborough parcel), commercial workers, town workers, and utility workers from ingestion of or dermal contact with Contaminants of Potential Concern (COPCs) (including arsenic, dioxin, and PCP) which would result in a cumulative excess cancer risk greater than $10^{-4}$ to $10^{-6}$ or HI=1;

- Subsurface Soil (Process Area) – Prevent future commercial workers and future on-site residents (Foxborough parcel) from ingestion of or dermal contact with COPCs (including arsenic, dioxin, and PCP) which would result in a cumulative risk greater than $10^{-4}$ to $10^{-6}$ or HI=1;

- Groundwater – Prevent discharge of pentachlorophenol and other COPCs from soil to groundwater and from groundwater to surface water at concentrations that would result in an in stream exceedence of the Ambient Water Quality Criteria (AWQCs) through source control. Prevent exposure to groundwater by future residents, recreational users, or commercial workers by monitoring extent of plume (to ensure it is remaining on-site) and implementing institutional controls to restrict groundwater use within the site boundary;

- Inter-Media Transfer – Eliminate or reduce potential for leaching through source control and inter-media transfer of COPCs from soil to groundwater and surface water;

- LNAPL – Minimize further contaminant transfer from LNAPL source material to groundwater by reducing LNAPL source material in soil excavation/treatment areas. Minimize further migration of LNAPL free product to groundwater and surface water by removing free product “hotspots” to the extent feasible.

The selected remedy for the site consisted of the following components:

- Excavation of approximately 31,000 cubic yards of soil exceeding cleanup levels.

- Demolition of the buildings in and near Hatheway & Patterson’s former manufacturing area to allow excavation of underlying contaminated soils and replacement of the excavated soil with clean backfill.

- Excavation of soils containing PCP, SVOCs, and arsenic, and testing of soils for leachability and, if they fail, utilization of a stabilization/solidification agent(s). Consolidation of the stabilized/solidified soils on-site under a low-permeability cover.

- Off-site disposal of soils containing dioxin and oily material (LNAPL) at a licensed facility.

- Institutional controls to prohibit the use of site groundwater and restrict land uses in a manner that ensures the protectiveness of the remedy as described in this ROD, and ensures the integrity of the on-site low-permeability cover and other remedial components. Evaluation of risks from soil exposures within the area of the existing railroad right of way during design and implementation of appropriate action such as deed restrictions or other legal and administrative measures if necessary.

- Long term monitoring of groundwater, surface water, fish tissue and sediment.

- Five-year reviews, and operation and maintenance of remedial components, including the low permeability cover

An ESD (USEPA, 2011a) was issued in August 2011 in order to document certain changes and clarifications to the remedy that was set forth in the ROD. The ESD had three main purposes as summarized below.

The remedy outlined in the ROD for the Foxborough parcel was based on future residential use of the parcel, as the property was zoned for residential use in 2005. After the ROD was issued, the Town of Foxborough took ownership of the parcel through tax foreclosure with the intent of redeveloping the parcel as a parking lot. In connection with this plan, the town voted at the May 2008 Town Meeting to adopt a change in zoning of the lot from R-40 Residential and Agricultural District to "Limited Industrial." The Town notified EPA of its intention to use the parcel as a parking facility for the nearby MBTA commuter rail station. Based on the change in zoning and intended reuse of the parcel, EPA and MassDEP determined that the Foxborough parcel should be remediated to a Reasonably Anticipated Future Use (RAFU) of commercial/open space and changed the cleanup level accordingly from 9.1 ppm to 16 ppm for arsenic and to 90 ppm for PCP (note that there was no Residential Cleanup Level for PCP in the ROD). EPA also determined that a consolidation area for soils in Foxborough contaminated with arsenic could be built on the Foxborough parcel and designed with an asphalt cover in order to facilitate reuse as a parking facility.

Second, EPA reevaluated the remedy for PCP and arsenic-contaminated soils excavated from the lots in the Mansfield portion of the site. The remedy chosen in the ROD called for on-site consolidation of these soils, rather than disposal at an off-site facility. Subsequent to the signing of the ROD, the relative costs of off-site disposal decreased significantly. EPA reevaluated both options using criteria required under CERCLA to compare different remedial options. The criteria included overall protection, long-term effectiveness and permanence, community support, and cost. The remedy was changed since the costs were similar, but the off-site disposal option offered the greatest overall protection, long-term protectiveness, and permanence.

Lastly, EPA clarified the extent of institutional controls to be placed on the site properties as called for in the ROD. Specifically, restrictions on future soil excavation, in the form of institutional controls, will be needed in the northeast quadrant of the site: 1) below the depth of the vertical extent of excavation reached during the remedial action (RA); and 2) at depths of two feet and below in a strip of land bordering the northeast quadrant and County Street to a distance about 5 feet laterally with the fence line. Institutional controls will also be necessary to protect the cover placed over the consolidated soils in the Foxborough parcel.

Risks from soil exposures within the area of the existing railroad right of way were evaluated during design and remedial action as specified by the ROD and institutional controls or other legal and administrative measures were deemed not to be necessary. The ESD stated that risk from the railroad right of way would be reevaluated as part of the five-year review process for the site. In addition, institutional controls to eliminate on-site exposures to groundwater and to prevent residential use will be necessary on all four quadrants of the site property.

### 4.2 REMEDY IMPLEMENTATION

Through an Interagency Agreement with EPA Region I, the U.S. Army Corps of Engineers New England District (USACE) contracted with Sevenson Environmental Services (Sevenson) to perform the remedial construction in accordance with Construction Specifications developed by Metcalf & Eddy and TRC Corporation (TRC, 2008). USACE provided construction management technical oversight.

Remedial construction activities commenced in September 2009 and were substantially completed in September 2010. The work conducted included the following:

- mobilization;
- geotechnical investigation;
- preparation of all required infrastructure including the construction of two small bridges;
- demolition and off-site disposal of one on-site building, including asbestos abatement;
- removal and disposal of six underground storage tanks;
- removal and disposal of all surficial and subsurface concrete and asphalt within the northeast and northwest quadrants of the site;
- installation of groundwater monitoring wells and groundwater sampling;
- pre-excavation soil investigation for waste characterization and to refine excavation limits;
- excavation of contaminated soils in the northeast, northwest, and southeast quadrants;
- consolidation of arsenic contaminated soils from the Foxborough parcels and installation of an asphalt cover over the consolidation area; and
- site restoration and demobilization.

A total of 34,000 tons of soil was removed from the NE and NW quadrants and 9,500 tons of soil was removed from the SE quadrant for off-site disposal as non-hazardous waste.

Buffer zone planting was initially completed in the fall of 2010 and then monitored for the first year after planting. Replanting of some trees was determined to be needed and was conducted in September 2011. Final inspection of the remedy construction occurred in September 2011.

Operation and maintenance of the remedy is currently being performed as described below. Institutional controls, as required by the ROD and ESD, are being prepared, but have not yet been implemented.

### 4.3 OPERATION AND MAINTENANCE

Operation and maintenance (O&M) of the remedy for the Hatheway & Patterson Site is being performed in accordance with the ROD and the O&M Manual (USEPA, 2011b). MassDEP is the lead agency performing O&M of the site.

The ROD required long-term monitoring of groundwater, surface water, fish tissue and sediment and operation and maintenance of the low-permeability cover. The monitoring frequencies and timing were described in the ROD as follows: 1) annual monitoring of sediment and surface water until completion of the first five-year review; 2) one round of fish tissue sampling in conjunction with the five-year review; and 3) sampling of on-site and off-site groundwater twice a year, every other year, until the first five-year review and continued monitoring after the five-year review in accordance with the O&M Manual to ensure that contaminated water is not impacting off-site receptors and to ensure protectiveness of the remedy. In addition to the monitoring schedule described in the ROD, the O&M Manual specifies annual monitoring of groundwater following the first five-year review and sampling of sediment, surface water, and fish tissue once every five years following the first five-year review. Maintenance activities required by the O&M Manual include inspections and maintenance of the asphalt cover, storm filter, catch basins and monitoring wells. Surface water sampling required by the ROD was not performed and frequency of sediment sampling was reduced due to EPA and MassDEP's agreement to continue discussions about the future operation and maintenance plan requirements for the site, as a result of changes to the remedy, which were documented in the ESD.

Inspections of the asphalt cover, storm filter, monitoring wells, and site security measures (fence, gates, locks, and signage) were conducted in May 2012, October 2012, April 2013, and November 2013 in conjunction with the groundwater monitoring events. No significant issues were noted.

To date, five rounds of groundwater monitoring were conducted since remedy construction: May 2011, May 2012, and October 2012, April 2013, and October/November 2013. Sediment monitoring was performed in May 2012 and a fish survey was conducted in June 2013. Monitoring activities were performed by subcontractors to MassDEP. A discussion of the monitoring results is provided in Section 6.3.

In addition to the sampling activities, a hydrogeological conditions report was prepared in 2013 (AECOM, 2013) which summarized the groundwater flow and groundwater quality data collected during the RI/FS, RD, and the RA. The report also presented recommendations for additional investigations and potential locations for new monitoring wells that may be needed to confirm that contaminated groundwater is not migrating beyond the site compliance boundary. A summary of the evaluation and resulting recommendations is provided in Section 6.3.1.

### 4.4 Institutional Controls

In order for the remedy at the Hatheway & Patterson Site to be protective in the long-term, institutional controls need to be created and recorded to restrict inappropriate land uses (including use of groundwater) and protect the consolidation area cover. The remedy is protective in the short-term, as there is no current use of on-site groundwater, and operation and maintenance activities ensure that the consolidation area and associated components of the remedy (e.g., groundwater monitoring wells) remain in good condition.

Implementation of institutional controls (ICs) in Massachusetts, namely the recording of Grants of Environmental Restrictions and Easements (GEREs), has been a continued challenge for EPA. The need to complete ICs has often been identified as an issue potentially impacting future protectiveness as part of five-year reviews at this and other Massachusetts sites. In an effort to address this issue and improve the process of completing ICs at Massachusetts NPL sites, EPA worked with the MassDEP to develop a new approach using Notices of Activity and Use Limitations (AUL Notices). This process involved first working with MassDEP to update and amend their regulations governing AULs (both Notices and GEREs) embodied in the Massachusetts Contingency Plan (310 CMR 40.0000). The MCP amendments published in May 2014 included new requirements allowing for use of AUL Notices at NPL sites. EPA and MassDEP are currently working on model documents and forms that will be used to implement AUL Notices. Once fully implemented, the overall process for IC implementation will be streamlined as AUL Notices do not require the signature of the MassDEP Commissioner nor do they require Subordination Agreements from those holding prior encumbrances on properties. Both of these requirements served to slow the GERE implementation process at many sites. EPA and MassDEP will work together to determine whether specific circumstances at sites still require GEREs or whether the new AUL Notices can be used instead. This new approach to ICs in Massachusetts should allow EPA to complete these activities more quickly and efficiently and implement ICs at the site within a reasonable timeframe. Implementation of the necessary Hathaway & Patterson ICs will be follow the above approach.

## SECTION 5.0
## PROGRESS SINCE THE LAST FIVE YEAR REVIEW

This is the first five-year review for the Hatheway & Patterson Site.

# SECTION 6.0
# FIVE-YEAR REVIEW PROCESS

This section describes the activities performed during the five-year review process and provides a summary of findings. The Hatheway & Patterson Superfund Site Five-Year Review was led by Kimberly White of the U.S. EPA, Remedial Project Manager for the Site, and Emily Zimmerman, the Community Involvement Coordinator (CIC). Gary Waldeck, of the MassDEP, assisted in the review as the representative for the support agency.

The review, which began in February 2014, consisted of the following components:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection; and Five-Year Review Report Development and Review.

## 6.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

On February 13, 2014, EPA issued a press release announcing that EPA was beginning five-year reviews of 27 Superfund sites across New England, including the Hatheway & Patterson site. A similar press release will be issued by EPA once the five-year reviews are complete.

## 6.2 DOCUMENT REVIEW

This five-year review included a review of relevant documents for the site including the ROD, the 2011 ESD, the Remedial Action Completion Report, and site groundwater and sediment monitoring data as presented in various reports prepared by MassDEP's contractors. See Appendix B for a list of documents that were reviewed and other references.

## 6.3 DATA REVIEW

As noted in Section 4.2.3, there have been a number of field monitoring efforts since the remedial action was completed. These results are summarized in this section. A summary of the site hydrogeology, the results of three rounds of groundwater monitoring, one round of sediment monitoring, and a fish survey performed by subcontractors for MassDEP are also provided in this section. Surface water sampling was not conducted during the five year review period due to EPA's and MassDEP's agreement to continue discussions about the future operation and maintenance plan requirements for the site following completion of the ESD in 2011.

In addition to monitoring required in the ROD and O&M Plan, several off-site private wells were sampled. These wells were identified during a review of information from the Mansfield Board of Health during preparation of a hydrogeologic conditions report in 2013 (discussed below), and were determined to be used either for irrigation or for industrial purposes.

### 6.3.1 Hydrogeology

A hydrogeological conditions report was prepared in 2013 (AECOM, 2013) which summarized the groundwater flow and groundwater quality data collected during the RI/FS, the RD, and the RA. The report also presented recommendations for additional investigations and potential locations for new monitoring wells that may be needed to confirm that contaminated groundwater is not migrating beyond the site compliance boundary. For reference, the compliance boundary defined in the 2005 ROD is the property boundary on the south side of the site, the Rumford River backwash channel on the west side of the site, and the Rumford River on the north side of the site. Figure A-1 in Appendix A presents

monitoring locations discussed in this section.

Groundwater generally flows to the west-southwest, toward the backwash channel (see Figures 2 and 3 in Appendix A, originally from the RI report). The piezometric surface map indicates that if site contaminants were going to migrate beyond the compliance boundary, they would most likely do so along the backwash channel on the west side of the site. Although migration of contaminated groundwater beyond the compliance boundaries on the north and south sides of the site is less likely, those possibilities are also discussed below.

**Flow to the North.** The compliance boundary to the north of the site is the Rumford River. Groundwater flow to the north is not indicated by the available piezometric surface data. Furthermore, the Rumford River is a major discharge feature, and it is reasonable to anticipate that groundwater would not flow beneath it to the north or northwest unless there were a pumped well or other groundwater "sink" in that direction. No such "sinks" are known to exist in that direction. Furthermore, the absence of contamination in MW-107 and MW-107R, which are west of the site but north of the Rumford River, suggests that plumes are not migrating past the compliance boundary on the north side of the site.

**Flow to the West/Southwest.** The compliance boundary to the west of the site is the backwash channel. This stream and wetland area appears to be a groundwater discharge zone, and it is reasonable to anticipate that groundwater would not flow beneath it and continue flowing to the west or southwest unless a pumped well or other groundwater "sink" existed in that direction.

The available information suggests that groundwater flow beyond the backwash channel is unlikely under natural conditions. However, a review of a list of private wells from the Mansfield Board of Health (BOH) indicated that three of the parcels on Highland Avenue have permits for "domestic auxiliary" (DA) water wells (see Figure 5 in Appendix A). The existence of two of these wells was confirmed during the site inspection. The well at 136 Highland Avenue is a driven point and is 12 feet deep, according to the owner. Although the well at 132 Highland Avenue is completely below ground and therefore not visible, it is suspected to be of similar construction. Shallow driven well points are probably less likely than bedrock wells to pull contaminated groundwater beneath the backwash channel since, unlike overburden wells, bedrock wells could be connected to the groundwater beneath the backwash channel by discrete fractures that could act as preferential pathways. Nonetheless, with heavy prolonged use during the dry season, the possibility cannot be discounted that the shallow well points could create gradients that would cause groundwater to cross beneath the compliance boundary.

The existence of the third possible well on Highland Avenue could not be confirmed. Figure 5 in Appendix A also shows four DA wells farther to the west, beyond the wells on Highland Avenue. Three of these wells have been confirmed not to exist, and the owner of the fourth property with a possible well did not respond to EPA's inquiries. In June 2014, EPA collected groundwater samples from the two wells on Highland Avenue. The results are discussed in Section 6.3.2.

While movement of groundwater beyond the backwash channel/compliance boundary in response to groundwater withdrawals from the wells on Highland Avenue is possible, the absence of contamination in MW-109R suggests that a plume is not migrating past the backwash channel to the north of those wells. If additional wells are to be installed to investigate possible migration beyond the compliance boundary, the wells should be located opposite the MW-111 and MW-113 well clusters (see Figure A-1 in Appendix A), where moderate to high concentrations of PCP have been recently detected and where there are currently no monitoring wells west of the compliance boundary.

**Flow to the South.** Prior to the early to mid-1950's, the backwash channel was the course of the Rumford River as it flowed south and crossed what is now Howe Street, Chauncy Street (Rt. 106), and the main railroad tracks south of the site. Sometime between 1951 and 1956, at approximately the same time that wood treatment operations began at the site, the Rumford River was diverted west into a new channel, and the backwash channel became a backwater and wetland. It is assumed that the former riverbed between the site and the railroad tracks south of Rt. 106 was filled with soil, and that no underdrains were placed in the filled channel. As a result, water levels would have risen in the filled area

between Howe Street and Rt. 106, and the backwash channel would have been forced to drain to the north into the new Rumford River channel. An aerial photograph of this area from 1977, which shows ponding of water at the southern end of the backwash channel, supports this conclusion, as does the observation of northwestward flow in the backwash channel during a site visit in 2010 and during the recent site inspection. Higher groundwater levels to the south would have prevented movement of plumes in that direction, so it is unlikely that contaminated groundwater would have flowed south from the site.

The review of the list of private well records from the Mansfield BOH indicated the possible presence of non-drinking water industrial/commercial auxiliary (ICA) and domestic auxiliary (DA) supply wells to the south of the site (see Figure 5 in Appendix A). The four wells that are closest to the site are listed as follows: 18 Thomas Street, ICA well for a laundry facility; 46 Chauncy Street, DA well for a car wash; 325 N. Main Street, DA well for irrigation; and 17 Pratt Street, no permit and use unknown. During the recent site inspection, the existence of three of these wells was confirmed. The well at 18 Thomas Street is reportedly a gravel-packed overburden well about 35 feet deep (used for laundry business); the well at 46 Chauncy Street is reportedly a bedrock well about 800 feet deep (used for car wash, “fracked” to increase yield); and the well at 325 North Main Street is a driven point (used for lawn irrigation). In addition, it was learned that permanent dewatering systems exist at the two railroad underpasses at Route 106 and North Main Street. While the three confirmed wells and the Route 106 underpass are about 1,000 feet from the site and do not appear to be downgradient, samples were collected by EPA in June 2014 to confirm that site contaminants are not following an unlikely pathway to the south in response to the combined pumping. The underpass at North Main Street is also not believed to be downgradient of the site; furthermore, the water from the dewatering system is discharged to the backwash channel wetland, which would tend to limit the effect of the dewatering at the site. Sampling results are discussed in Section 6.3.2.

### 6.3.2 Groundwater Monitoring Results

Groundwater monitoring for remedy compliance has been performed multiple times since completion of remedy construction: May 2011, May 2012, October 2012, April 2013, and October/November 2013. Locations both inside and outside the compliance boundary have been selected for this long-term compliance monitoring. Figure A-1 in Appendix A presents the locations sampled during the events. It should be noted that an apparent field error resulted in a sample being incorrectly collected from an interior well (RCA-8) rather than the planned perimeter well (RCA-9) in the two 2012 monitoring rounds.

Analyses included the three analytes which have performance standards established in the ROD: PCP, arsenic, and chromium. Maximum Contaminant Levels (MCLs) were identified in the ROD as groundwater performance standards at the site compliance boundary. As dioxins are a known site contaminant, dioxin congeners (forms of dioxin differing only in the number and location of chlorine atoms) were also analyzed and compared to the dioxin MCL (following conversion to a dioxin toxicity equivalency [TEQ]). Appendix C presents results from each monitoring round, as well as a summary table (Table C-1) compiling the monitoring rounds along with historical results for comparison purposes. As shown in this table, there have been no exceedances of compliance boundary performance standards in the wells located beyond the compliance boundary. However, detection limits for PCP in the 2012 monitoring events exceeded the performance standard. Other monitoring rounds did not show detections of PCP in these wells with lower detection limits. There were detections of the four analytes in interior wells, but no exceedances of on-site performance standards established for protection of surface water.

As described in the previous section, non-potable DA/private wells were sampled for metals, PCP and dioxins in June 2014. Figure 6 in Appendix A shows the location of the wells sampled. The monitoring event summary memorandum and analytical data are presented in Appendix C. The results showed no exceedances of MCLs for metals or dioxin. There was only one PCP detection (2.7 µg/L), but this detection was also above the MCL (1 µg/L). Based on a brief review of this non-potable well (shallow) and its location relative to the site, the detection is not likely site-related. In addition, there were no detections above MCLs in the other wells in the same area. However, further investigation/evaluation will be performed to confirm this.

### 6.3.3 Sediment Monitoring Results

The 2005 ROD included annual sediment monitoring prior to the first five-year review as part of the long-term monitoring to document conditions at and near the site. Monitoring was performed in May 2012 at four locations in the Rumford River (see Figure 1 included in Appendix C). These four sampling locations were different from the sampling locations used prior to the remedial action. Some or all of the previous locations were inaccessible during the May 2012 sampling event due to modifications of the riverbank made during the remedial action. Similar to the groundwater monitoring, samples were analyzed for dioxins, PCP, arsenic, and chromium. Appendix C presents results from the monitoring event, as well as a summary table (Table C-3). As there were no sediment performance standards in the ROD or ESD, the table presents historical statistical data (e.g., maximum detections) from the 2004/2005 risk assessments for comparison purposes. All detections in the 2012 monitoring event were below the historical maximum detections, except for one dioxin congener (1,2,3,7,8,9-HxCDF). Further discussion of these results as they relate to the risk assessments can be found in Section 7.2. Only one round of sediment sampling was conducted before this five year review due to MassDEP's interpretation of the monitoring requirements described in the Operations and Maintenance Plan. MassDEP and EPA will determine the locations and frequency of any additional sediment samples to be obtained before the next five year review.

### 6.3.4 Fish Survey

The 2005 ROD recommended a round of fish tissue sampling to be performed in conjunction with the five-year review. A fish survey was conducted during June 2013 at three locations along the Rumford River. The sampling procedures and results are summarized in a report prepared by Environmental Strategies and Management, Inc., dated October 1, 2013 (ESM, 2013). The report documents that no fish were collected in Area 1, which was a reference area located upstream of the site. In both Area 1 (reference) and Area 2 (on site between County Street and the railroad tracks), only crayfish were collected, and no fish were observed. In the downstream area of the river (Area 3, located approximately 400 feet downgradient of the site, immediately upstream of where Henkes Brook flows into the Rumford River), a few crayfish and fish were observed as part of the survey. Fish samples were not collected at that time; however, EPA and MassDE P will determine what, if any, samples can be collected before the next five year review.

### 6.3.5 Surface Water Monitoring

Surface water sampling has not yet been implemented at the Site. However, on-site groundwater performance standards established to protect surface water have been monitored and have not been exceeded. Surface water monitoring is required under the 2005 ROD, and the O&M Manual was based on the remedy selected in the ROD; however, due to changes in the remedy outlined in the ESD (no on-site consolidation of PCP and arsenic contaminated soils in the Mansfield portion of the Site), MassDEP and EPA determined that the requirement to sample surface water would be further discussed. EPA and MassDEP will evaluate whether surface water sampling is necessary or whether monitoring of the groundwater performance standards is sufficient to determine impacts to surface water.

## 6.4 SITE INSPECTION

A site inspection was performed by the EPA Project Manager and AECOM on June 3, 2014. The MassDEP Project Manager was also present for part of the inspection. The inspection included cursory examinations of the site fences and gates; the asphalt cover on the Foxborough portion of the site that is used as a commuter parking lot; a subset of the site monitoring wells; and the Rumford River and its confluence with the backwash channel. The site inspection checklist and photographs from the site inspection are included in the Management System Review (MSR) Technical Memorandum in Appendix D.

The site was observed to be secure, and no evidence of trespassing or vandalism was noted. The NW Quadrant of the site is mostly covered with crushed rock except for a vegetated buffer along the Rumford River and a commuter parking lot for the Town of Foxborough in the extreme northwest corner. As described in the site inspection checklist, the parking lot is well maintained, and the fencing and gates that surround the entire NW and NE Quadrants of the site are in good condition (except for very minor damage to the stockade fence on the northwest side of the commuter lot).

The monitoring wells that were observed were locked and appeared to be in good condition. The compliance boundary on the southwest side of the site is the backwash channel, which is a vegetated marshy area and is difficult to traverse. Where observed near its confluence with the Rumford River, the amount of water in the backwash channel was miniscule, and no flow was observable. However, at the actual confluence, it was confirmed that the trickle of flow in the channel was moving northwest and discharging to the river. The wells along the compliance boundary had been sampled several weeks before the site inspection and were found to be in good condition, and therefore were not inspected.

### 6.5 INTERVIEWS

Representatives of the Town of Mansfield DPW and the Town of Foxborough, and the MassDEP Project Manager each responded to a request for an interview by providing written responses to a series of interview questions. Appendix E includes a detailed summary of the interviews. In general, representatives from both towns were very pleased with the work conducted at the site. The town representatives stated that they have been well informed throughout the process and that they have no concerns. The representative from the Town of Mansfield would like to see the institutional controls implemented so that the town can move forward with potential reuse of the property. Town of Mansfield personnel periodically inspect the site. It was noted by the representative from Mansfield that, although vandalism has generally not been an issue at the site, a few fence cuts in the deep woods have been found. EPA has followed up with the town and is waiting for an update on the status of the repairs. The Project Manager for the MassDEP also stated that the project was a success, that he was well informed, and that he has no concerns.

# SECTION 7.0
# TECHNICAL ASSESSMENT

This section discusses the technical assessment of the remedy for the site and provides answers to the three questions posed in the EPA guidance for five-year reviews (USEPA, 2001).

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

**Yes.** The remedy resulted in the removal of soil to the ROD cleanup levels and/or on-site consolidation under a protective cover. Site related groundwater contaminants have not been detected beyond the compliance boundary at concentrations exceeding performance standards, nor on-site at concentrations exceeding performance standards established to protect surface water. However, institutional controls, as required under the ROD and ESD, have not been established yet.

The groundwater monitoring program may be modified via recommendations presented in the recent hydrogeological evaluation report (AECOM, 2013; see Section 6.3.1).

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

**No.** EPA's dioxin reassessment has been developed and undergone review for many years, with the participation of scientific experts in EPA and other federal agencies, as well as scientific experts in the private sector and academia. The Agency followed current guidelines and incorporated the latest data and physiological/biochemical research into the reassessment. On February 17, 2012, EPA released the final human health non-cancer dioxin reassessment, publishing an oral non-cancer toxicity value, or reference dose (RfD), of $7x10^{-10}$ mg/kg-day for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in EPA's Integrated Risk Information System (IRIS). The dioxin cancer reassessment will follow thereafter. The dioxin RfD was approved for immediate use at Superfund sites to ensure protection of human health.

These changes do not affect the current protectiveness of the remedy. However, institutional controls will now also be required along the railroad right-of-way due to changes in toxicity values (see below).

### 7.2.1 Review of Human Health Risk Assessment

The baseline human health risk assessment performed in 2005 (M&E, 2005) concluded that there would be significant risk to human health if groundwater from the site containing VOCs, SVOCs, dioxins, and metals was used as a potable water supply in the future. The risk assessment further determined that the following exposures to site soil exceeded EPA risk management guidelines:

- Adolescent trespasser, due primarily to arsenic in surface and subsurface soil;
- Town worker, due primarily to arsenic in surface soil;
- Commercial worker, due primarily to dioxin and arsenic in surface soil, and pentachlorophenol and arsenic in subsurface soil;
- Utility worker, due primarily to arsenic in surface soil; and
- On-site resident (Foxborough only), due primarily to dioxin, arsenic, and chromium in surface soil, and pentachlorophenol and arsenic in subsurface soil.

While there were no exceedances of EPA's risk management guidelines due to exposures of site surface water and sediment, it was noted in the 2005 ROD that, for the surface water and groundwater dermal contact pathways, risk associated with dermal absorption could not be quantified for all contaminants (due to lack of chemical-specific dermal absorption factors). This uncertainty was noted as something that needed to be periodically reviewed as changes in dermal exposure assessment occurred.

MCLs were selected as compliance boundary groundwater performance standards for pentachlorophenol, arsenic, and chromium. Additional onsite groundwater performance standards for the

protection of surface water were developed based on Massachusetts ambient water quality criteria and dilution associated with groundwater and river discharge. Risk-based soil cleanup levels were developed based on site-specific exposure assumptions used in the human health risk assessment.

The 2005 ROD also noted that soil exposures within the area of the existing railroad right of way would be evaluated during design, with appropriate action being implemented as necessary. This evaluation was performed by EPA initially in 2007, using existing site data, and then updated in 2011 using data collected in 2010 during the remedial action (Sevenson, 2011). The results indicated that risks were within the acceptable risk range in the railroad right of way and that, therefore, deed restrictions were not required. The 2011 ESD recommended a review of this risk evaluation during the five-year review. EPA completed this review in June 2014 utilizing updated toxicity information, and determined that the potential estimated exposure exceeds the acceptable level of 1 for hazard index, but that the exposure scenario is unlikely to occur at the railroad right-of-way. Details of the review are provided in the June 2014 memo in Appendix F. The implementation of institutional controls regulating land use in the railroad right-of-way is necessary to assure that construction and utility worker exposures do not occur in the future.

The 2011 ESD included a change in the anticipated future land use on the Foxborough parcel, from "residential" to "limited industrial" zoning, with the property being used as a parking facility. This change resulted in a reevaluation of the arsenic cleanup level designated in the 2005 ROD. It was concluded that the cleanup level being used for the rest of the site (for commercial/open space areas) was also protective for the Foxborough parcel.

In this five-year review report, the toxicity values that served as the basis for the soil cleanup levels, as contained in the 2005 ROD, have been re-evaluated to determine whether any changes in toxicity impact the protectiveness of the remedy. Changes in toxicity values since the 2005 risk evaluation are also discussed to determine whether reuse decisions remain valid. Any changes in current or potential future exposure pathways or exposure assumptions that may impact remedy protectiveness are also noted. In addition, environmental data, available since the 2005 ROD and implementation of the remedy, have been qualitatively evaluated to determine whether exposure levels existing at the site present a risk to current human receptors.

**Changes in Toxicity**

Table 2 presents a summary of the changes in toxicity values (oral reference doses and oral cancer slope factors) for compounds selected as COPCs as identified in the 2005 risk assessment. Updated toxicity information was obtained from the Integrated Risk Information System (USEPA, 2014a) and other current EPA sources (e.g., the Superfund Health Risk Technical Support Center). Note that an increase in an oral reference dose will decrease the resulting hazard quotient, while an increase in an oral slope factor will increase the resulting cancer risk.

For most contaminants, any changes to toxicity information have been minimal and most would not have any impact on selected site Contaminants of Concern (COCs) or remedy protectiveness. It should be noted that not all site COCs (i.e., analytes which exceeded EPA's risk criteria) were utilized when developing performance standards to protect receptors outside of the groundwater compliance boundary. Therefore, although 1,1'-biphenyl would have been selected as a COC based solely on changes in toxicity values, it would likely not have been used to set a performance standard. Furthermore, groundwater performance standards were developed based either on water quality standards or federal MCLs, so changes to toxicity values would not impact the performance standards.

With respect to soil, if chromium at the site is evaluated as hexavalent chromium (typical unless speciation or other justification is available), it would also have been selected as a COC based on the changes in toxicity values. It was likely co-located with the other soil COCs which were remediated (either excavated or covered), which would therefore not impact remedy protectiveness.

A noteworthy change between 2005 and 2014 toxicity values is for dioxin. EPA's dioxin reassessment has been developed and undergone review for many years, with the participation of scientific experts in EPA and other federal agencies, as well as experts in the private sector and academia. The Agency followed current guidelines and incorporated the latest data and physiological/biochemical research into the reassessment. On February 17, 2012, EPA released the final human health non-cancer dioxin reassessment, publishing an oral non-cancer toxicity value, or RfD, of $7x10^{-10}$ mg/kg-day for TCDD in EPA's IRIS database. The dioxin cancer reassessment is ongoing. The dioxin RfD was approved for immediate use at Superfund sites to ensure protection of human health. While dioxin was already a COC in groundwater and soil (based on cancer risk), the new oral reference dose would have also resulted in a hazard quotient above 1 for a nearby resident wading in the Rumford River, based on sediment exposure. The sediment exposure point concentration (EPC) used for dioxin TEQ (toxicity equivalency) in 2005 was 1,641 ng/kg. The maximum dioxin TEQ resulting from sediment detections in 2012 was 173 ng/kg (see Appendix C), which results in a hazard quotient equal to 1 when applying the site-specific parameters utilized in the 2005 Human Health Risk Assessment (HHRA). Therefore, the remedy is still considered protective.

In addition, based on a compilation and review of data on relative bioavailability of arsenic in soil (USEPA, 2012), arsenic was found to be less bioavailable via soil ingestion relative to other analytes. A default value of relative bioavailability (RBA) of 60% is now applied during soil/sediment ingestion calculations of risk/cleanup levels. This default RBA value reduces arsenic contribution to risk and/or increases arsenic cleanup levels. The remedy remains protective with respect to arsenic exposures.

**Table 2: Comparison of 2005 and 2014 Oral Reference Doses and Oral Cancer Slope Factors for Compounds of Potential Concern**

| Contaminant of Potential Concern | Oral Reference Dose (RfD) (mg/kg-day) | | Oral Slope Factor (SF) $(mg/kg\text{-}day)^{-1}$ | |
|---|---|---|---|---|
| | 2005 | 2014 | 2005 | 2014 |
| 1,1,2-Trichloroethane | 0.004 | 0.004 | 0.057 | 0.057 |
| 1,2-Dichloroethane | 0.02 | 0.006 | 0.091 | 0.091 |
| Trichloroethene | 0.0003 | 0.0005 | 0.4 | 0.046 |
| Vinyl chloride (a) | 0.003 | 0.003 | 0.75 | 0.72 |
| Xylenes (total) | 0.2 | 0.2 | N/A | N/A |
| 1,1'-Biphenyl | 0.05 | 0.5 | N/A | 0.008 |
| 2,3,5,6-Tetrachlorophenol | 0.03 | 0.03 | N/A | N/A |
| 2,4,6-Trichlorophenol | 0.0001 | 0.001 | 0.011 | 0.011 |
| 2,4-Dinitrophenol | 0.002 | 0.002 | N/A | N/A |
| 2,6-Dinitrotoluene | 0.001 | 0.0003 | 0.68 | 1.5 |
| 2-Methylnaphthalene | 0.004 | 0.004 | N/A | N/A |
| 4,6-Dinitro-2-methylphenol | 0.0001 | 0.00008 | N/A | N/A |
| Acenaphthene | 0.06 | 0.06 | N/A | N/A |
| Acenaphthylene (c) | 0.02 | 0.06 | N/A | N/A |
| Acetophenone | 0.1 | 0.1 | N/A | N/A |
| Atrazine | 0.035 | 0.035 | 0.22 | 0.23 |
| Benzo(a)anthracene | N/A | N/A | 0.73 | 0.73 |
| Benzo(a)pyrene | N/A | N/A | 7.3 | 7.3 |
| Benzo(b)fluoranthene | N/A | N/A | 0.73 | 0.73 |
| Benzo(k)fluoranthene | N/A | N/A | 0.073 | 0.073 |
| Bis(2-ethylhexyl)phthalate | 0.02 | 0.02 | 0.014 | 0.014 |
| Chrysene | N/A | N/A | 0.0073 | 0.0073 |

| Contaminant of Potential Concern | Oral Reference Dose (RfD) (mg/kg-day) | | Oral Slope Factor (SF) (mg/kg-day)$^{-1}$ | |
|---|---|---|---|---|
| | 2005 | 2014 | 2005 | 2014 |
| Dibenz(a,h)anthracene | N/A | N/A | 7.3 | 7.3 |
| Dibenzofuran | 0.002 | 0.001 | N/A | N/A |
| Fluorene | 0.04 | 0.04 | N/A | N/A |
| Indeno(1,2,3-cd)pyrene | N/A | N/A | 0.73 | 0.73 |
| Naphthalene | 0.02 | 0.02 | N/A | N/A |
| Pentachlorophenol | 0.03 | 0.005 | 0.12 | 0.4 |
| Phenanthrene (c) | 0.02 | 0.03 | N/A | N/A |
| 2,3,7,8-TCDD (Dioxin TEQ) | N/A | 7E-10 | 1.5E+05 | 1.56E+05 |
| Antimony | 0.0004 | 0.0004 | N/A | N/A |
| Arsenic | 0.0003 | 0.0003 | 1.5 | 1.5 |
| Barium | 0.07 | 0.2 | N/A | N/A |
| Cadmium (food) | 0.001 | 0.001 | N/A | N/A |
| Cadmium (water) | N/A | 0.0005 | N/A | N/A |
| Chromium | 0.003 | 0.003 | N/A | 0.5 |
| Lead (b) | N/A | N/A | N/A | N/A |
| Manganese (drinking water) | 0.024 | 0.024 | N/A | N/A |
| Manganese (diet) | 0.07 | 0.14 | N/A | N/A |
| Mercury | 0.0001 | 0.0001 | N/A | N/A |
| Thallium | 0.00008 | 0.00001 | N/A | N/A |
| Vanadium | 0.001 | 0.005 | N/A | N/A |
| Zinc | 0.3 | 0.3 | N/A | N/A |

N/A = Not Applicable or Not Available
a. Vinyl chloride has toxicity values for both adult and child to account for mutagenic mode of action (see discussion below). Toxicity values presented in table are for adult receptors.
b. Lead is currently evaluated through the use of exposure modeling for adults and children.
c. Naphthalene was used as a surrogate in the 2005 HHRA. Based on toxicity changes since that time, it would be considered more appropriate to use acenaphthene as a surrogate for acenaphthylene and pyrene as a surrogate for phenanthrene due to structural similarities.

**Changes in Exposure Pathways/Assumptions**

Since the 2005 HHRA, the Foxborough parcel was rezoned such that residential use is no longer applicable (it is now a parking facility). The 2011 ESD changed the cleanup levels for this parcel to be similar to the rest of the site (commercial/open space). No other changes in land use have occurred on or near the site since the 2005 HHRA. Therefore, the land use assumptions used in the risk assessments continue to be valid for the site. However, the implementation of institutional controls regulating land use is necessary to assure that land use changes resulting in more intense human exposures than under current conditions do not occur in the future.

The consolidation area cover on the Foxborough parcel remains intact, based on recent inspections. Because contamination is present beneath the cover, prevention of a complete exposure pathway between human receptors (e.g., commuters) and subsurface contamination is necessary. Continued maintenance of the cover is required to assure that human exposure to the covered material does not occur.

**Changes in Risk Assessment Methodology/New Guidance**

A new method to evaluate compounds with mutagenic modes of action such as the carcinogenic PAHs and vinyl chloride, which was not in use in 2005, is now recommended by EPA. The current methodology calls for the use of age-specific adjustment factors to account for an increased sensitivity during early life. Vinyl chloride also has a unique set of exposure equations to account for early-life exposures with a separate set of toxicity values for adult and child. The early-life calculation does not affect the conclusions of the 2005 evaluation for the commercial scenario (the land use which was utilized to define cleanup levels), because workers are assumed to be greater than 16 years of age for which the early-life component is not applicable. The 2005 evaluation showed that the cancer risk for the adolescent trespasser scenario was less than that for the commercial worker scenario. However, as noted above, the supplemental early-life calculation for child trespassers was not included as part of the 2005 evaluation. A supplemental calculation that included the early-life component for carcinogens with mutagenic modes of action, performed as part of this five-year review, confirmed the conclusion that adolescent trespasser cancer risk is less than the commercial worker risk. Therefore, the conclusions of the 2005 supplemental risk evaluation continue to be valid. Institutional controls, as required by the ROD and ESD, should be implemented to assure that future use of the site is consistent with the commercial land use assumptions used in the 2005 risk evaluation, and that adolescent exposures of greater frequency and intensity than assumed for trespassing (78 days per year for 10 years) do not occur. The implementation of comprehensive institutional controls, as required by the ROD and ESD, is on-going, and when complete, will provide long-term protectiveness for soil and groundwater remedies.

A recent EPA directive (USEPA, 2014b) was published which provides revised default exposure parameter assumptions for various exposure scenarios. Many of these parameters differ from those utilized in the 2005 site-specific HHRA. Most are related to residential exposures, which would not impact the protectiveness of the remedy. There are, however, changes to the worker soil adherence factor (reduction from 0.2 to 0.12 mg/cm-day), the worker skin surface area (increase from 3,300 $cm^2$ to 3,470 $cm^2$), and the worker body weight (increase from 70 to 80 kg). These changes result in an increase in the cleanup levels which would provide the same level of Reasonable Maximum Exposure (RME) risk as defined in the ROD. However, when the new toxicity values (see above) are also incorporated, the cleanup levels for dioxin (due to non-cancer hazards) and pentachlorophenol would actually be reduced. The following table shows the residual risk associated with the ROD cleanup levels (which were used during the remedial action) using the current toxicity values, recommended arsenic RBA of 60%, and updated exposure parameters:

**Table 3. Soil Cleanup Levels (Commercial/Open Space)**

| Compound | ROD Cleanup Level (ppm) | Risk-Level (established in the ROD) | Risk-Level (using current toxicity values and exposure parameters) | Hazard Quotient (using current toxicity values and exposure parameters) |
|---|---|---|---|---|
| Benzo(a)pyrene | 2.1 | $1 \times 10^{-5}$ | $7 \times 10^{-6}$ | N/A |
| Dioxin TEQ | 0.001 | $6 \times 10^{-5}$ | $5 \times 10^{-5}$ | 1* |
| Arsenic | 16 | $1 \times 10^{-6}$ | $5 \times 10^{-6}$ | 0.03 |
| Pentachlorophenol | 90 | $1 \times 10^{-5}$ | $2 \times 10^{-5}$ | 0.03 |
| Residual Risk | | $9 \times 10^{-5}$ | $8 \times 10^{-5}$ | |

* The HQ value of 1 is rounded down from HQ of 1.4.In addition, after remediation a 6” soil cover was placed across the site in areas not excavated.

The residual risk remains within EPA’s target risk range.

No other changes to dermal exposure assessment have occurred which would change the protectiveness of the remedy.

**Evaluation of Railroad Right-Of-Way**

A review of the railroad right-of-way evaluations performed by EPA in 2007 and 2011 (Sevenson, 2011) was performed as part of this five-year review, incorporating the toxicity value and exposure parameter changes listed above. Using the 2010 soil data collected in the railroad right-of-way (see Figure 4.1 in Appendix F), EPCs were established and used in risk calculations for a utility worker, using the current toxicity values, arsenic RBA of 60%, and updated exposure parameters described above (see Appendix F). The utility worker scenario was deemed the most appropriate for the active railroad right-of-way given the fact that any intrusive work in the area is limited and carefully controlled by the railroad company. The calculations resulted in a cancer risk of 1E-5, which is within EPA's target risk range. There is currently no utility work being conducted in the railroad right-of-way so the remedy remains protective in the short term. However, the non-cancer hazard index of 5 for utility worker (due primarily to applying the new dioxin RfD) exceeds EPA's target hazard index of 1. The utility worker results show that institutional controls, as required by the ROD and ESD, should also be applied to this area to protect future utility workers.

**Evaluation of Recent Sampling Data**

As noted in Section 6.3.2, there have been no exceedances of groundwater performance standards for site related contaminants beyond the compliance boundary in site monitoring wells. There is no evidence at this time showing that the groundwater remedy is not protective. However, as discussed in Section 6.3.1, improvements to the groundwater monitoring network have been recommended. While there was one private well detection of PCP above its MCL, based on a brief review of this well (shallow) and its location relative to the site, the detection is not likely site-related. However, further investigation/evaluation may be necessary to confirm this.

As discussed in Section 6.3.3, 2012 sediment detections were all below the maximum historical detections of the same analytes, except for one dioxin congener (1,2,3,7,8,9-HxCDF) (see Table C-3 in Appendix C). While there were two detections of arsenic above the 95% Upper Confidence Limit (UCL) from the HHRA, which was used as the RME scenario EPC, these concentrations would not have changed the HHRA conclusions regarding sediment risk. However, as the locations sampled in 2012 may not correspond with the historical locations which provided the maximum concentrations used in the HHRA, it may be appropriate to include additional monitoring locations in future sampling efforts to determine if those higher concentrations remain in the river.

While surface water monitoring data was not collected during the five years since remedy construction, on-site groundwater concentrations have not been detected at levels above performance standards developed to be protective of surface water.

### 7.2.2 Review of Ecological Risk Assessment

The baseline ecological risk assessment (BERA) (Lockheed Martin, 2004) performed for the site was based on data collected during the remedial investigations (RI). The media of concern were surface water, sediments, and aquatic biota in the Rumford River. Due to the lack of habitat in contaminated soil areas, soils were not evaluated in the BERA for risk to terrestrial receptors due to a lack of a complete exposure pathway. The conclusion of the BERA was that benthic invertebrates, water column invertebrates, fish, piscivorous birds and mammals feeding along the Rumford River are unlikely to be at a substantial risk from exposure to site-related contaminants. Based on the results of the risk assessment, the remedy did not include clean-up in the Rumford River, but recommended long-term monitoring of groundwater, surface water, sediment, and fish tissue in order to confirm that groundwater is not migrating off-site or adversely impacting the Rumford River above acceptable levels. Monitoring of sediment and surface water was to be continued annually to ensure that contaminated groundwater is not impacting off-site receptors and to ensure the protectiveness of the remedy.

The BERA was conducted using methodology which would generally comply with current EPA risk assessment guidance. The minor discrepancies between current guidance and previous guidance exist in the areas of benchmarks and toxicity values utilized. For most contaminants, changes to toxicity information have been minimal. There have been minor changes in National Ambient Water Quality Criteria (NAWQC) since 2005. The NAWQCs were used as screening values (mainly metals and pentachlorophenol) to select COCs in the BERA for surface water in the Rumford River. The NAWQCs for metals used in the BERA were not adjusted for hardness in the river and the analytical data for inorganics represented unfiltered metals which were not corrected to represent the dissolved fraction. However, the selection of COCs would not have been different in the BERA if these adjustments had been made, since all of the hardness-dependent inorganics that were likely to be site-related were selected as COCs during the screening process, with the exception of copper.

The only change in NAWQCs relevant to the site was the change in the basis of the copper standard in 2007 with the adoption of the Biotic Ligand Model (BLM)-based criterion. The BLM is a metal bioavailability model that uses receiving water body characteristics to develop site-specific freshwater aquatic life criteria (USEPA, 2007). The BLM requires ten input factors, and these data were not all collected in the surface water of Rumford River, so the site-specific value could not be calculated from the data provided in the BERA. However, the selection of copper as a COC in surface water would not have changed the conclusions of the BERA, or the protectiveness of the remedy. Additional measurement endpoints, including toxicity testing, were utilized to evaluate surface water toxicity, and were the primary basis for determination in the BERA that there were not significant risks to aquatic receptors in the river.

The selection of COCs in sediment was based on screening that is generally consistent with methodology and benchmarks currently used in ecological risk assessments and consistent with guidance.

Dioxins and furans were major COCs of concern evaluated in the BERA. All of the methods used in the BERA were generally consistent with current guidance (USEPA, 2008). In the BERA, the concentrations of individual dioxin and furan congeners in surface water, sediments and aquatic biota were measured and multiplied by published toxic equivalence factors (TEFs) for fish, birds and mammals. The TEFs were summed to calculate receptor-specific toxic equivalent (TEQ) values for use in the exposure calculations. The BERA used toxicity reference values (TRVs) and critical body residues that were conservative. More recent data, particularly for mink (piscivorous mammal), have indicated that the TEQ method and TRVs used in the BERA are likely to over-estimate reproductive effects (Moore et al., 2012; Blankenship et al., 2008). Exceedance of the TRVs used in the mink food-chain models would not necessarily be expected to lead to adverse effects. The BERA concluded that there was no significant risk to piscivorous mammals (mink) expected based on the conservative analysis and TRVs utilized; consequently, the remedy is considered protective.

The ROD recommended monitoring of sediment and surface water be continued annually until completion of the first five-year review after construction of the remedy is completed in order to document conditions at and near the site. A round of fish tissue sampling was to be performed in conjunction with the five-year review as well. Although a fish survey was performed prior to this five-year review, no additional fish tissue data were collected, thus it could not be confirmed whether or not the concentrations of contaminants in fish continue to indicate negligible risk to fish populations.

Sediment monitoring was performed in May 2012 at four locations in the Rumford River. As discussed in Section 6.3.3, 2012 sediment detections were all below the maximum historical detections of the same analytes, except for one dioxin congener (1,2,3,7,8,9-HxCDF) (see Table C-3 in Appendix C).

In conclusion, since the BERA was prepared in 2005, there are no newly promulgated standards, relevant to the site, which bear on the protectiveness of the remedy. The reference values and exposure assumptions in the BERA were conservative and therefore protective. There are no major changes in site conditions or exposure assumptions upon which the risk assessment was based that would result in increased exposure or risk. Recent sediment sampling data from the Rumford River indicate that sediment COC concentrations detected in 2012, with the exception of one dioxin congener (1,2,3,7,8,9-HxCDF). Were below measurements evaluated for exposures in the BERA.

### 7.2.3 ARARs Review

A review of Applicable or Relevant and Appropriate Requirements (ARARs) was performed to check the impact on the remedy due to any changes in standards that were identified as ARARs in the ROD, newly promulgated standards for chemicals of potential concern, and TBCs (to be considered) that may affect the protectiveness of the remedy. Tables documenting the review of each ARAR, using the regulations and requirement synopses listed in the ROD as a basis, are presented in Appendix G. The evaluation included a determination of whether the regulation is currently ARAR or TBC and whether the requirements have been met. A discussion of the review is summarized below.

The 2005 ROD set forth the following ARARs for the selected remedy:

Location-Specific:

- Executive Order 11990 (Protection of Wetlands)
- Executive Order 11988 (Floodplain Management)
- Fish and Wildlife Coordination Act
- Resource Conservation and Recovery Act (RCRA)
- Endangered Species Act
- 310 CMR 10.00 - Massachusetts Wetlands Protection Regulations
- 321 CMR 10.00 - Massachusetts Endangered Species Act Regulations

Action-Specific:

- Clean Water Act (CWA)
- Rivers and Harbors Act of 1899
- Safe Drinking Water Act (SDWA)
- Resource Conservation and Recovery Act (RCRA)
- National Emission Standards for Hazardous Air Pollutants (NESHAPs)
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 314 CMR 9.00 - Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters
- 314 CMR 3.00 – Massachusetts Surface Water Discharge Permit Program
- 314 CMR 6.00 - Massachusetts Groundwater Quality Standards
- 310 CMR 22.00 - Massachusetts Drinking Water Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations
- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations

Additional policies, criteria, and guidance were identified in the ROD as TBC, including:

- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)
- EPA Risk RfDs, Carcinogen Assessment Group Potency Factors, and Carcinogenicity Slope Factors
- EPA Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils
- EPA Guidance: Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites
- Ontario Ministry of Environment and Energy Lowest and Severe Effect Levels (LELs and SELs) for Freshwater Sediments
- EPA Policy on Floodplains and Wetland Assessments for CERCLA Actions
- Massachusetts Threshold Effects Exposure Levels (TELs) and Allowable Ambient Air Limits - Annual (AALs)
- EPA Revised Alternative Cap Design Guidance Proposed for Unlined, Hazardous Waste Landfills in the EPA Region I
- EPA Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments

SDWA MCLs were selected as compliance boundary groundwater performance standards for pentachlorophenol, arsenic, and chromium. MCLs have not changed since the 2005 ROD for these contaminants. Additional onsite groundwater performance standards for the protection of surface water were developed for pentachlorophenol, arsenic, and chromium based on Massachusetts ambient water quality criteria and dilution associated with groundwater and river discharge. The ambient water quality criteria for these contaminants have not changed since the 2005 ROD. Cleanup levels for soil were risk-based and EPA's 1998 OSWER *Directive Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites*, which is no longer in effect, was specifically used in setting the soil cleanup level for dioxin. Section 7.2.1 addresses the potential impacts of changes in EPA toxicity values and addition of an RfD for dioxin since the 2005 ROD.

Vapor intrusion was evaluated in the baseline human health risk assessment consistent with the EPA's 2002 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. Any changes to the vapor intrusion guidance (once finalized) would be considered with respect to the institutional controls, as required by the ROD and ESD, and future building construction.

The requirements of many of the ARARs identified in the ROD were met during remedy construction.

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

**No.** There is no other information that calls into question the protectiveness of the remedy.

## SECTION 8.0
## ISSUES

Based on the activities conducted during this five-year review, the issues identified in Table 4 have been noted.

**Table 4: Issues**

| Issue | Affects Protectiveness (Y/N) | |
|---|---|---|
| | Current | Future |
| Institutional controls restricting land uses that may impact the protectiveness of the remedy (including preventing the use of groundwater, protecting the consolidation area cover and other components of the remedy) need to be established. Also, an updated risk evaluation shows that the railroad right-of-way will also require institutional controls to protect workers who may contact soil in that area. | N | Y |
| The 2012 sediment sampling event included locations which were not collected at the historic sampling locations and the results showed lower contaminant concentrations than seen previously. As a result, it is uncertain whether the higher concentrations historically seen remain at the Site. If the historic concentrations are still present, recent changes to toxicity values and exposure parameters included in risk evaluation for sediment may result in a future change to the protectiveness determination with respect to sediment exposure. | N | Y |
| The fish tissue collection required by the ROD was not performed due to a lack of fish in the Rumford River. Also, surface water sampling required by the ROD was not performed due to EPA and MassDEP's agreement to continue discussions about the future operation and maintenance plan for the site. | N | Y |
| Determine whether a PCP detection above its MCL in a private groundwater supply well is site-related. | N | Y |
| Active irrigation wells have been identified approximately 300 feet beyond the compliance boundary. Irrigation wells are not expected to create enough drawdown to induce groundwater to flow to them from the compliance boundary. An on-site monitoring well just east (upgradient) of the compliance boundary does indicate the presence of contamination at concentrations above performance standards. | N | Y |

## SECTION 9.0
## RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In response to the issues noted in Section 8.0 it is recommended that the actions listed in Table 5 be taken:

**Table 5: Recommendations and Follow-up Actions**

| Issue | Recommendations/ Follow-up Actions | Party Responsible | Oversight Agency | Milestone Date | Affects Protectiveness? (Y/N) | |
|---|---|---|---|---|---|---|
| | | | | | Current | Future |
| Institutional controls are not in place | Prepare documentation and record the AULs | EPA/ MassDEP | EPA | Aug 2019 | N | Y |
| Sediment sampling coverage is limited | If accessible, collect sediment samples from locations which correspond to historical sampling locations and assess the new data. | MassDEP | EPA | Dec 2018 | N | Y |
| Surface water and fish tissue not sampled | Review current site information, determine the need for and, if necessary, collect any additional data. Update/ document changes in the monitoring requirements accordingly. | EPA/ MassDEP | EPA | Dec 2018 | N | Y |
| PCP detection in a private well | Perform evaluation which potentially includes the following: determine if detection is real (potential resampling); review well construction and any potential hydrogeologic connection to the site; and review nearby potential sources. | EPA | EPA | Dec 2016 | N | Y |
| Active irrigation wells identified near compliance boundary. | Additional investigations should be conducted to confirm whether groundwater flow directions have been impacted by the irrigation wells. | EPA/ MassDEP | EPA | Dec 2015 | N | Y |

## SECTION 10.0
## PROTECTIVENESS STATEMENTS

The remedy at the Hatheway & Patterson Superfund Site currently protects human health and the environment because remediation of soil (soil removal and on-site consolidation) has been completed to cleanup levels that are considered protective for the anticipated future use of the property, and there is no current use of on-site groundwater which is classified as non-potable. However, in order for the remedy to be protective in the long-term, institutional controls need to be created and recorded to restrict inappropriate land uses (including use of groundwater) and protect the consolidation area cover. Operation and maintenance activities have been initiated and will ensure that the consolidation cell and associated components of the remedy (e.g., groundwater monitoring wells) remain in good condition. In addition, monitoring of groundwater will continue to assess the protectiveness of the remedy.

## SECTION 11.0
## NEXT FIVE-YEAR REVIEW

The next Five-Year Review for the Hatheway & Patterson Superfund Site is due in September 2019, five years from the signature date of this review.

# APPENDIX A

# FIGURES

SITE LOCATION MAP

Hatheway and Patterson
Superfund Site
35 County Street
Mansfield, MA

Location of Facility

FIGURE 1.1

★ Site Location

N

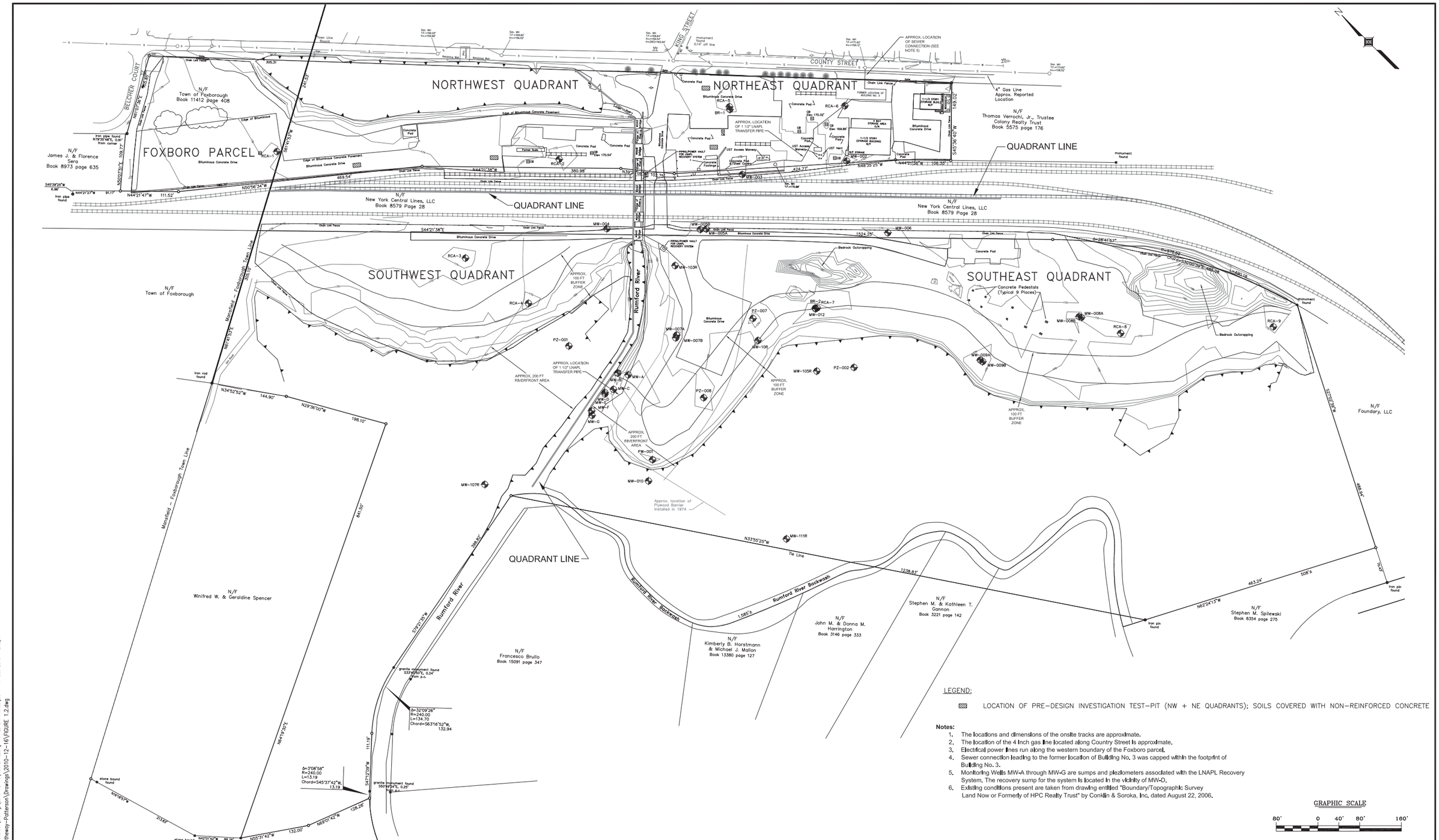
0 Feet 2,000

amec

AMEC Earth and Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090



Base Map Data from ESRI, 7/1/1989.




LEGEND:

▨ LOCATION OF PRE-DESIGN INVESTIGATION TEST-PIT (NW + NE QUADRANTS); SOILS COVERED WITH NON-REINFORCED CONCRETE

**Notes:**

1. The locations and dimensions of the onsite tracks are approximate.
2. The location of the 4 inch gas line located along Country Street is approximate.
3. Electrical power lines run along the western boundary of the Foxboro parcel.
4. Sewer connection leading to the former location of Building No. 3 was capped within the footprint of Building No. 3.
5. Monitoring Wells MW-A through MW-G are sumps and piezlometers associated with the LNAPL Recovery System. The recovery sump for the system is located in the vicinity of MW-D.
6. Existing conditions present are taken from drawing entitled "Boundary/Topographic Survey Land Now or Formerly of HPC Realty Trust" by Conklin & Soroka, Inc. dated August 22, 2006.

GRAPHIC SCALE

80' 0 40' 80' 160'

Sevenson Environmental Services, Inc.

SEVENSON ENVIRONMENTAL SERVICES, INC.
2749 LOCKPORT ROAD
NIAGARA FALLS, NY 14305

SOURCE DRAWING FROM *CONSTRUCTION SPECIFICATIONS, HATHEWAY & PATTERSON SUPERFUND SITE*, METCALF & EDDY, INC AND TRC ENVIRONMENTAL CORPORATION, 2008.

| REV | D | M | Y | ISSUE/REVISION DESCRIPTION | ENG. | APPR. |
|---|---|---|---|---|---|---|
| 6 | | | | | | |
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| 2 | | | | | | |
| 1 | | | | | | |
| 0 | | | | | | |

*Client Logos:*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

US Army Corps of Engineers

*Clients:*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
UNITED STATES ARMY CORPS OF ENGINEERS

AMEC Earth & Environmental
2 ROBBINS ROAD
WESTFORD, MASSACHUSETTS 01886

amec

| | |
|---|---|
| DATUM: | N/A |
| PROJECTION: | N/A |
| DRAWN BY: | M. YAU |
| REVIEWED BY: | H. COLBY |
| ORIGINAL SCALE: | AS SHOWN |

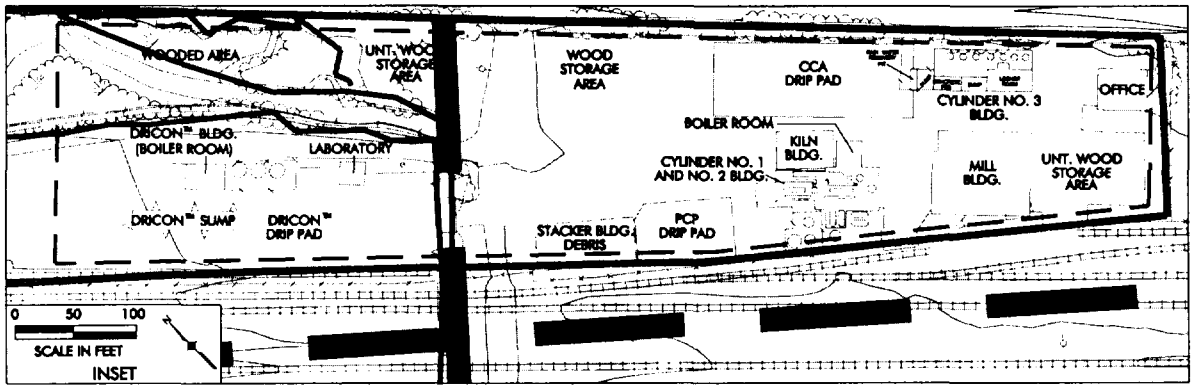
PROJECT: PRE-REMEDIATION SITE FEATURES

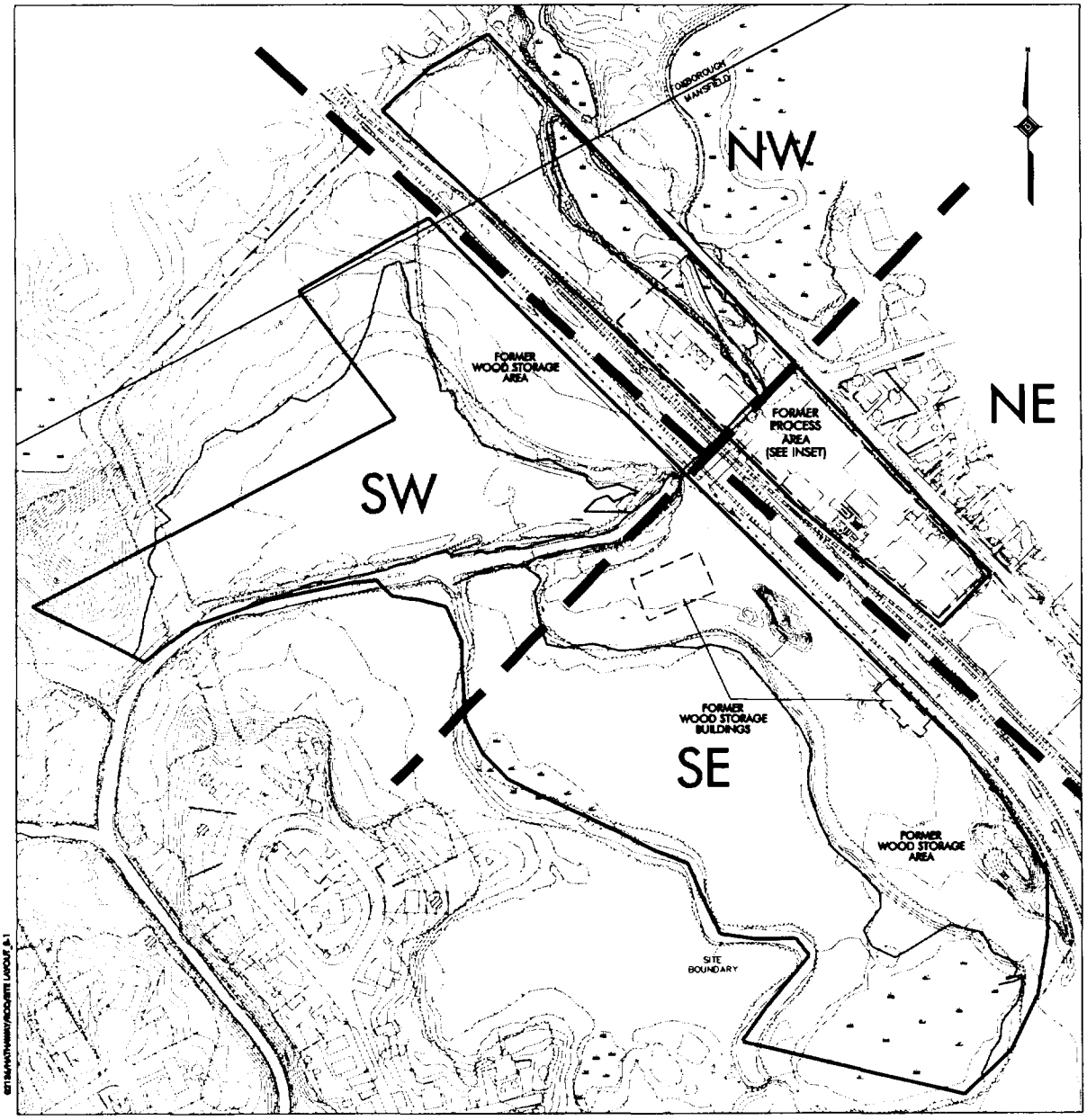
TITLE: HATHEWAY AND PATTERSON SITE
35 COUNTY STREET
MANSFIELD, MASSACHUSETTS

| | |
|---|---|
| PROJECT NO.: | 774840002.0600 |
| REVISION NO. | A |
| DATE: | 17 DECEMBER 2010 |
| FIGURE NO.: | 1.2 |
| SHEET NO.: | 1 of 1 |

www.amec.com/earthandenvironmental

FILE: W:\Projects\Sevenson MARC\Hatheway-Patterson\Drawings\2010-12-16\FIGURE 1.2.dwg PRINTED BY: michael.yau - 17 Dec 2010 - 2:42pm
FILE: W:\Projects\Sevenson MARC\Hatheway-Patterson\Drawings\2010-12-16\FIGURE 1.2.dwg




0 225 450

SCALE IN FEET

FIGURE B-1

SITE LAYOUT

HATHEWAY AND PATTERSON SITE
15 COUNTY ROAD
MANSFIELD, MASSACHUSETTS

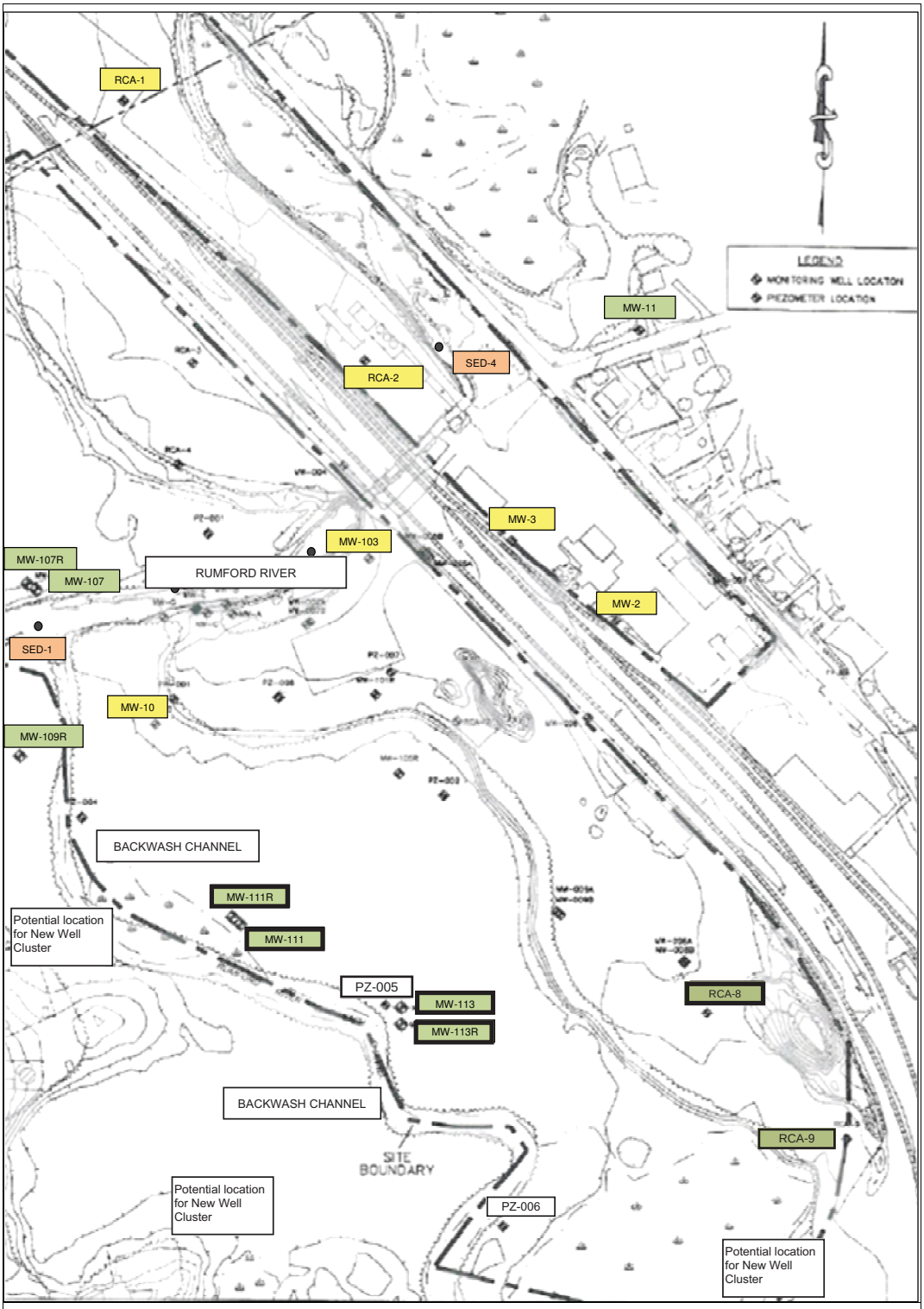
Metcalf & Eddy

TRC
Scott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0490-01X39

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACTOR: 107061




BOLD BOX AROUND WELL NUMBER INDICATES PERFORMANCE STANDARD EXCEEDENCE IN 2011/2012

LOCATION OF POST-RA GW SAMPLE

LOCATION OF HISTORIC GW SAMPLE

Sediment sample locations are approximate.

**AECOM**

MONITORING WELL AND SEDIMENT SAMPLE LOCATIONS

CLIENT: USEPA

LOCATION: 15 COUNTY STREET MANSFIELD MA

FIGURE: A-1

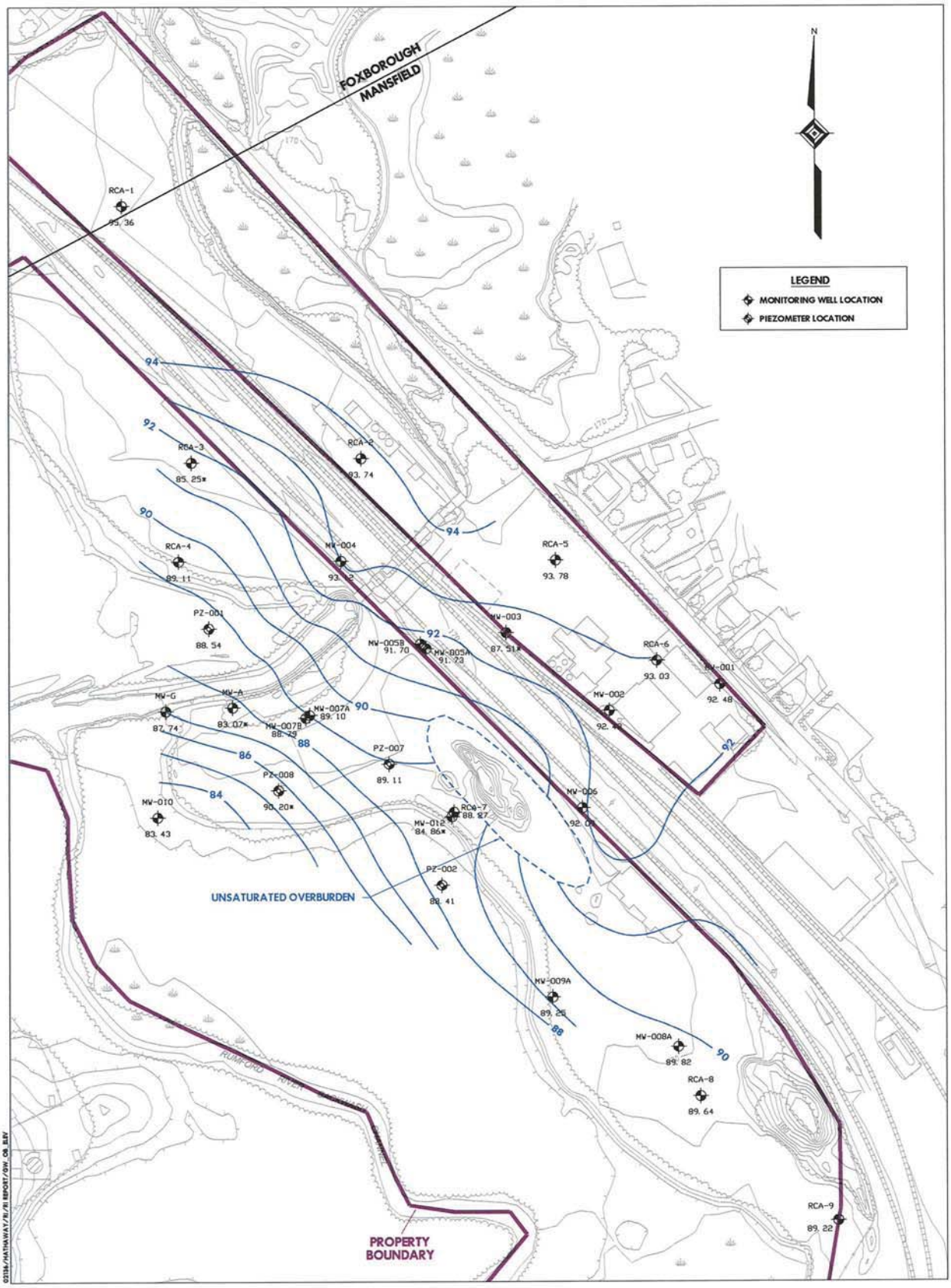



Figure 2
OVERBURDEN GROUND WATER ELEVATION MAP (APRIL 2004)
HATHEWAY AND PATTERSON SITE
15 COUNTY ROAD
MANSFIELD, MASSACHUSETTS

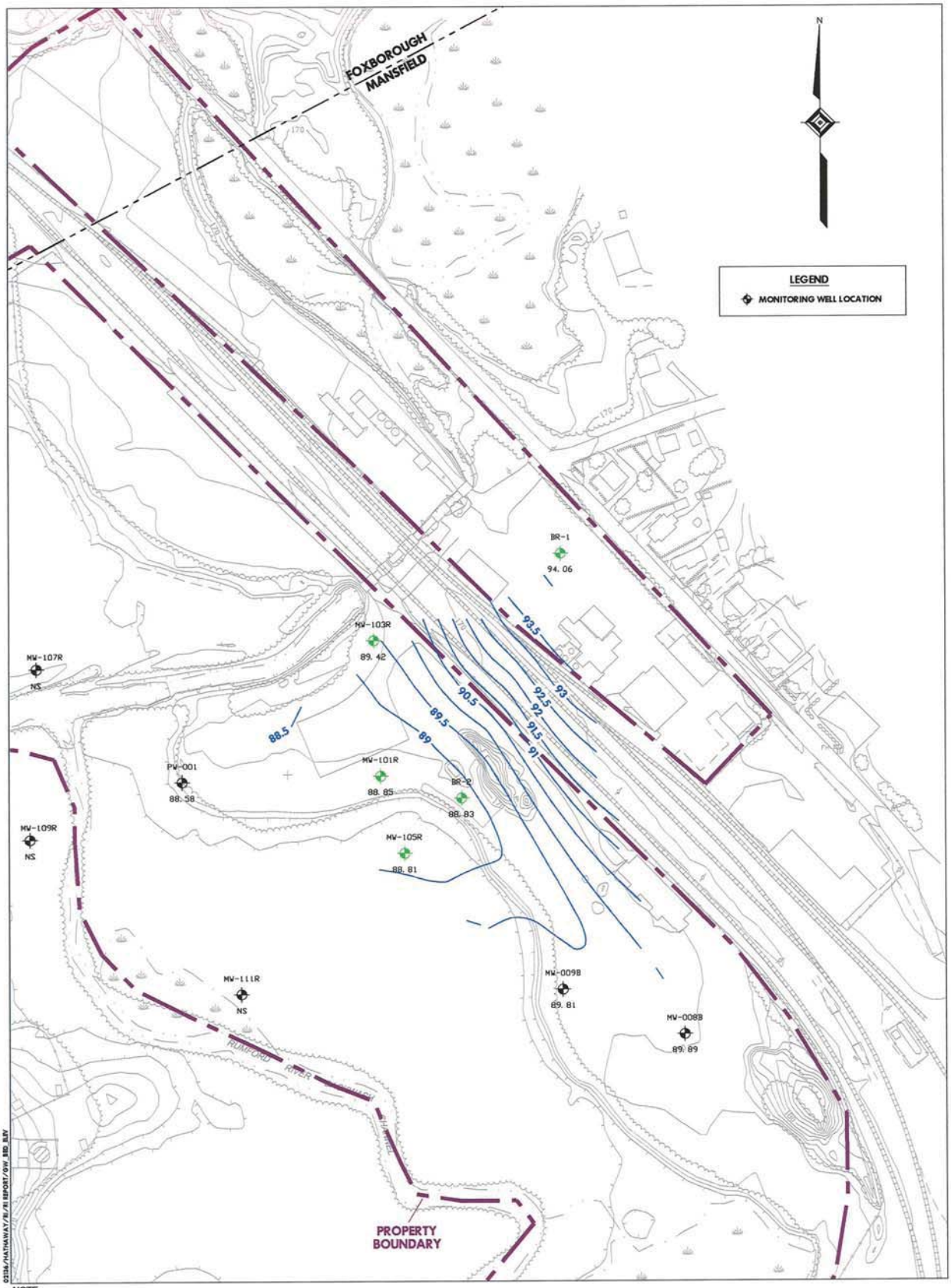
Metcalf & Eddy

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0490-01X39

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACT NO.: 107061




NOTE:
NS - NOT SURVEYED

0 75 150 225 300
SCALE IN FEET

Figure 3
BEDROCK GROUND WATER ELEVATION MAP (APRIL 2004)
HATHEWAY AND PATTERSON SITE
15 COUNTY ROAD
MANSFIELD, MASSACHUSETTS

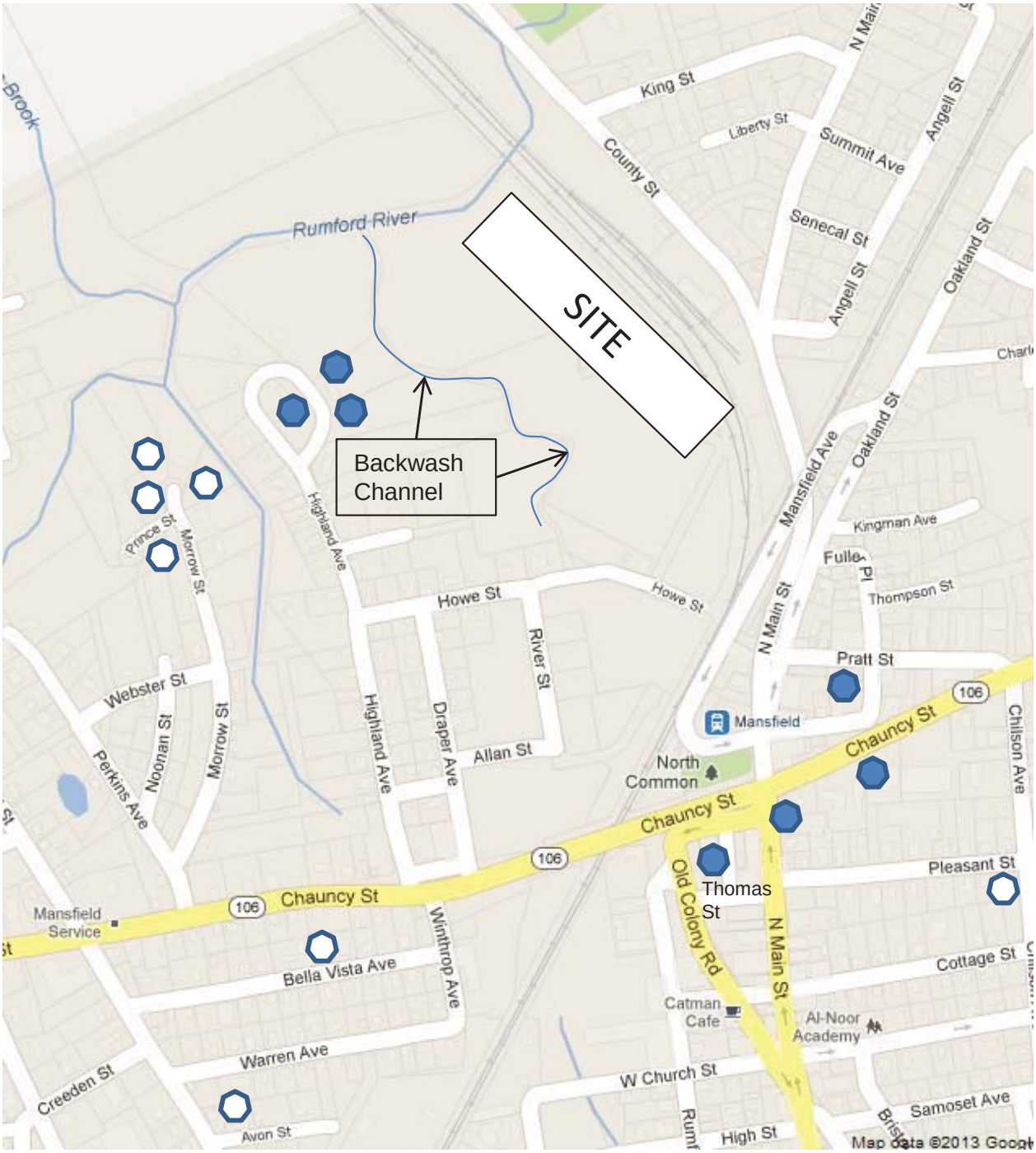
Metcalf & Eddy

TRC
Boott Mills South
Foot of John Street
Lowell, MA 01852
978-970-5600

TRC PROJ. NO.: 02136-0490-01X39

EPA CONTRACT NO.: 68-W6-0042

RAC SUBCONTRACT NO.: 107061




Possible Private Well To Be Considered For Sampling

Possible Private Well

Figure 5. Possible Private Wells

Well

Underpass Dewatering System

0 300 600 1,200

Feet

AECOM

**FIGURE 6**

**PRIVATE WELLS AND UNDERPASS DEWATERING SYSTEMS**

G:\Projects\HAZWASTE\60318204WRG\Maps\Milton.mxd

## APPENDIX B

## LIST OF DOCUMENTS REVIEWED AND REFERENCES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# APPENDIX C

# ANALYTICAL RESULTS

# GROUNDWATER ANALYTICAL RESULTS

**TABLE C-1. PENTACHLOROPHENOL (PCP), DIOXIN TEQ, ARSENIC, AND CHROMIUM CONCENTRATIONS IN SELECT WELLS AT HATHEWAY & PATTERSON, 2001 TO 2012**

| Well No. | Notes | | | Dec 2002 (unless footnoted) | | | | May 2011 | | | | May 2012 | | | | Oct 2012 | | | | Apr 2013 | | | | Oct/Nov/Dec 2013 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PCP ug/L | Dioxin TEQ pg/L | As ug/L | Cr ug/L | PCP ug/L | Dioxin TEQ pg/L | As ug/L | Cr ug/L | PCP ug/L | Dioxin TEQ pg/L | As ug/L | Cr ug/L | PCP ug/L | Dioxin TEQ pg/L | As ug/L | Cr ug/L | PCP ug/L | Dioxin TEQ pg/L | As ug/L | Cr ug/L | PCP ug/L | Dioxin TEQ pg/L | As ug/L | Cr ug/L |
| MW-011 | O | BK | LT | NA | NA | 0.55[1] | <2.5[1] | <0.5 | 0.186 | ND | ND | **<11[2]** | 0.0126[3] | <8[2] | <50[2] | **<11[2]** | NCD[2] | <8[2] | <50[2] | <1[2] | 0.013[3] | <8[2] | <50[2] | <1[2] | 0.38[3] | <8[2] | <50[2] |
| MW-111 | O | ICB | LT | | | | | ***6.55*** | NCD | 4.4 | ND | **<10** | 0.00336 | <8 | <50 | **<10** | 0.21 | <8 | <50 | ***3*** | 0.023 | <8 | <50 | ***2*** | 0.25 | <8 | <50 |
| MW-113 | O | ICB | LT | | | | | ***86.4*** | NCD | 3.2 | 1.1 | ***51*** | 0.00269 | <8 | <50 | ***130*** | NCD | <8 | <50 | ***110*** | NCD | <8 | <50 | ***110*** | 0.16 | <8 | <50 |
| RCA-9 | O | ICB | LT | ***2.1*** [4] | NA | 0.14 B[4] | <2.5[4] | <0.5[2] | 0.171[3] | ND | 0.7[3] | | | | | | | | | <1 | NCD | <8 | <50 | <1 | 0.59 | <8 | <50 |
| MW-111R | B | ICB | LT | ***4*** [5] | NA | 3.6[5] | <2.5[5] | ***1270*** | 0.0938 | 3.5 | 2.4 | ***350*** | 0.00399 | <8 | <50 | ***1400*** | NCD | <8 | <50 | ***1200*** | 0.081 | ***15*** | <50 | ***1200*** | 0.38 | <8 | <50 |
| MW-113R | B | ICB | LT | | | | | ***55.9*** | 0.00363 | 1.6 | 2.3 | ***70*** | 0.003 | <8 | <50 | ***200*** | 7.66 | <8 | <50 | ***140*** | NCD | <8 | <50 | <1 | 0.26 | <8 | <50 |
| MW-107 | O | BCB | LT | | | | | <0.5 | 0.00115 | 9 | 1.2 | **<11** | NCD | 10 | <50 | **<10** | NCD | 8 | <50 | <1 | NCD | <8 | <50 | <1 | 0.17 | <8 | <50 |
| MW-107R | B | BCB | LT | <0.2[5] | NA | 4.2[5] | <2.5[5] | <0.5 | NCD | ND | 0.6 | **<10** | 0.00579 | <8 | <50 | **<10** | NCD | <8 | <50 | <1 | NCD | <8 | <50 | <1 | 0.18 | <8 | <50 |
| MW-109R | B | BCB | LT | <0.2[5] | NA | 2.5[5] | <2.5[5] | <0.5 | 1.31 | 3.5 | ND | **<10** | 0.00513 | <8 | <50 | **<10** | 1.32 | <8 | <50 | <1 | 0.011 | <8 | <50 | <1 | 0.52 | <8 | <50 |
| RCA-8 | O | ICB | | ***18*** [4] | NA | 1.2[4] | NA | | | | | ***11*** | ***34.6*** | <8 | <50 | ***13*** | ***44.66*** | <8 | <50 | | | | | | | | |
| Compliance Boundary Performance Standard | | | | 1 | 30 | 10 | 100 | 1 | 30 | 10 | 100 | 1 | 30 | 10 | 100 | 1 | 30 | 10 | 100 | 1 | 30 | 10 | 100 | 1 | 30 | 10 | 100 |
| On-Site Performance Standard (Surface Water Protection) | | | | 1,792 | None Established | 17,924 | 1,314 | 1,792 | None Established | 17,924 | 1,314 | 1,792 | None Established | 17,924 | 1,314 | 1,792 | None Established | 17,924 | 1,314 | 1,792 | None Established | 17,924 | 1,314 | 1,792 | None Established | 17,924 | 1,314 |

1. Nov 2001
2. Sample and duplicate sample were analyzed. For non-detects, value reflects higher reporting limit (RL) if RLs were different.
3. Value is average of two (sample and duplicate) analyses
4. Dec 2003
5. Oct 2004

Column 2 Notes: O = Overburden Well; B = Bedrock Well; BK = Background Location; BCB = Beyond Compliance Boundary; ICB = Inside Compliance Boundary; LT = Long-Term Monitoring Location, per Groundwater, Surface Water, and Sediment Sampling and Analysis Plan (SES, 2011)

Dioxin TEQ calculated using WHO 2005 TEFs (ND=0) except for Oct/Nov/Dec 2013, calculated using MassDEP 1995 TEFs (ND=0). Results using WHO TEFs would be less conservative and therefore still not exceed the performance standard.

ND = Not detected (reporting limit unknown)

NCD = No congeners detected, and no dioxin TEQ calculated

NA = Not analyzed

TEQ - Toxicity Equivalence

TEF - Toxicity Equivalence Factor

WHO - World Health Organization

Values in bold italic exceed performance criteria

"Less than" (<) values in bold = reporting limit is higher than performance standard

Light gray shading = well was not sampled

Dark gray shading = well did not exist

Sources: May 2011 results taken from Analytical Data Report prepared by Waste Stream Technology Inc, 06/09/11 (Note that concentrations are incorrectly reported in Remedial Action Completion Report (SES, Sep 2011). May 2012 through Dec 2013 results taken from reports prepared by Environmental Strategies & Mgmt (Jul and Dec 2012; Jan 2014). Pre-2011 results taken from Interim Final RI Report, Hatheway & Patterson Superfund Site (M&E/TRC, Apr 2005)

# 2014 PRIVATE WELL MONITORING

Table C-2. Hatheway & Patterson Private Well Sampling - June 2014

| | | 18 Thomas Street 6/18/2014 | | 136 Highland Ave 6/18/2014 | | 46 Chauncy Street 6/18/2014 | | 325 N Main Street 6/18/2014 | | Town 1 6/18/2014 | | Town 2 6/18/2014 | | 132 Highland ave 6/18/2014 | | 132 Highland ave (FD) 6/18/2014 | | Max Detect | MCL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Conc. | RL | Conc. | RL | Conc. | RL | Conc. | RL | Conc. | RL | Conc. | RL | Conc. | RL | Conc. | RL | | |
| Beryllium | ug/L | ND | 0.2 | 0.2 | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | 0.2 | 4 |
| Aluminum | ug/L | ND | 5 | 59 | 5 | ND | 5 | ND | 5 | ND | 5 | 10 | 5 | 36 | 5 | 49 | 5 | 59 | |
| Vanadium | ug/L | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | 0.28 | 0.2 | ND | 0.2 | ND | 0.2 | 0.22 | 0.2 | 0.28 | |
| Chromium | ug/L | 1 | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | 0.5 | 0.5 | 0.56 | 0.5 | 1 | 100 |
| Manganese | ug/L | 27 | 0.2 | 20 | 0.2 | 1600 | 0.2 | 2600 | 2 | 1.5 | 0.2 | 1400 | 0.2 | 11 | 0.2 | 11 | 0.2 | 2600 | |
| Cobalt | ug/L | ND | 0.2 | ND | 0.2 | 2.2 | 0.2 | 8.1 | 0.2 | ND | 0.2 | 5 | 0.2 | ND | 0.2 | ND | 0.2 | 8.1 | |
| Nickel | ug/L | 3.2 | 0.2 | 1.3 | 0.2 | 3.3 | 0.2 | 3.4 | 0.2 | 1.8 | 0.2 | 6.7 | 0.2 | 2.1 | 0.2 | 2.2 | 0.2 | 6.7 | |
| Copper | ug/L | 22 | 0.5 | 1.2 | 0.5 | 7.4 | 0.5 | 3.7 | 0.5 | 1.9 | 0.5 | 7.2 | 0.5 | 46 | 0.5 | 78 | 0.5 | 78 | 1300 |
| Zinc | ug/L | 13 | 5 | 88 | 5 | 590 | 5 | 18 | 5 | 19 | 5 | 39 | 5 | 17 | 5 | 24 | 5 | 590 | |
| Arsenic | ug/L | ND | 1 | ND | 1 | 4.1 | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | 4.1 | 10 |
| Selenium | ug/L | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 50 |
| Silver | ug/L | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | |
| Cadmium | ug/L | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 5 |
| Molybdenum | ug/L | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | |
| Antimony | ug/L | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 6 |
| Barium | ug/L | 92 | 0.2 | 42 | 0.2 | 41 | 0.2 | 60 | 0.2 | 32 | 0.2 | 300 | 0.2 | 60 | 0.2 | 61 | 0.2 | 300 | 2000 |
| Thallium | ug/L | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 0.5 | ND | 2 |
| Lead | ug/L | 1.3 | 0.2 | ND | 0.2 | 0.58 | 0.2 | 0.46 | 0.2 | ND | 0.2 | 0.74 | 0.2 | 3.5 | 0.2 | 7.6 | 0.2 | 7.6 | 15 |
| Magnesium (mg/L) | mg/L | 7.2 | 0.1 | 1.6 | 0.1 | 3.8 | 0.1 | 4.2 | 0.1 | 1.7 | 0.1 | 6.9 | 0.1 | 2.1 | 0.1 | 2.1 | 0.1 | 7.2 | |
| Calcium (mg/L) | mg/L | 67 | 0.2 | 15 | 0.2 | 59 | 0.2 | 33 | 0.2 | 18 | 0.2 | 57 | 2 | 24 | 0.2 | 24 | 0.2 | 67 | |
| Iron | ug/L | ND | 50 | ND | 50 | 3200 | 50 | 3100 | 50 | ND | 50 | 3500 | 50 | 340 | 50 | 940 | 50 | 3500 | |
| Uranium | ug/L | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 1 | ND | 30 |
| Pentachlorophenol | ug/L | ND | 0.2 | ND | 0.2 | ND | 0.2 | 2.7 DB | | ND | 0.2 | ND | 0.2 | ND | 0.2 | ND | 0.2 | 2.7 | 1 |
| Dioxin TEQ | pg/L | 0.281 | | 0.196 | | 0.375 | | 1.58 | | 0.197 | | 0.28 | | 0.646 | | 0.255 | | 1.58 | |
| | ug/L | 2.81E-07 | | 1.96E-07 | | 3.75E-07 | | 1.58E-06 | | 1.97E-07 | | 2.80E-07 | | 6.46E-07 | | 2.55E-07 | | 1.58E-06 | 3.00E-05 |

Notes:
RL - Reporting Limit
ND - Not Detected
DB - Value reported is from a diluted sample and there was contamination associated with a laboratory blank
FD - Field Duplicate
TEQ - Toxicity Equivalency - based on WHO 2005 values

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

DATE: July 22, 2014

SUBJ: Hatheway and Patterson Ground water Sampling and Analysis – June 2014

FROM: Jerry Keefe, EIA Team Leader

TO: Kimberly White, RPM OSRR

## I. Background Information

A. Date of Sampling: Wednesday, June 18

B. Weather Conditions: Mostly sunny, approximately 85 degrees F

C. USEPA Representatives: Jerry Keefe
Mike Looney

D. Samples Requested by: Kim White, RPM OSRR

E. Address: Various locations within the town of Mansfield, Massachusetts

## II. Purpose of Sampling

The sampling event was being done as part of a 5-year review to obtain additional information on potential contaminant migration in the site aquifer. The objective of the sampling event was to collect representative groundwater samples from private irrigation wells; all the properties are connected to a public water supply system for drinking water. Samples will be analyzed for dioxin/furans, PCP (pentachlorophenol), and metals. NERL will be analyzing samples for metals. The Dioxin and PCP samples will be analyzed at a CLP laboratory and is not discussed in this summary report.

## III. Description of Sampling Locations

Sample locations and descriptions are shown in table 1.

Table 1

| Sample Location/ Address | Owner/phone# | Map/Lot # | Time | Comments |
|---|---|---|---|---|
| Mansfield Fabric Care Center /18 Thomas St, Mansfield, MA | Billings Realty Trust Fontanini & Kennedy Trs 508-339-9057 | Map 021, Lot 182 | 0935 | Sampled at Spigot before filters. (Picture 1)<br>Temperature –14.0 C<br>Conductivity – 1618 uS/cm<br>pH – 6.19 |
| Private Residence/ 136 Highland Ave, Mansfield, MA | John & Donna Harrington 508-339-8731 | Map 018, Lot 460 | 1038 | Sampled at pump head. (Picture 2)<br>Temperature – 11.2 C<br>Conductivity – 363.6 uS/cm<br>pH – 5.53 |
| Car Wash / 46 Chauncy St, Mansfield, MA | Nicks Realty Trust Nicholas & Steven Anagnos 508-339-9556 | Map 022, Lot 008 | 1130 | Sampled at top of system not thru hose. (Picture 3)<br>Readings are grabs, flow was to high from system.<br>Flushed system for 30 minutes.<br>Temperature – 13.9 C<br>Conductivity – 501 uS/cm<br>pH – 7.14 |
| Multi-tenant Residence/ 325 N Main Street, Mansfield, MA | Nicks Realty Trust Nicholas & Steven Anagnos 508-339-9556 | Map 022, Lot 003 | 1215 | Sampled at outside spigot – before treatment (Picture 4)<br>Temperature – 13.1 C<br>Conductivity – 886 uS/cm<br>pH – 6.29 |
| Town 1/ Underpass on N. Main St at Mansfield Ave, Mansfield, MA | Mark Cook 508-922-8388 | Underpass | 1419 | Sample taken from seep in road. Mansfield Ave overpass on North Main Street. (Picture 5)<br>Start purge at 1400 using peristaltic pump<br>Temperature – 18 C<br>Conductivity – 513.2 uS/cm<br>pH – 6.53 |
| Town 2/ Underpass on Chauncy St at Mansfield Ave, Mansfield, MA | Mark Cook 508-922-8388 | Underpass | 1500 | Sample taken from storm sewer manhole on sidewalk. Overpass Route 106 and Chauncy Street. (Picture 6)<br>Sample from 5 gallon pail dropped into manhole. No readings taken. |
| Private Residence/ 132 Highland Ave, Mansfield, MA | Kimberly Horstmann & Michael Mallon 774-406-1559 | Map 018, Lot 459 | 1610 | Sample taken from just after pump head. (Picture 7)<br>Temperature – 15.6 C<br>Conductivity – 98.6 uS/cm<br>pH – 6.01 |

## IV. Sampling Summary

On Wednesday, June 18, 2014, EPA investigators Jerry Keefe and Mike Looney conducted a Sampling Project at seven locations within the town of Mansfield, MA. Pre and post calibrations of field instruments were within acceptable limits. All locations sampled were completed according to sampling and analysis plan except for the Town 1 and Town 2 locations. These locations are stormwater and groundwater collections tanks for 2 town underpasses. Both holding tanks contain extensive debris (plastic cup/bottles, cigarette butts, etc) and were therefore not appropriate groundwater sample locations (Picture 8). Pipes with flowing groundwater were observed in the tanks but could not be sampled directly because of difficulty and safety concerns. The Town 1 location had breakouts of groundwater up-flowing into the street and then to the storm sewer. These groundwater up-flows appeared to be representative groundwater sampling locations. Picture 5 shows the sample location and the sample tubing. The peristaltic pump was pumping at approximately 400 ml/min with no draw down. Due to safety concerns the purging

was only for 20 minutes and the samples were collected along with field parameters. The Town 2 location was sampled from a manhole using a clean 5 gallon bucket from a 10" pipe flowing groundwater (according to Mark Cook) to the holding tank. The route 106 underpass is shown in Picture 6.

To ensure that data quality objectives were met and acceptable for decision making purposes the following was reviewed.

1) SAP – Hatheway and Patterson Well Sampling for Analysis of Dioxins, PCP, and metals.
2) Chain of Custody (COC)
3) Field duplicate comparison

*Sampling and Analysis Plan*

The SAP objectives were achieved and all locations were sampled accordingly. As stated above two sample locations Town 1 and Town 2 were sampled based upon the investigators' professional judgment and safety considerations. Although these sampling locations appeared representative and satisfactory, the locations have potential of being affected by other conditions that are not representative of actual ground water (stormwater, road debris).

*Chain of Custody*

All COC information as compared to field notes showed no issues. Sample delivery, preservation, and signage were acceptable.

*Field Duplicate Comparison*

A field duplicate is a collection of two or more samples collected at the same location side by side or one immediately after the other. This duplicate represents the precision of the whole method, site heterogeneity, field sampling and the laboratory analysis. Relative Percent Difference (RPD) was calculated for metals. The USEPA nationally has not set control criteria for field duplicates but the site SAP used 30 percent as a standard. Site contaminant of concern (chromium and arsenic) are within acceptable limits. Aluminum, copper, zinc, lead, and iron are above the 30 percent limit. In general water samples that are not filtered and/or collected at high flow rates may tend to have fluctuations in sample results due to the solubility of such compounds. The results show good correlation and field precision.

*Overall Assessment*

None of the data were qualified or rejected based upon this review and the quality of the data is acceptable. All data can be used for decision making purposes.

Table 2

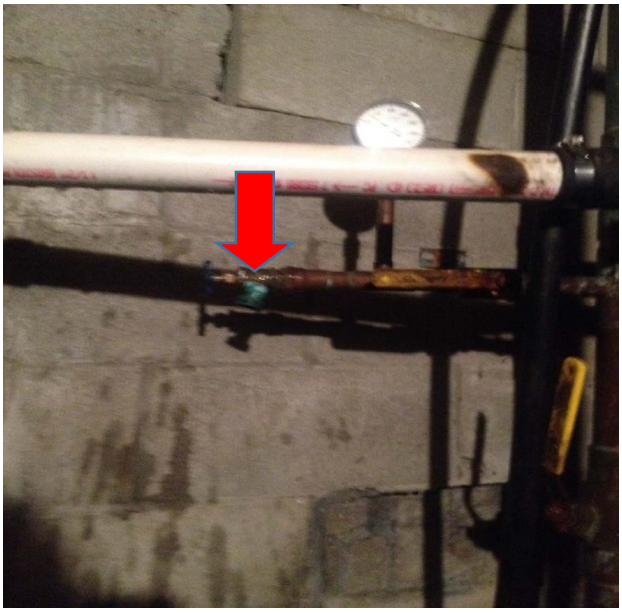
| | 132 Highland Ave | 132(d) Highland | | RPD |
|---|---|---|---|---|
| Beryllium | ND | ND | | 0.0 |
| Aluminum | 36 | 49 | | 30.6 |
| Vanadium | ND | 0.22 | | 9.5 |
| Chromium | 0.5 | 0.56 | | 11.3 |
| Manganese | 11 | 11 | | 0.0 |
| Cobalt | ND | ND | | 0.0 |
| Nickel | 2.1 | 2.2 | | 4.7 |
| Copper | 46 | 78 | | 51.6 |
| Zinc | 17 | 24 | | 34.1 |
| Arsenic | ND | ND | | 0.0 |
| Selenium | ND | ND | | 0.0 |
| Silver | ND | ND | | 0.0 |
| Cadmium | ND | ND | | 0.0 |
| Molybdenum | ND | ND | | 0.0 |
| Antimony | ND | ND | | 0.0 |
| Barium | 60 | 61 | | 1.7 |
| Thallium | ND | ND | | 0.0 |
| Lead | 3.5 | 7.6 | | 73.9 |
| Magnesium (mg/L) | 2.1 | 2.1 | | 0.0 |
| Calcium (mg/L) | 24 | 24 | | 0.0 |
| Iron | 340 | 940 | | 93.8 |
| Uranium | ND | ND | | 0.0 |

Hatheway &

Patterson Well Sampling

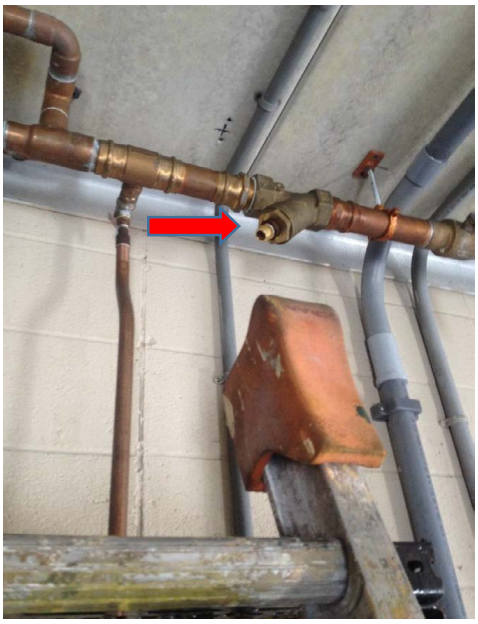
June 18, 2014

Picture 1 – 18 Thomas Street



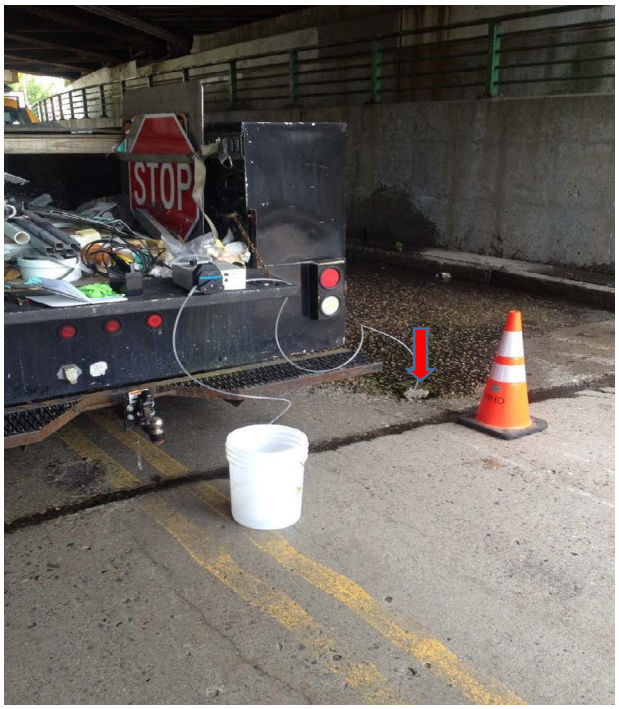
Picture 2 – 136 Highland Ave

Picture 3 – 46 Chauncy Street



Picture 4 – 325 North Main Street

Picture 5 – Town 1




Picture 6 – Town 2

Picture 7

Picture 8 – Town 1 Debris in Holding Tank

**United States Environmental Protection Agency**
**Office of Environmental Measurement & Evaluation**
**11 Technology Drive**
**North Chelmsford, MA 01863-2431**



# Laboratory Report

July 17, 2014

Jerry Keefe - EIA / OEME
Kimberly White - Mail Code OSRR07-1
US EPA New England, Region 1
Kimberly White - Mail Code OSRR07-1

Project Number: 14060018
Project: Hatheway & Patterson Co - Mansfield, MA
Analysis: Total Recoverable Metals in Water
EPA Chemist: Michael Dowling

Date Samples Received by the Laboratory: 06/19/2014

Analytical Procedure:

All samples were received and logged in by the laboratory according to the USEPA New England Laboratory SOP for Sample Log-in.

Sample preparation and analysis was done following the EPA Region I SOP, EIASOP-INGICPMS5.

Samples were prepared following USEPA New England Sample Prep SOP: EIA-INGPREP8.SOP.

Samples were analyzed using a Perkin Elmer Elan 6000 inductively coupled plasma mass spectrometer. Preparation and analysis SOP's are based on Methods 200.2 and 200.8, respectively, as stated in "Methods for the Determination of Metals in Environmental Samples, Supplement I (EPA/600/R-94/111), Rev. 5.4, May 1994."

Data were reviewed in accordance with the internal verification procedures described in the EPA New England Quality Manual for NERL.

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

If you have any questions please call me at 617-918-8340 .

Sincerely,

**Qualifiers**:

| | |
|---|---|
| **RL** | Reporting limit |
| **ND** | Not Detected above reporting limit |
| **NA** | Not Applicable |
| **NC** | Not calculated since analyte concentration is ND |
| **J1** | Estimated value due to MS recovery outside accceptance criteria |
| **J2** | Estimated value due to LFB result outside acceptance criteria |
| **J3** | Estimated value due to RPD result outside acceptance criteria |
| **J4** | Estimated value due to LCS result outside acceptance criteria |
| **B** | Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 10 times the concentration in the blank. |
| **R** | No recovery was calculated since the analyte concentration is greater than four times the spike level. |

Comments: The pH values of all samples were approximately 1.9.

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | 18 Thomas Street | Lab Sample ID: | AB48954 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | ND | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | **1.0** | 0.50 | |
| 7439-96-5 | Manganese | **27** | 0.20 | |
| 7440-48-4 | Cobalt | ND | 0.20 | |
| 7440-02-0 | Nickel | **3.2** | 0.20 | |
| 7440-50-8 | Copper | **22** | 0.50 | |
| 7440-66-6 | Zinc | **13** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **92** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | **1.3** | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **7.2** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **67** | 0.20 | |
| 7439-89-6 | Iron | ND | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | 136 Highland Ave | Lab Sample ID: | AB48955 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | **0.20** | 0.20 | |
| 7429-90-5 | Aluminum | **59** | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | ND | 0.50 | |
| 7439-96-5 | Manganese | **20** | 0.20 | |
| 7440-48-4 | Cobalt | ND | 0.20 | |
| 7440-02-0 | Nickel | **1.3** | 0.20 | |
| 7440-50-8 | Copper | **1.2** | 0.50 | |
| 7440-66-6 | Zinc | **88** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **42** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | ND | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **1.6** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **15** | 0.20 | |
| 7439-89-6 | Iron | ND | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | 46 Chauncy Street | Lab Sample ID: | AB48956 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | ND | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | ND | 0.50 | |
| 7439-96-5 | Manganese | **1600** | 0.20 | |
| 7440-48-4 | Cobalt | **2.2** | 0.20 | |
| 7440-02-0 | Nickel | **3.3** | 0.20 | |
| 7440-50-8 | Copper | **7.4** | 0.50 | |
| 7440-66-6 | Zinc | **590** | 5.0 | |
| 7440-38-2 | Arsenic | **4.1** | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **41** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | **0.58** | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **3.8** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **59** | 0.20 | |
| 7439-89-6 | Iron | **3200** | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | 325 N Main Street | Lab Sample ID: | AB48957 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | ND | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | ND | 0.50 | |
| 7439-96-5 | Manganese | **2600** | 2.0 | |
| 7440-48-4 | Cobalt | **8.1** | 0.20 | |
| 7440-02-0 | Nickel | **3.4** | 0.20 | |
| 7440-50-8 | Copper | **3.7** | 0.50 | |
| 7440-66-6 | Zinc | **18** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **60** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | **0.46** | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **4.2** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **33** | 0.20 | |
| 7439-89-6 | Iron | **3100** | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:** The manganese result is reported from a 10x dilution.

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | Town 1 | Lab Sample ID: | AB48958 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | ND | 5.0 | |
| 7440-62-2 | Vanadium | **0.28** | 0.20 | |
| 7440-47-3 | Chromium | ND | 0.50 | |
| 7439-96-5 | Manganese | **1.5** | 0.20 | |
| 7440-48-4 | Cobalt | ND | 0.20 | |
| 7440-02-0 | Nickel | **1.8** | 0.20 | |
| 7440-50-8 | Copper | **1.9** | 0.50 | |
| 7440-66-6 | Zinc | **19** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **32** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | ND | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **1.7** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **18** | 0.20 | |
| 7439-89-6 | Iron | ND | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | Town 2 | Lab Sample ID: | AB48959 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | **10** | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | ND | 0.50 | |
| 7439-96-5 | Manganese | **1400** | 0.20 | |
| 7440-48-4 | Cobalt | **5.0** | 0.20 | |
| 7440-02-0 | Nickel | **6.7** | 0.20 | |
| 7440-50-8 | Copper | **7.2** | 0.50 | |
| 7440-66-6 | Zinc | **39** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **300** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | **0.74** | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **6.9** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **57** | 2.0 | |
| 7439-89-6 | Iron | **3500** | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:** The calcium result is reported from a 10x dilution.

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | 132 Highland ave | Lab Sample ID: | AB48960 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | **36** | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | **0.50** | 0.50 | |
| 7439-96-5 | Manganese | **11** | 0.20 | |
| 7440-48-4 | Cobalt | ND | 0.20 | |
| 7440-02-0 | Nickel | **2.1** | 0.20 | |
| 7440-50-8 | Copper | **46** | 0.50 | |
| 7440-66-6 | Zinc | **17** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **60** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | **3.5** | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **2.1** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **24** | 0.20 | |
| 7439-89-6 | Iron | **340** | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**Total Recoverable Metals in Water**

| | | | |
|---|---|---|---|
| Client Sample ID: | 132 (d) Highland ave | Lab Sample ID: | AB48961 |
| Date of Collection: | 6/18/2014 | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | <2 |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | **49** | 5.0 | |
| 7440-62-2 | Vanadium | **0.22** | 0.20 | |
| 7440-47-3 | Chromium | **0.56** | 0.50 | |
| 7439-96-5 | Manganese | **11** | 0.20 | |
| 7440-48-4 | Cobalt | ND | 0.20 | |
| 7440-02-0 | Nickel | **2.2** | 0.20 | |
| 7440-50-8 | Copper | **78** | 0.50 | |
| 7440-66-6 | Zinc | **24** | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | **61** | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | **7.6** | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | **2.1** | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | **24** | 0.20 | |
| 7439-89-6 | Iron | **940** | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**Laboratory Reagent Blank Result (ug/L)**

| | | | |
|---|---|---|---|
| Client Sample ID: | N/A | Lab Sample ID: | N/A |
| Date of Collection: | N/A | Matrix: | Water |
| Date of Preparation: | 7/14/2014 | Amount Prepared: | 25 mL |
| Date of Analysis: | 7/15/2014 | Percent Solids: | N/A |
| Dry Weight Prepared: | N/A | Extract Dilution: | 1.01 |
| Wet Weight Prepared: | N/A | pH: | N/A |

| CAS Number | Compound | Concentration ug/L | RL ug/L | Qualifier |
|---|---|---|---|---|
| 7440-41-7 | Beryllium | ND | 0.20 | |
| 7429-90-5 | Aluminum | ND | 5.0 | |
| 7440-62-2 | Vanadium | ND | 0.20 | |
| 7440-47-3 | Chromium | ND | 0.50 | |
| 7439-96-5 | Manganese | ND | 0.20 | |
| 7440-48-4 | Cobalt | ND | 0.20 | |
| 7440-02-0 | Nickel | ND | 0.20 | |
| 7440-50-8 | Copper | ND | 0.50 | |
| 7440-66-6 | Zinc | ND | 5.0 | |
| 7440-38-2 | Arsenic | ND | 1.0 | |
| 7782-49-2 | Selenium | ND | 1.0 | |
| 7440-22-4 | Silver | ND | 0.20 | |
| 7440-43-9 | Cadmium | ND | 0.20 | |
| 7439-98-7 | Molybdenum | ND | 1.0 | |
| 7440-36-0 | Antimony | ND | 0.50 | |
| 7440-39-3 | Barium | ND | 0.20 | |
| 7440-28-0 | Thallium | ND | 0.50 | |
| 7439-92-1 | Lead | ND | 0.20 | |
| 7439-95-4 | Magnesium (mg/L) | ND | 0.10 | |
| 7440-70-2 | Calcium (mg/L) | ND | 0.20 | |
| 7439-89-6 | Iron | ND | 50 | |
| 7440-61-1 | Uranium | ND | 1.0 | |

**Comments:**

**Hatheway & Patterson Co - Mansfield, MA**

**MATRIX SPIKE (MS) RECOVERY**

Sample ID: AB48957

| PARAMETER | SPIKE ADDED ug/L | SAMPLE CONCENTRATION ug/L | MS CONCENTRATION ug/L | MS % REC | QC LIMITS (% REC) |
|---|---|---|---|---|---|
| Aluminum | 40 | ND | 37.9 | 95 | 70 - 130 |
| Antimony | 40 | ND | 42.2 | 106 | 70 - 130 |
| Arsenic | 40 | ND | 44.2 | 110 | 70 - 130 |
| Barium | 40 | 60 | 97.2 | 93 | 70 - 130 |
| Beryllium | 40 | ND | 39.7 | 99 | 70 - 130 |
| Cadmium | 40 | ND | 39.5 | 99 | 70 - 130 |
| Chromium | 40 | ND | 38.6 | 97 | 70 - 130 |
| Cobalt | 40 | 8.1 | 47.1 | 98 | 70 - 130 |
| Copper | 40 | 3.7 | 40.9 | 93 | 70 - 130 |
| Iron | 440 | 3100 | 3480 | R | 70 - 130 |
| Lead | 40 | 0.46 | 42.1 | 104 | 70 - 130 |
| Manganese | 40 | 2600 | 2440 | R | 70 - 130 |
| Molybdenum | 40 | ND | 43.2 | 108 | 70 - 130 |
| Nickel | 40 | 3.4 | 40.6 | 93 | 70 - 130 |
| Selenium | 40 | ND | 40.3 | 101 | 70 - 130 |
| Silver | 40 | ND | 38.3 | 96 | 70 - 130 |
| Thallium | 40 | ND | 42.0 | 105 | 70 - 130 |
| Uranium | 40 | ND | 43.4 | 108 | 70 - 130 |
| Vanadium | 40 | ND | 41.2 | 103 | 70 - 130 |
| Zinc | 40 | 18 | 58.1 | 100 | 70 - 130 |

**Hatheway & Patterson Co - Mansfield, MA**

**Laboratory Duplicate Results**

Sample ID: AB48955

| PARAMETER | SAMPLE RESULT ug/L | SAMPLE DUPLICATE RESULT ug/L | PRECISION RPD % | QC LIMITS |
|---|---|---|---|---|
| Aluminum | 59 | 62 | 5.0 | 20 |
| Antimony | ND | ND | NC | 20 |
| Arsenic | ND | ND | NC | 20 |
| Barium | 42 | 42 | 0.0 | 20 |
| Beryllium | 0.20 | ND | NC | 20 |
| Cadmium | ND | ND | NC | 20 |
| Calcium (mg/L) | 15 | 15 | 0.0 | 20 |
| Chromium | ND | ND | NC | 20 |
| Cobalt | ND | ND | NC | 20 |
| Copper | 1.2 | 1.3 | 8.0 | 20 |
| Iron | ND | ND | NC | 20 |
| Lead | ND | ND | NC | 20 |
| Magnesium (mg/L) | 1.6 | 1.7 | 6.1 | 20 |
| Manganese | 20 | 21 | 4.9 | 20 |
| Molybdenum | ND | ND | NC | 20 |
| Nickel | 1.3 | 1.4 | 7.4 | 20 |
| Selenium | ND | ND | NC | 20 |
| Silver | ND | ND | NC | 20 |
| Thallium | ND | ND | NC | 20 |
| Uranium | ND | ND | NC | 20 |
| Vanadium | ND | ND | NC | 20 |
| Zinc | 88 | 92 | 4.4 | 20 |

**Hatheway & Patterson Co - Mansfield, MA**

**Laboratory Fortified Blank (LFB) Results**

| PARAMETER | LFB AMOUNT SPIKED ug/L | LFB RESULT ug/L | LFB RECOVERY % | QC LIMITS % |
|---|---|---|---|---|
| Aluminum | 40.0 | 39.2 | 98 | 85 - 115 |
| Antimony | 40.0 | 39.9 | 100 | 85 - 115 |
| Arsenic | 40.0 | 41.8 | 104 | 85 - 115 |
| Barium | 40.0 | 39.7 | 99 | 85 - 115 |
| Beryllium | 40.0 | 40.0 | 100 | 85 - 115 |
| Cadmium | 40.0 | 40.0 | 100 | 85 - 115 |
| Calcium (mg/L) | 8.00 | 7.58 | 95 | 85 - 115 |
| Chromium | 40.0 | 40.1 | 100 | 85 - 115 |
| Cobalt | 40.0 | 41.9 | 105 | 85 - 115 |
| Copper | 40.0 | 40.7 | 102 | 85 - 115 |
| Iron | 440 | 441 | 100 | 85 - 115 |
| Lead | 40.0 | 40.2 | 100 | 85 - 115 |
| Magnesium (mg/L) | 4.00 | 4.14 | 104 | 85 - 115 |
| Manganese | 40.0 | 40.0 | 100 | 85 - 115 |
| Molybdenum | 40.0 | 40.4 | 101 | 85 - 115 |
| Nickel | 40.0 | 40.7 | 102 | 85 - 115 |
| Selenium | 40.0 | 40.2 | 100 | 85 - 115 |
| Silver | 40.0 | 41.4 | 104 | 85 - 115 |
| Thallium | 40.0 | 41.1 | 103 | 85 - 115 |
| Uranium | 40.0 | 41.2 | 103 | 85 - 115 |
| Vanadium | 40.0 | 40.1 | 100 | 85 - 115 |
| Zinc | 40.0 | 42.8 | 107 | 85 - 115 |

**Comments:**

**Samples in Batch:** AB48954, AB48955, AB48956, AB48957, AB48958, AB48959, AB48960, AB48961

ENVIRONMENTAL PROTECTION AGENCY

REGION 1

# CHAIN OF CUSTODY RECORD

PROJ. NO.: 16060018

PROJECT NAME: Hathaway + Patterson Superfund site

SAMPLERS: (Signature)

| STA. NO. | DATE | TIME | COMP. | GRAB | STATION LOCATION | NO. OF CONTAINERS | Metals (As + Cr) | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6/18/14 | 0935 | | X | 18 Thomas Street | 1 | 1 | | | | | | water sample pre-preserved with $HNO_3$ |
| | 6/18/14 | 1038 | | X | 136 Highland Ave | 1 | 1 | | | | | | |
| | 6/18/14 | 1130 | | X | 46 Chauncy Street | 1 | 1 | | | | | | |
| | 6/18/14 | 1215 | | X | 325 N Main Street | 1 | 1 | | | | | | |
| | 6/18/14 | 1419 | | X | Town 1 | 1 | 1 | | | | | | |
| | 6/18/14 | 1500 | | X | Town 2 | 1 | 1 | | | | | | |
| | 6/18/14 | 1610 | | X | 132 Highland Ave | 1 | 1 | | | | | | |
| | 6/18/14 | 1610 | | X | 132(d) Highland Ave | 1 | 1 | | | | | | field duplicate |

| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
|---|---|---|---|---|---|
| | 6/19/14 1035 | | | | |
| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
| | | | | | |
| Relinquished by: (Signature) | Date / Time | Received for Laboratory by: (Signature) | Date / Time | Remarks | |
| | | | 6/19/14 10:35 | | |

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Page 15 of 15

14060018$MTMSW

1- 19475

EPA Sample No.

A0AA0

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496756

Sample wt/vol: 970 mL Lab File ID: 14M854568_5496756

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 0.722 |
| 2378-TCDF | 304/306 | 24.70 | 0.66 | 0.907 | J | |
| 12378-PeCDF | 340/342 | 28.45 | 1.67 | 1.20 | BJ | |
| 12378-PeCDD | 356/358 | | | | U | 0.474 |
| 23478-PeCDF | 340/342 | 29.19 | 1.24 | | * | 0.722 |
| 123478-HxCDF | 374/376 | 32.35 | 1.16 | 1.20 | J | |
| 123678-HxCDF | 374/376 | 32.47 | 1.33 | 0.619 | J | |
| 123478-HxCDD | 390/392 | | | | U | 0.474 |
| 123678-HxCDD | 390/392 | | | | U | 0.515 |
| 123789-HxCDD | 390/392 | | | | U | 0.495 |
| 234678-HxCDF | 374/376 | | | | U | 0.392 |
| 123789-HxCDF | 374/376 | 33.99 | 1.26 | 1.05 | BJ | |
| 1234678-HpCDF | 408/410 | 35.85 | 1.13 | 0.722 | J | |
| 1234678-HpCDD | 424/426 | | | | U | 0.804 |
| 1234789-HpCDF | 408/410 | 37.54 | 1.10 | 0.784 | J | |
| OCDD | 458/460 | 41.13 | 1.49 | | * | 1.94 |
| OCDF | 442/444 | 41.35 | 0.90 | 2.60 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.30 | 0.82 | 0.65-0.89 | 65.2 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.54 | 1.56 | 1.32-1.78 | 88.3 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.23 | 1.30 | 1.05-1.43 | 84.1 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.32 | 1.32 | 1.05-1.43 | 77.1 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 37.00 | 1.07 | 0.88-1.20 | 99.1 | 23-140 |
| 13C-OCDD | 470/472 | 41.14 | 0.93 | 0.76-1.02 | 103.1 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.68 | 0.84 | 0.65-0.89 | 72.4 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.43 | 1.60 | 1.32-1.78 | 79.6 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.18 | 1.62 | 1.32-1.78 | 88.1 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.35 | 0.53 | 0.43-0.59 | 78.7 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.47 | 0.53 | 0.43-0.59 | 74.9 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.96 | 0.53 | 0.43-0.59 | 78.9 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.08 | 0.53 | 0.43-0.59 | 84.6 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.84 | 0.44 | 0.37-0.51 | 89.9 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.52 | 0.45 | 0.37-0.51 | 99.1 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.32 | NA | NA | 78.3 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA1

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496758

Sample wt/vol: 1000 mL Lab File ID: 14M854568_5496758

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 0.880 |
| 2378-TCDF | 304/306 | 24.70 | 0.82 | 0.740 | J | |
| 12378-PeCDF | 340/342 | 28.44 | 1.43 | 1.10 | BJ | |
| 12378-PeCDD | 356/358 | | | | U | 0.560 |
| 23478-PeCDF | 340/342 | | | | U | 0.600 |
| 123478-HxCDF | 374/376 | 32.36 | 1.31 | 0.880 | J | |
| 123678-HxCDF | 374/376 | | | | U | 0.360 |
| 123478-HxCDD | 390/392 | | | | U | 0.820 |
| 123678-HxCDD | 390/392 | | | | U | 0.800 |
| 123789-HxCDD | 390/392 | | | | U | 0.840 |
| 234678-HxCDF | 374/376 | | | | U | 0.380 |
| 123789-HxCDF | 374/376 | | | | U | 0.540 |
| 1234678-HpCDF | 408/410 | | | | U | 0.360 |
| 1234678-HpCDD | 424/426 | | | | U | 0.680 |
| 1234789-HpCDF | 408/410 | | | | U | 0.580 |
| OCDD | 458/460 | 41.14 | 0.92 | 1.52 | J | |
| OCDF | 442/444 | 41.34 | 0.90 | 3.20 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.30 | 0.82 | 0.65-0.89 | 44.6 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.55 | 1.60 | 1.32-1.78 | 68.4 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.23 | 1.31 | 1.05-1.43 | 69.8 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.32 | 1.31 | 1.05-1.43 | 68.8 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 37.00 | 1.09 | 0.88-1.20 | 82.4 | 23-140 |
| 13C-OCDD | 470/472 | 41.13 | 0.91 | 0.76-1.02 | 84.4 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.68 | 0.83 | 0.65-0.89 | 44.0 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.44 | 1.62 | 1.32-1.78 | 56.2 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.18 | 1.64 | 1.32-1.78 | 58.6 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.35 | 0.52 | 0.43-0.59 | 67.7 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.47 | 0.54 | 0.43-0.59 | 62.1 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.96 | 0.52 | 0.43-0.59 | 68.3 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.08 | 0.53 | 0.43-0.59 | 66.4 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.83 | 0.43 | 0.37-0.51 | 74.2 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.52 | 0.45 | 0.37-0.51 | 80.9 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.32 | NA | NA | 49.0 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA2

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496759

Sample wt/vol: 960 mL Lab File ID: 14M854568_5496759

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 0.688 |
| 2378-TCDF | 304/306 | 24.68 | 0.83 | 0.958 | J | |
| 12378-PeCDF | 340/342 | 28.44 | 1.26 | | * | 0.792 |
| 12378-PeCDD | 356/358 | | | | U | 0.458 |
| 23478-PeCDF | 340/342 | | | | U | 0.396 |
| 123478-HxCDF | 374/376 | 32.37 | 1.33 | 0.833 | J | |
| 123678-HxCDF | 374/376 | | | | U | 0.271 |
| 123478-HxCDD | 390/392 | | | | U | 0.521 |
| 123678-HxCDD | 390/392 | | | | U | 0.542 |
| 123789-HxCDD | 390/392 | | | | U | 0.542 |
| 234678-HxCDF | 374/376 | | | | U | 0.292 |
| 123789-HxCDF | 374/376 | 33.95 | 1.13 | 0.667 | BJ | |
| 1234678-HpCDF | 408/410 | 35.84 | 1.11 | 0.458 | J | |
| 1234678-HpCDD | 424/426 | 37.00 | 1.00 | 0.625 | J | |
| 1234789-HpCDF | 408/410 | | | | U | 0.458 |
| OCDD | 458/460 | | | | U | 0.729 |
| OCDF | 442/444 | 41.34 | 0.79 | 3.35 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids)..

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.30 | 0.79 | 0.65-0.89 | 69.4 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.54 | 1.64 | 1.32-1.78 | 85.7 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.21 | 1.30 | 1.05-1.43 | 87.5 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.31 | 1.29 | 1.05-1.43 | 75.3 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 36.99 | 1.10 | 0.88-1.20 | 100.4 | 23-140 |
| 13C-OCDD | 470/472 | 41.13 | 0.92 | 0.76-1.02 | 110.6 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.68 | 0.83 | 0.65-0.89 | 74.8 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.43 | 1.63 | 1.32-1.78 | 81.7 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.18 | 1.63 | 1.32-1.78 | 84.5 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.35 | 0.51 | 0.43-0.59 | 83.5 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.47 | 0.53 | 0.43-0.59 | 73.4 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.95 | 0.53 | 0.43-0.59 | 85.5 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.07 | 0.54 | 0.43-0.59 | 80.9 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.82 | 0.45 | 0.37-0.51 | 88.5 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.51 | 0.46 | 0.37-0.51 | 102.5 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.32 | NA | NA | 69.6 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA3

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496760

Sample wt/vol: 990 mL Lab File ID: 14M854568_5496760

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-04-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 1.11 |
| 2378-TCDF | 304/306 | 24.68 | 0,87 | 1.72 | J | |
| 12378-PeCDF | 340/342 | 28.41 | 1,16 | | * | 1.41 |
| 12378-PeCDD | 356/358 | 29.56 | 1,72 | 0.869 | BJ | |
| 23478-PeCDF | 340/342 | 29.19 | 1,38 | 0.949 | BJ | |
| 123478-HxCDF | 374/376 | 32.35 | 1,27 | 1.94 | J | |
| 123678-HxCDF | 374/376 | | | | U | 0.768 |
| 123478-HxCDD | 390/392 | | | | U | 0.970 |
| 123678-HxCDD | 390/392 | | | | U | 1.01 |
| 123789-HxCDD | 390/392 | | | | U | 0.990 |
| 234678-HxCDF | 374/376 | | | | U | 0.808 |
| 123789-HxCDF | 374/376 | | | | U | 1.54 |
| 1234678-HpCDF | 408/410 | 35.84 | 1,19 | 1.23 | J | |
| 1234678-HpCDD | 424/426 | | | | U | 1.03 |
| 1234789-HpCDF | 408/410 | | | | U | 0.808 |
| OCDD | 458/460 | 41.10 | 0,78 | 3.92 | J | |
| OCDF | 442/444 | 41.33 | 1,02 | 4.20 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.29 | 0,77 | 0.65-0.89 | 71,7 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.53 | 1,59 | 1.32-1.78 | 94,1 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.20 | 1,30 | 1.05-1.43 | 88,4 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.30 | 1,29 | 1.05-1.43 | 86.0 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 37.00 | 1,08 | 0.88-1.20 | 111 | 23-140 |
| 13C-OCDD | 470/472 | 41.11 | 0,91 | 0.76-1.02 | 95.0 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.65 | 0,83 | 0.65-0.89 | 76.0 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.41 | 1,56 | 1.32-1.78 | 81,7 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.16 | 1,66 | 1.32-1.78 | 95,9 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.34 | 0,53 | 0.43-0.59 | 89,1 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.45 | 0,54 | 0.43-0.59 | 79,4 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.95 | 0,52 | 0.43-0.59 | 65,6 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.07 | 0,53 | 0.43-0.59 | 79.0 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.83 | 0,44 | 0.37-0.51 | 93,4 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.51 | 0,44 | 0.37-0.51 | 111 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.30 | NA | NA | 72.6 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA4

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496761

Sample wt/vol: 970 mL Lab File ID: 14M854568_5496761

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 0.825 |
| 2378-TCDF | 304/306 | 24.68 | 0.72 | 1.09 | J | |
| 12378-PeCDF | 340/342 | 28.43 | 1.43 | 1.09 | BJ | |
| 12378-PeCDD | 356/358 | | | | U | 0.474 |
| 23478-PeCDF | 340/342 | | | | U | 0.619 |
| 123478-HxCDF | 374/376 | 32.36 | 1.09 | 1.49 | J | |
| 123678-HxCDF | 374/376 | | | | U | 0.309 |
| 123478-HxCDD | 390/392 | | | | U | 0.495 |
| 123678-HxCDD | 390/392 | | | | U | 0.474 |
| 123789-HxCDD | 390/392 | | | | U | 0.495 |
| 234678-HxCDF | 374/376 | | | | U | 0.289 |
| 123789-HxCDF | 374/376 | 33.95 | 1.20 | 0.742 | BJ | |
| 1234678-HpCDF | 408/410 | 35.83 | 1.08 | 0.742 | J | |
| 1234678-HpCDD | 424/426 | | | | U | 0.845 |
| 1234789-HpCDF | 408/410 | | | | U | 0.412 |
| OCDD | 458/460 | 41.12 | 0.93 | 2.80 | J | |
| OCDF | 442/444 | 41.34 | 0.88 | 4.99 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.30 | 0.79 | 0.65-0.89 | 41.9 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.54 | 1.52 | 1.32-1.78 | 73.1 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.22 | 1.29 | 1.05-1.43 | 71.5 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.31 | 1.29 | 1.05-1.43 | 69.6 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 36.99 | 1.08 | 0.88-1.20 | 90.3 | 23-140 |
| 13C-OCDD | 470/472 | 41.13 | 0.92 | 0.76-1.02 | 73.0 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.68 | 0.81 | 0.65-0.89 | 44.5 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.43 | 1.61 | 1.32-1.78 | 58.4 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.18 | 1.63 | 1.32-1.78 | 64.4 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.35 | 0.52 | 0.43-0.59 | 64.2 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.46 | 0.53 | 0.43-0.59 | 60.8 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.95 | 0.53 | 0.43-0.59 | 73.3 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.07 | 0.53 | 0.43-0.59 | 70.7 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.82 | 0.45 | 0.37-0.51 | 70.3 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.51 | 0.43 | 0.37-0.51 | 97.5 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.32 | NA | NA | 47.7 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA5

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496762

Sample wt/vol: 1000 mL Lab File ID: 14M854568_5496762

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-03-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 0.800 |
| 2378-TCDF | 304/306 | 24.68 | 0.83 | 0.740 | J | |
| 12378-PeCDF | 340/342 | 28.43 | 1.44 | 1.06 | BJ | |
| 12378-PeCDD | 356/358 | | | | U | 0.640 |
| 23478-PeCDF | 340/342 | | | | U | 0.520 |
| 123478-HxCDF | 374/376 | 32.36 | 1.63 | | * | 0.680 |
| 123678-HxCDF | 374/376 | | | | U | 0.400 |
| 123478-HxCDD | 390/392 | | | | U | 0.640 |
| 123678-HxCDD | 390/392 | | | | U | 0.620 |
| 123789-HxCDD | 390/392 | | | | U | 0.660 |
| 234678-HxCDF | 374/376 | | | | U | 0.420 |
| 123789-HxCDF | 374/376 | | | | U | 0.620 |
| 1234678-HpCDF | 408/410 | 35.81 | 1.12 | 0.800 | J | |
| 1234678-HpCDD | 424/426 | 36.99 | 0.97 | 1.32 | J | |
| 1234789-HpCDF | 408/410 | | | | U | 0.560 |
| OCDD | 458/460 | 41.11 | 0.81 | 3.72 | J | |
| OCDF | 442/444 | 41.33 | 0.79 | 3.16 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.29 | 0.81 | 0.65-0.89 | 66.2 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.53 | 1.61 | 1.32-1.78 | 83.7 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.20 | 1.31 | 1.05-1.43 | 83.2 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.30 | 1.30 | 1.05-1.43 | 77.3 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 36.98 | 1.08 | 0.88-1.20 | 94.7 | 23-140 |
| 13C-OCDD | 470/472 | 41.11 | 0.90 | 0.76-1.02 | 103.4 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.66 | 0.83 | 0.65-0.89 | 67.3 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.41 | 1.65 | 1.32-1.78 | 77.1 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.17 | 1.64 | 1.32-1.78 | 77.7 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.34 | 0.52 | 0.43-0.59 | 78.1 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.45 | 0.54 | 0.43-0.59 | 77.5 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.94 | 0.52 | 0.43-0.59 | 81.7 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.06 | 0.55 | 0.43-0.59 | 80.4 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.81 | 0.45 | 0.37-0.51 | 86.4 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.49 | 0.45 | 0.37-0.51 | 94.8 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.30 | NA | NA | 63.4 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA6

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496763

Sample wt/vol: 990 mL Lab File ID: 14M854568_5496763

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-03-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 0.727 |
| 2378-TCDF | 304/306 | 24.66 | 0.65 | | * | 1.13 |
| 12378-PeCDF | 340/342 | 28.44 | 1.35 | 0.869 | BJ | |
| 12378-PeCDD | 356/358 | | | | U | 0.444 |
| 23478-PeCDF | 340/342 | | | | U | 0.606 |
| 123478-HxCDF | 374/376 | 32.34 | 1.12 | 1.13 | J | |
| 123678-HxCDF | 374/376 | | | | U | 0.364 |
| 123478-HxCDD | 390/392 | | | | U | 0.545 |
| 123678-HxCDD | 390/392 | | | | U | 0.525 |
| 123789-HxCDD | 390/392 | | | | U | 0.566 |
| 234678-HxCDF | 374/376 | | | | U | 0.364 |
| 123789-HxCDF | 374/376 | | | | U | 0.525 |
| 1234678-HpCDF | 408/410 | 35.83 | 0.92 | 0.768 | J | |
| 1234678-HpCDD | 424/426 | 36.99 | 1.11 | 1.64 | J | |
| 1234789-HpCDF | 408/410 | | | | U | 0.566 |
| OCDD | 458/460 | 41.11 | 0.98 | 6.73 | J | |
| OCDF | 442/444 | 41.31 | 0.84 | 5.46 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.29 | 0.81 | 0.65-0.89 | 47.8 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.53 | 1.56 | 1.32-1.78 | 79.6 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.20 | 1.30 | 1.05-1.43 | 72.9 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.30 | 1.29 | 1.05-1.43 | 73.1 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 36.97 | 1.09 | 0.88-1.20 | 85.6 | 23-140 |
| 13C-OCDD | 470/472 | 41.11 | 0.94 | 0.76-1.02 | 67.6 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.66 | 0.82 | 0.65-0.89 | 49.0 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.41 | 1.62 | 1.32-1.78 | 63.5 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.17 | 1.65 | 1.32-1.78 | 68.4 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.33 | 0.52 | 0.43-0.59 | 66.7 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.45 | 0.53 | 0.43-0.59 | 62.9 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.94 | 0.53 | 0.43-0.59 | 75.3 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.06 | 0.54 | 0.43-0.59 | 71.9 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.81 | 0.44 | 0.37-0.51 | 65.8 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.48 | 0.45 | 0.37-0.51 | 94.0 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.30 | NA | NA | 46.8 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA8

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496764

Sample wt/vol: 960 mL Lab File ID: 14M854568_5496764

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-04-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | | | | U | 1.15 |
| 2378-TCDF | 304/306 | 24.68 | 0.87 | 0.875 | J | |
| 12378-PeCDF | 340/342 | | | | U | 0.917 |
| 12378-PeCDD | 356/358 | | | | U | 1.08 |
| 23478-PeCDF | 340/342 | | | | U | 0.750 |
| 123478-HxCDF | 374/376 | 32.36 | 1.24 | 1.58 | J | |
| 123678-HxCDF | 374/376 | | | | U | 0.563 |
| 123478-HxCDD | 390/392 | | | | U | 1.06 |
| 123678-HxCDD | 390/392 | | | | U | 1.08 |
| 123789-HxCDD | 390/392 | | | | U | 1.08 |
| 234678-HxCDF | 374/376 | | | | U | 0.604 |
| 123789-HxCDF | 374/376 | | | | U | 1.15 |
| 1234678-HpCDF | 408/410 | 35.83 | 1.13 | 0.708 | J | |
| 1234678-HpCDD | 424/426 | | | | U | 1.15 |
| 1234789-HpCDF | 408/410 | | | | U | 1.00 |
| OCDD | 458/460 | 41.13 | 0.78 | 2.94 | J | |
| OCDF | 442/444 | 41.32 | 0.89 | 4.58 | J | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.29 | 0.83 | 0.65-0.89 | 69.3 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.53 | 1.66 | 1.32-1.78 | 93.1 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.22 | 1.29 | 1.05-1.43 | 89.7 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.31 | 1.29 | 1.05-1.43 | 89.6 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 37.00 | 1.09 | 0.88-1.20 | 114.7 | 23-140 |
| 13C-OCDD | 470/472 | 41.11 | 0.91 | 0.76-1.02 | 95.9 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.66 | 0.82 | 0.65-0.89 | 76.2 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.41 | 1.60 | 1.32-1.78 | 80.0 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.17 | 1.66 | 1.32-1.78 | 93.5 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.34 | 0.52 | 0.43-0.59 | 91.5 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.45 | 0.53 | 0.43-0.59 | 77.8 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.95 | 0.54 | 0.43-0.59 | 70.2 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.07 | 0.53 | 0.43-0.59 | 80.8 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.83 | 0.44 | 0.37-0.51 | 96.6 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.51 | 0.46 | 0.37-0.51 | 114.7 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.30 | NA | NA | 80.5 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AB0

1DFA - FORM I-HR CDD-1
CDD/CDF SAMPLE DATA SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496768

Sample wt/vol: 855 ml (See case narrative) Lab File ID: 14M854568_5496768

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-03-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Selected Ions | Peak RT | Ion Ratio # | Concentration | Q | EMPC/EDL |
|---|---|---|---|---|---|---|
| 2378-TCDD | 320/322 | 25.30 | 0.88 | 186 | | |
| 2378-TCDF | 304/306 | 24.68 | 0.78 | 587 | | |
| 12378-PeCDF | 340/342 | 28.43 | 1.55 | 344 | B | |
| 12378-PeCDD | 356/358 | 29.54 | 1.61 | 238 | B | |
| 23478-PeCDF | 340/342 | 29.18 | 1.51 | 227 | B | |
| 123478-HxCDF | 374/376 | 32.35 | 1.22 | 219 | | |
| 123678-HxCDF | 374/376 | 32.47 | 1.22 | 421 | | |
| 123478-HxCDD | 390/392 | 33.23 | 1.32 | 528 | B | |
| 123678-HxCDD | 390/392 | 33.33 | 1.13 | 429 | | |
| 123789-HxCDD | 390/392 | 33.70 | 1.32 | 388 | B | |
| 234678-HxCDF | 374/376 | 33.10 | 1.20 | 419 | | |
| 123789-HxCDF | 374/376 | 33.96 | 1.25 | 531 | B | |
| 1234678-HpCDF | 408/410 | 35.85 | 0.98 | 234 | | |
| 1234678-HpCDD | 424/426 | 37.01 | 1.04 | 524 | | |
| 1234789-HpCDF | 408/410 | 37.52 | 1.04 | 527 | | |
| OCDD | 458/460 | 41.12 | 0.94 | 809 | | |
| OCDF | 442/444 | 41.31 | 0.90 | 979 | | |

NOTE: Concentrations, Estimated Maximum Possible Concentrations (EMPCs), and Estimated Detection Levels (EDLs) for solid samples are calculated on a dry weight basis (except tissues, which are reported on a wet weight basis with % Lipids).

| Labeled Compounds | Selected Ions | Peak RT | Ion Ratio # | Ion Ratio Limits | % Rec # | Recovery Limits |
|---|---|---|---|---|---|---|
| 13C-2378-TCDD | 332/334 | 25.27 | 0.81 | 0.65-0.89 | 73.7 | 25-164 |
| 13C-12378-PeCDD | 368/370 | 29.53 | 1.54 | 1.32-1.78 | 93.2 | 25-181 |
| 13C-123478-HxCDD | 402/404 | 33.22 | 1.30 | 1.05-1.43 | 101.8 | 32-141 |
| 13C-123678-HxCDD | 402/404 | 33.31 | 1.30 | 1.05-1.43 | 81.6 | 28-130 |
| 13C-1234678-HpCDD | 436/438 | 36.99 | 1.10 | 0.88-1.20 | 119.0 | 23-140 |
| 13C-OCDD | 470/472 | 41.11 | 0.92 | 0.76-1.02 | 122.2 | 17-157 |
| 13C-2378-TCDF | 316/318 | 24.65 | 0.81 | 0.65-0.89 | 75.9 | 24-169 |
| 13C-12378-PeCDF | 352/354 | 28.40 | 1.62 | 1.32-1.78 | 86.0 | 24-185 |
| 13C-23478-PeCDF | 352/354 | 29.16 | 1.65 | 1.32-1.78 | 92.2 | 21-178 |
| 13C-123478-HxCDF | 384/386 | 32.34 | 0.52 | 0.43-0.59 | 94.5 | 26-152 |
| 13C-123678-HxCDF | 384/386 | 32.45 | 0.53 | 0.43-0.59 | 81.2 | 26-123 |
| 13C-123789-HxCDF | 384/386 | 33.95 | 0.53 | 0.43-0.59 | 72.8 | 29-147 |
| 13C-234678-HxCDF | 384/386 | 33.07 | 0.52 | 0.43-0.59 | 87.0 | 28-136 |
| 13C-1234678-HpCDF | 418/420 | 35.83 | 0.45 | 0.37-0.51 | 105.0 | 28-143 |
| 13C-1234789-HpCDF | 418/420 | 37.51 | 0.45 | 0.37-0.51 | 119.0 | 26-138 |
| 37Cl-2378-TCDD | 328/NA | 25.29 | NA | NA | 78.4 | 35-197 |

# Column to be used to flag values outside QC limits.

EPA Sample No.

A0AA0

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496756

Sample wt/vol: 970 mL Lab File ID: 14M854568_5496756

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 0.907 | x 0.1 = | 0.0907 |
| 12378-PeCDF | 1.20 | x 0.03 = | 0.0359 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.722 | x 0.3 = | 0.216 |
| 123478-HxCDF | 1.20 | x 0.1 = | 0.120 |
| 123678-HxCDF | 0.619 | x 0.1 = | 0.0619 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 1.05 | x 0.1 = | 0.105 |
| 1234678-HpCDF | 0.722 | x 0.01 = | 0.00722 |
| 1234678-HpCDD | 0.0 | x 0.01 = | 0.0 |
| 1234789-HpCDF | 0.784 | x 0.01 = | 0.00784 |
| OCDD | 1.94 | x 0.0003 = | 0.000581 |
| OCDF | 2.60 | x 0.0003 = | 0.000779 |
| | | | |
| | | Total = | 0.646 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA1

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496758

Sample wt/vol: 1000 mL Lab File ID: 14M854568_5496758

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 0.740 | x 0.1 = | 0.0740 |
| 12378-PeCDF | 1.10 | x 0.03 = | 0.0330 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.0 | x 0.3 = | 0.0 |
| 123478-HxCDF | 0.880 | x 0.1 = | 0.0880 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 1234678-HpCDF | 0.0 | x 0.01 = | 0.0 |
| 1234678-HpCDD | 0.0 | x 0.01 = | 0.0 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 1.52 | x 0.0003 = | 0.000456 |
| OCDF | 3.20 | x 0.0003 = | 0.000960 |
| | | | |
| | | Total = | 0.196 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA2

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496759

Sample wt/vol: 960 mL Lab File ID: 14M854568_5496759

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 0.958 | x 0.1 = | 0.0958 |
| 12378-PeCDF | 0.792 | x 0.03 = | 0.0238 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.0 | x 0.3 = | 0.0 |
| 123478-HxCDF | 0.833 | x 0.1 = | 0.0833 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.667 | x 0.1 = | 0.0667 |
| 1234678-HpCDF | 0.458 | x 0.01 = | 0.00458 |
| 1234678-HpCDD | 0.625 | x 0.01 = | 0.00625 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 0.0 | x 0.0003 = | 0.0 |
| OCDF | 3.35 | x 0.0003 = | 0.00101 |
| | | | |
| | | Total = | 0.281 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA3

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496760

Sample wt/vol: 990 mL Lab File ID: 14M854568_5496760

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-04-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 1.72 | x 0.1 = | 0.172 |
| 12378-PeCDF | 1.41 | x 0.03 = | 0.0424 |
| 12378-PeCDD | 0.869 | x 1.0 = | 0.869 |
| 23478-PeCDF | 0.949 | x 0.3 = | 0.285 |
| 123478-HxCDF | 1.94 | x 0.1 = | 0.194 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 1234678-HpCDF | 1.23 | x 0.01 = | 0.0123 |
| 1234678-HpCDD | 0.0 | x 0.01 = | 0.0 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 3.92 | x 0.0003 = | 0.00118 |
| OCDF | 4.20 | x 0.0003 = | 0.00126 |
| | | | |
| | | Total = | 1.58 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA4

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496761

Sample wt/vol: 970 mL Lab File ID: 14M854568_5496761

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-02-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 1.09 | x 0.1 = | 0.109 |
| 12378-PeCDF | 1.09 | x 0.03 = | 0.0328 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.0 | x 0.3 = | 0.0 |
| 123478-HxCDF | 1.49 | x 0.1 = | 0.149 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.742 | x 0.1 = | 0.0742 |
| 1234678-HpCDF | 0.742 | x 0.01 = | 0.00742 |
| 1234678-HpCDD | 0.0 | x 0.01 = | 0.0 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 2.80 | x 0.0003 = | 0.000841 |
| OCDF | 4.99 | x 0.0003 = | 0.00150 |
| | | | |
| | | Total = | 0.375 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA5

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496762

Sample wt/vol: 1000 mL Lab File ID: 14M854568_5496762

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-03-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 0.740 | x 0.1 = | 0.0740 |
| 12378-PeCDF | 1.06 | x 0.03 = | 0.0318 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.0 | x 0.3 = | 0.0 |
| 123478-HxCDF | 0.680 | x 0.1 = | 0.0680 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 1234678-HpCDF | 0.800 | x 0.01 = | 0.00800 |
| 1234678-HpCDD | 1.32 | x 0.01 = | 0.0132 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 3.72 | x 0.0003 = | 0.00112 |
| OCDF | 3.16 | x 0.0003 = | 0.000948 |
| | | | |
| | | Total = | 0.197 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA6

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496763

Sample wt/vol: 990 mL Lab File ID: 14M854568_5496763

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-03-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 1.13 | x 0.1 = | 0.113 |
| 12378-PeCDF | 0.869 | x 0.03 = | 0.0261 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.0 | x 0.3 = | 0.0 |
| 123478-HxCDF | 1.13 | x 0.1 = | 0.113 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 1234678-HpCDF | 0.768 | x 0.01 = | 0.00768 |
| 1234678-HpCDD | 1.64 | x 0.01 = | 0.0164 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 6.73 | x 0.0003 = | 0.00202 |
| OCDF | 5.46 | x 0.0003 = | 0.00164 |
| | | | |
| | | Total = | 0.280 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AA8

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496764

Sample wt/vol: 960 mL Lab File ID: 14M854568_5496764

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-04-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 0.0 | x 1.0 = | 0.0 |
| 2378-TCDF | 0.875 | x 0.1 = | 0.0875 |
| 12378-PeCDF | 0.0 | x 0.03 = | 0.0 |
| 12378-PeCDD | 0.0 | x 1.0 = | 0.0 |
| 23478-PeCDF | 0.0 | x 0.3 = | 0.0 |
| 123478-HxCDF | 1.58 | x 0.1 = | 0.158 |
| 123678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123478-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123678-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDD | 0.0 | x 0.1 = | 0.0 |
| 234678-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 123789-HxCDF | 0.0 | x 0.1 = | 0.0 |
| 1234678-HpCDF | 0.708 | x 0.01 = | 0.00708 |
| 1234678-HpCDD | 0.0 | x 0.01 = | 0.0 |
| 1234789-HpCDF | 0.0 | x 0.01 = | 0.0 |
| OCDD | 2.94 | x 0.0003 = | 0.000881 |
| OCDF | 4.58 | x 0.0003 = | 0.00138 |
| | | | |
| | | Total = | 0.255 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

EPA Sample No.

A0AB0

1DFB - FORM I-HR CDD-2
CDD/CDF TOXICITY EQUIVALENCE SUMMARY
HIGH RESOLUTION

Lab Name: AGAT LABORATORIES Contract: EP10W001067

Lab Code: AGATAB Case No.: 44423 TO No.: 2134.2 SDG No.: A0AA0

Matrix: Water Lab Sample ID: 5496768

Sample wt/vol: 855 ml (See case narrative) Lab File ID: 14M854568_5496768

Water Sample Prep: SEPF Date Received: 06-23-2014

Concentrated Extract Volume: 20 uL Date Extracted: 06-26-2014

Injection Volume: 1.0 uL % Solids/Lipids: Date Analyzed: 07-03-2014

GC Column: DB-5 ID: 0.250 mm Dilution Factor: 1.0

Concentration Units: pg/L

| Target Analyte | Concentration | TEF* | TEF-Adjusted Concentration |
|---|---|---|---|
| 2378-TCDD | 186 | x 1.0 = | 186 |
| 2378-TCDF | 587 | x 0.1 = | 58.7 |
| 12378-PeCDF | 344 | x 0.03 = | 10.3 |
| 12378-PeCDD | 238 | x 1.0 = | 238 |
| 23478-PeCDF | 227 | x 0.3 = | 68.0 |
| 123478-HxCDF | 219 | x 0.1 = | 21.9 |
| 123678-HxCDF | 421 | x 0.1 = | 42.1 |
| 123478-HxCDD | 528 | x 0.1 = | 52.8 |
| 123678-HxCDD | 429 | x 0.1 = | 24.9 |
| 123789-HxCDD | 388 | x 0.1 = | 38.8 |
| 234678-HxCDF | 419 | x 0.1 = | 41.9 |
| 123789-HxCDF | 531 | x 0.1 = | 53.1 |
| 1234678-HpCDF | 234 | x 0.01 = | 2.34 |
| 1234678-HpCDD | 524 | x 0.01 = | 5.24 |
| 1234789-HpCDF | 527 | x 0.01 = | 4.27 |
| OCDD | 809 | x 0.0003 = | 0.153 |
| OCDF | 979 | x 0.0003 = | 0.294 |
| | | | |
| | | Total = | 849 |

* TEF - Toxicity Equivalent Factors from the World Health Organization (WHO), 2005.

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA0

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-001

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B10

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA1

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-002

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B11

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA2

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-003

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B12

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA3

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-004

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B13

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 3.3 | EB |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA3DL

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-004

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B18

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 5.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 2.7 | DB |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA4

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-005

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B14

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA5

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-006

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B15

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA6

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-007

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B16

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

1F - FORM I SV-SIM
SEMIVOLATILE SIM ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
A0AA8

Lab Name: Shealy Environmental Services, Inc. Contract: EP-W-11-035

Lab Code: SHEALY Case No.: 44423 Mod. Ref No.: 2110.4 SDG No.: A0AA0

Matrix: (SOIL/SED/WATER) Water Lab Sample ID: PF20038-009

Sample wt/vol: 1000 (g/mL) mL Lab File ID: 120708B17

Extraction: (Type) CONT

% Moisture: _____ Decanted: (Y/N) _____ Date Received: 06/20/2014

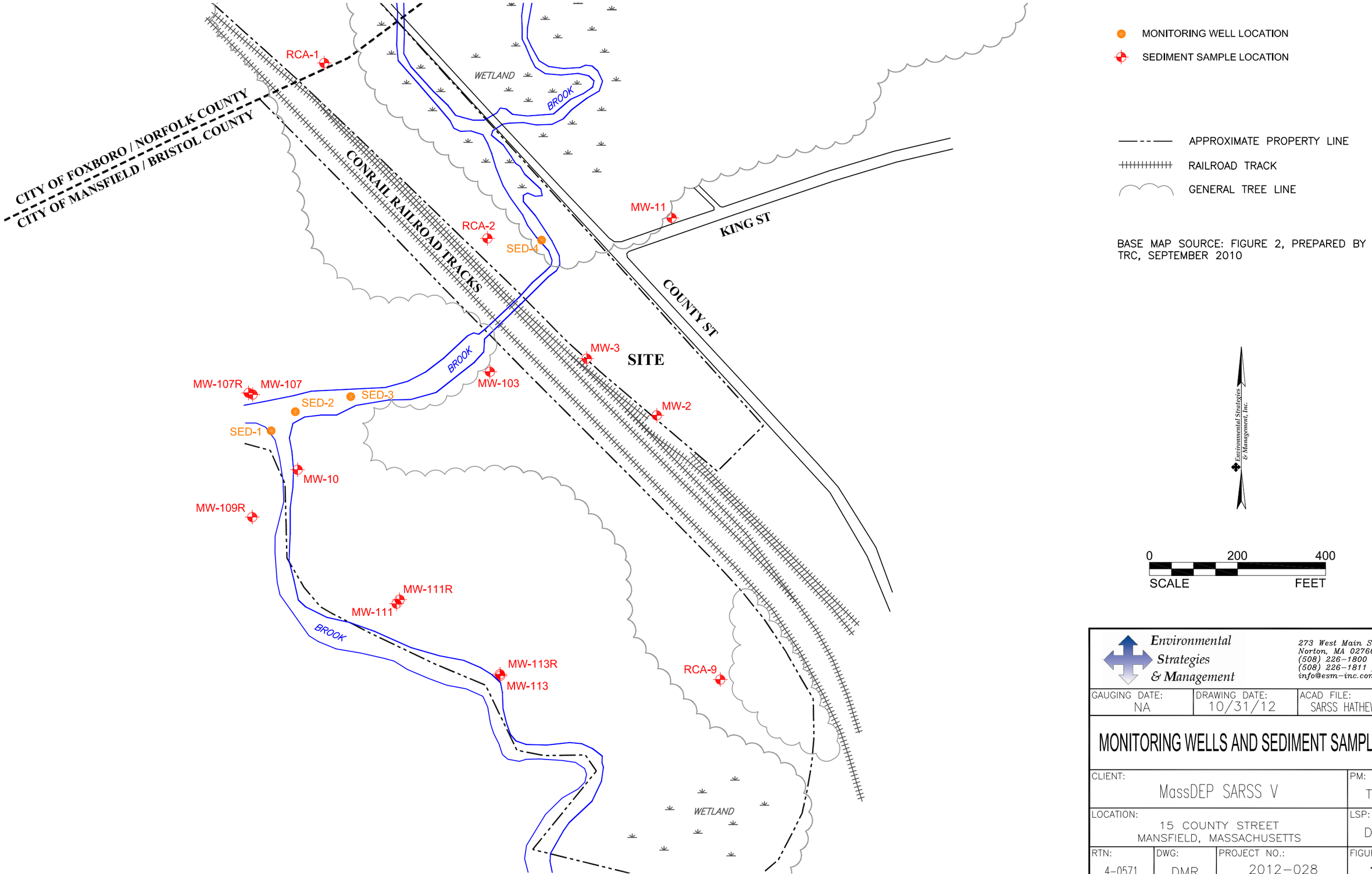
Concentrated Extract Volume: 1000 (uL) Date Extracted: 06/24/2014

Injection Volume: 1.0 (uL) GPC Factor: 1.0 Date Analyzed: 07/08/2014

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1.0

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L | Q |
|---|---|---|---|
| 87-86-5 | Pentachlorophenol | 0.20 | U |

# SEDIMENT ANALYTICAL RESULTS




Environmental Strategies & Management

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Norton, MA 02766
(508) 226-1800
(508) 226-1811 fax
info@esm-inc.com

| GAUGING DATE: | DRAWING DATE: | ACAD FILE: |
|---|---|---|
| NA | 10/31/12 | SARSS HATHEWAY |

# MONITORING WELLS AND SEDIMENT SAMPLES

| CLIENT: | PM: |
|---|---|
| MassDEP SARSS V | TS |
| LOCATION: 15 COUNTY STREET MANSFIELD, MASSACHUSETTS | LSP: DH |

| RTN: | DWG: | PROJECT NO.: | FIGURE: |
|---|---|---|---|
| 4-0571 | DMR | 2012-028 | 1 |

Table C-3. Hatheway & Patterson Superfund Site Sediment Sampling Results

| | | SED-1 5/16/2012 | SED-2 5/16/2012 | SED-3 5/16/2012 | SED-4 5/16/2012 | SED-4-FD 5/16/2012 | Maximum Detection | | Maximum Historical Detections HHRA | 95% UCL HHRA | Maximum Historical Detections BERA | Geomean BERA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,3,7,8-TCDD | mg/kg | 7.02E-07 | < 1.24E-06 | < 1.13E-06 | 2.64E-06 | 1.37E-06 | 2.64E-06 | | NA | NA | 3.29E-06 | 6.76E-07 |
| 1,2,3,7,8-PeCDD | mg/kg | 6.05E-06 | 2.39E-06 | 3.11E-06 | 1.72E-05 | 3.64E-06 | 1.72E-05 | | NA | NA | 4.91E-05 | 3.03E-06 |
| 1,2,3,4,7,8-HxCDD | mg/kg | 2.34E-05 | 7.41E-06 | 7.59E-06 | 4.45E-05 | 5.73E-06 | 4.45E-05 | | NA | NA | 2.15E-04 | 8.45E-06 |
| 1,2,3,6,7,8-HxCDD | mg/kg | 2.31E-04 | 3.87E-05 | 4.60E-05 | 2.17E-04 | 2.99E-05 | 2.31E-04 | | NA | NA | 1.82E-03 | 3.50E-05 |
| 1,2,3,7,8,9-HxCDD | mg/kg | 7.04E-05 | 1.84E-05 | 1.80E-05 | 1.14E-04 | 1.91E-05 | 1.14E-04 | | NA | NA | 6.15E-04 | 2.25E-05 |
| 1,2,3,4,6,7,8-HpCDD | mg/kg | 8.72E-03 | 1.03E-03 | 1.44E-03 | 5.27E-03 | 8.17E-04 | 8.72E-03 | | NA | NA | 5.90E-02 | 1.05E-03 |
| OCDD | mg/kg | 6.61E-02 | 6.57E-03 | 1.14E-02 | 3.66E-02 | 7.27E-03 | 6.61E-02 | | NA | NA | 5.24E-01 | 7.09E-03 |
| 2,3,7,8-TCDF | mg/kg | < 1.24E-06 | < 1.24E-06 | < 1.13E-06 | 4.83E-06 | 2.46E-06 | 4.83E-06 | | NA | NA | 2.81E-05 | 1.38E-06 |
| 1,2,3,7,8-PeCDF | mg/kg | 1.84E-06 | < 3.1E-06 | 7.10E-07 | 7.83E-06 | 1.62E-06 | 7.83E-06 | | NA | NA | 3.60E-05 | 1.29E-06 |
| 2,3,4,7,8-PeCDF | mg/kg | 1.72E-06 | < 3.1E-06 | 5.87E-07 | 5.20E-06 | 1.56E-06 | 5.20E-06 | | NA | NA | 2.89E-05 | 1.43E-06 |
| 1,2,3,4,7,8-HxCDF | mg/kg | 3.16E-05 | 6.15E-06 | 7.39E-06 | 5.15E-05 | 7.87E-06 | 5.15E-05 | | NA | NA | 2.79E-04 | 1.15E-05 |
| 1,2,3,6,7,8-HxCDF | mg/kg | 1.24E-05 | 3.91E-06 | 5.27E-06 | 4.16E-05 | 6.44E-06 | 4.16E-05 | | NA | NA | 1.37E-04 | 9.87E-06 |
| 2,3,4,6,7,8-HxCDF | mg/kg | < 3.1E-06 | < 3.1E-06 | 1.73E-06 | < 4.25E-06 | < 3.57E-06 | 1.73E-06 | | NA | NA | 1.38E-04 | 3.08E-06 |
| 1,2,3,7,8,9-HxCDF | mg/kg | 2.51E-05 | 7.19E-06 | 1.03E-05 | 7.93E-05 | 1.16E-05 | 7.93E-05 | | NA | NA | 3.31E-05 | 5.81E-07 |
| 1,2,3,4,6,7,8-HpCDF | mg/kg | 1.50E-03 | 2.14E-04 | 2.89E-04 | 1.39E-03 | 2.02E-04 | 1.50E-03 | | NA | NA | 9.12E-03 | 2.06E-04 |
| 1,2,3,4,7,8,9-HpCDF | mg/kg | 9.86E-05 | 1.51E-05 | 2.78E-05 | 1.44E-04 | 1.97E-05 | 1.44E-04 | | NA | NA | 8.15E-04 | 1.77E-05 |
| OCDF | mg/kg | 1.06E-02 | 7.58E-04 | 1.34E-03 | 4.32E-03 | 5.65E-04 | 1.06E-02 | | NA | NA | 5.38E-02 | 6.28E-04 |
| Dioxin TEQ [1] | mg/kg | 1.73E-04 | 2.67E-05 | 3.49E-05 | 1.57E-04 | 2.68E-05 | 1.73E-04 | | 2.27E-03 | 1.60E-03 | NA | NA |
| Arsenic | mg/kg | 26 | 1.7 | 4.8 | 20 | 6.2 | 26 | | 65 | 18 | 65 | 2.77 |
| Chromium | mg/kg | 7 | 5 | 9 | 26 | 17 | 26 | | 330 | 240 | 330 | 15.6 |
| Pentachlorophenol | mg/kg | < 1 | < 1 | < 1 | < 8 | < 7 | ND | | 690 | 81 | 24 | 0.438 |

Notes

1. Using 2005 WHO TEFs and non-detects equal to the 1/2 reporting limit.

NA - Not Applicable

ND - Not Detected

< - Not detected at the value reported

HHRA - 2005 Human Health Risk Assessment

BERA - 2004 Baseline Ecological Risk Assessment

UCL - Upper Confidence Limit

TABLE 2A
SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT SAMPLES
DIOXINS

Hatheway Patterson Site RTN 4-571
15 County Street
Mansfield MA
(results in ng/kg)

| Lab ID | Sample | Sample Type | Sample Date | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD) | Octachlorodibenzo-p-dioxin (OCDD) | 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24087-13 (SED-1) | SED-1 | Sample | 5/16/2012 | 0.702 J | 6.05 | 23.4 | 231 | 70.4 | 8720 E | 66100 B,E | 0.76 C,J | 1.84 J | 1.72 J | 31.6 | 12.4 K | <3.1 | 25.1 |
| 24087-13 (SED-1) | SED-1 | Re-analyzed TCDF | 5/16/2012 | | | | | | | | <1.24 | | | | | | |
| 24087-13 (SED-1) | SED-1 | Diluted | 5/16/2012 | <24.8 | <62.1 | 24.1 J,K | 226 | 71.6 | 7620 | 68100 B | <24.8 | <62.1 | <62.1 | 23.5 J | <62.1 | <62.1 | <62.1 |
| 24087-13 (SED-1) | SED-1 | Matrix Spike | 5/16/2012 | 24.1 | 70.1 | 91.9 | | 155 | 12900 E | 94900 E | 25.8 | 66.2 | 55.5 | 98.8 | 75.3 | 56.6 | 85.3 |
| 24087-13 (SED-1) | SED-1 | Dup Matrix Spike | 5/16/2012 | 25.6 | 67.5 | 92.3 | 347 | 173 | 10500 E | 79600 E | 26.3 | 66.7 | 52.6 | 90.4 | 74.6 | 58.5 | 84 |
| 24087-14 (SED-2) | SED-2 | Sample | 5/16/2012 | <1.24 | 2.39 J | 7.41 | 38.7 | 18.4 | 1030 | 6570 B,E | <1.24 | <3.1 | <3.1 | 6.15 | 3.91 | <3.1 | 7.19 |
| 24087-15 (SED-3) | SED-3 | Sample | 5/16/2012 | <1.13 | 3.11 | 7.59 | 46 | 18 | 1440 | 11400 B,E | <1.13 | 0.71 J | 0.587 J | 7.39 | 5.27 | 1.73 J,K | 10.3 |
| 24087-16 (SED-4) | SED-4 | Sample | 5/16/2012 | 2.64 | 17.2 | 44.5 | 217 | 114 | 5270 E | 36600 B,E | 6.82 C | 7.83 | 5.2 K | 51.5 | 41.6 | <4.25 | 79.3 |
| 24087-16 (SED-4) | SED-4 | Re-analyzed TCDF | 5/16/2012 | | | | | | | | 4.83 | | | | | | |
| 24087-16 (SED-4) | SED-4 | Diluted | 5/16/2012 | <17 | 15.4 J | 40.3 J,K | 248 | 132 | 5190 | 39500 B | <17 | <42.5 | <42.5 | 46.8 K | 42.1 J,K | <42.5 | 71.9 |
| 24087-17 (SED-4 Dup) | (SED-4 Dup) | Sample | 5/16/2012 | 1.37 J | 3.64 | 5.73 K | 29.9 | 19.1 | 817 | 7270 B,E | 3.69 C | 1.62 J | 1.56 J | 7.87 | 6.44 | <3.57 | 11.6 |
| 24087-17 (SED-4 Dup) | (SED-4 Dup) | Re-analyzed TCDF | 5/16/2012 | | | | | | | | 2.46 | | | | | | |
| Lab Control Sample | LCS | Sample | 5/16/2012 | 17.8 | 45.4 | 45.6 | 48.3 | 48 | 43.9 | 78.1 | 18.5 | 49.3 | 45.8 | 42 | 45.8 | 43.3 | 44 |
| Method Blank | MB | Method Blank | 5/16/2012 | <0.937 | <2.34 | <2.34 | <2.34 | <2.34 | <2.34 | 1.55 J | <0.937 | <2.34 | <2.34 | <2.34 | <2.34 | <2.34 | <2.34 |

**Notes:**
List of flags and qualifiers is attached.
NA - not applicable
Results for non-detected comounds shown as less than (<) the laboratory reporting limit.
* EPA Fresh Water Screening Criterion



Environmental Strategies & Management

TABLE 2A
SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT SAMPLES
DIOXINS

Hatheway Patterson Site RTN 4-571
15 County Street
Mansfield MA
(results in ng/kg)

| Lab ID | Sample | Sample Type | Sample Date | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF) | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF) | Octachlorodibenzofuran (OCDF) | Tetrachlorodibenzo-p-dioxins (TCDD), Total | Pentachlorodibenzo-p-dioxin (PeCDD), Total | Hexachlorodibenzo-p-dioxins (HxCDD), Total | Heptachlorodibenzo-p-dioxins (HpCDD), Total | Tetrachlorodibenzofurans (TCDF), Total | Pentachlorodibenzofurans (PeCDF), Total | Hexachlorodibenzofurans (HxCDF), Total | Heptachlorodibenzofurans (HpCDF), Total | Total TCDD TEQ - 2005 WHO (ND = MRL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24087-13 (SED-1) | SED-1 | Sample | 5/16/2012 | 1500 P | 98.6 | 10600 E,P | 12.2 | 55.7 | 839 | 13500 | 2.07 | 88.3 | 1090 | 1600 | 162 |
| 24087-13 (SED-1) | SED-1 | Re-analyzed TCDF | 5/16/2012 | | | | | | | | | | | | 162 |
| 24087-13 (SED-1) | SED-1 | Diluted | 5/16/2012 | 1200 | <62.1 | 9480 | | | | | | | | | 162 |
| 24087-13 (SED-1) | SED-1 | Matrix Spike | 5/16/2012 | 2220 | 193 | 14300 E | 28.8 | 138 | 1380 | 20100 | 31.1 | 234 | 1780 | 10900 | |
| 24087-13 (SED-1) | SED-1 | Dup Matrix Spike | 5/16/2012 | 1860 | 166 | 12200 E | 25.6 | 123 | 1270 | 16300 | 30.5 | 225 | 1540 | 8490 | |
| 24087-14 (SED-2) | SED-2 | Sample | 5/16/2012 | 214 | 15.1 | 758 | <1.24 | 4.8 | 152 | 1600 | <1.24 | 21.1 | 202 | 858 | 25.4 |
| 24087-15 (SED-3) | SED-3 | Sample | 5/16/2012 | 289 | 27.8 | 1340 | <1.13 | 7.09 | 161 | 2190 | <1.13 | 37.1 | 232 | 1260 | 34.3 |
| 24087-16 (SED-4) | SED-4 | Sample | 5/16/2012 | 1390 | 144 | 4320 | 22.4 | 81.7 | 1270 | 8850 | 64.7 | 298 | 1540 | 5050 | 157 |
| 24087-16 (SED-4) | SED-4 | Re-analyzed TCDF | 5/16/2012 | | | | | | | | | | | | 157 |
| 24087-16 (SED-4) | SED-4 | Diluted | 5/16/2012 | 1250 | 117 | 4420 | | | | | | | | | 157 |
| 24087-17 (SED-4 Dup) | (SED-4 Dup) | Sample | 5/16/2012 | 202 | 19.7 | 565 | 5.11 | 42.1 | 458 | 1740 | 25.1 | 55.5 | 210 | 706 | 26.6 |
| 24087-17 (SED-4 Dup) | (SED-4 Dup) | Re-analyzed TCDF | 5/16/2012 | | | | | | | | | | | | 26.6 |
| Lab Control Sample | LCS | Sample | 5/16/2012 | 46.4 | 48.9 | 75.5 | | | | | | | | | |
| Method Blank | MB | Method Blank | 5/16/2012 | <2.34 | <2.34 | <4.68 | <0.937 | <2.34 | <2.34 | <2.34 | <0.937 | <2.34 | <2.34 | <2.34 | |

**Notes:**
List of flags and qualifiers is attached.
NA - not applicable
Results for non-detected comounds shown as less than (<) the laborato
* EPA Fresh Water Screening Criterion



Environmental Strategies & Management

TABLE 2B
SUMMARY OF ANALYTICAL RESULTS IN SEDIMENT SAMPLES
As, Cr, and PCP

Hatheway Patterson Site RTN 4-571
15 County Street
Mansfield MA
(results in mg/kg)

| | | Sampled Date | Arsenic | Chromium | Pentachlorophenol |
|---|---|---|---|---|---|
| Field Samples | SED-1 | 5/16/2012 | 26 | 7 | < 1 |
| | SED-2 | 5/16/2012 | 1.7 | 5 | < 1 |
| | SED-3 | 5/16/2012 | 4.8 | 9 | < 1 |
| | SED-4 | 5/16/2012 | 20 | 26 | < 8 |
| | SED-4 Duplicate | 5/16/2012 | 6.2 | 17 | < 7 |

**Notes:**
List of flags and qualifiers is attached.
NA - not applicable
Results for non-detected comounds shown as less than (<) the laboratory reporting limit.
* EPA Fresh Water Screening Criterion



Environmental Strategies & Management

# Data Qualifier Flags – Dioxin/Furans

- **B** Indicates the associated analyte is found in the method blank, as well as in the sample.

- **C** Confirmation of the TCDF compound: When 2378-TCDF is detected on the DB-5 column, confirmation analyses are performed on a second column (DB-225). The results from both the DB-5 column and the DB-225 column are included in this data package. The results from the DB-225 analyses should be used to evaluate the 2378-TCDF in the samples. The confirmed result should be used in determining the TEQ value for TCDF.

- **E** Indicates an estimated value – used when the analyte concentration exceeds the upper end of the linear calibration range.

- **J** Indicates an estimated value – used when the analyte concentration is below the method reporting limit (MRL) and above the estimated detection limit (EDL).

- **K** EMPC - When the ion abundance ratios associated with a particular compound are outside the QC limits, samples are flagged with a 'K' flag. A 'K' flag indicates an estimated maximum possible concentration for the associated compound.

- **U** Indicates the compound was analyzed and not detected.

- **Y** Samples that had recoveries of labeled standards outside the acceptance limits are flagged with 'Y'. In all cases, the signal-to-noise ratios are greater than 10:1, making these data acceptable.

- **ND** Indicates concentration is reported as 'Not Detected.'

- **S** Peak is saturated; data not reportable.

- **P** Indicates chlorodiphenyl ether interference present at the retention time of the target compound.

- **Q** Lock-mass interference by chlorodiphenyl ether compounds.

# APPENDIX D

# MANAGEMENT SYSTEM REVIEW

**TECHNICAL MEMORANDUM**

**MANAGEMENT SYSTEM REVIEW AND TECHNICAL COMPLIANCE EVALUATION**

**HATHEWAY AND PATTERSON SUPERFUND SITE**

**MANSFIELD, MASSACHUSETTS**

**JULY 2014**

As part of the Five-Year Review for the Hatheway and Patterson Superfund Site in Mansfield, MA, a Management System Review (MSR) has been performed which includes performance of a site inspection, review of the remedy, and a technical compliance evaluation in order to evaluate whether each element of the remedy is being maintained and operated in accordance with its intended function. This technical memorandum includes the completed inspection checklist from the site inspection performed on June 3, 2014, as well as annotated photographs of various site features taken on that date, and a technical assessment of physical features of the remedy. The portion of the review associated with risk standards was submitted under separate cover on June 9, 2014, in a memorandum entitled Assessment of Changes in Standards Memorandum.

## Background

The Hatheway & Patterson Superfund Site is located at 35 County Street in Mansfield, Massachusetts (see Figure 1.1). Approximately 36 acres of the 38.17-acre site are located in the Town of Mansfield. The remaining 1.77 acres are located in the Town of Foxborough. The site is divided into four quadrants by the Rumford River, which runs north to south, and by a railroad right-of-way, which runs east to west. The northeast (NE) and northwest (NW) quadrants are referred to as the “Process Area” and are located north of the railroad tracks operated by CSX (see Figure 1.2). The southeast (SE) and southwest (SW) quadrants cover the area south of the railroad tracks. The “County Street area” lies north of the site fence in the northeast and northwest quadrants.

The majority of the historical operational areas and buildings were located on the northern portion of the property, north of the railroad tracks, and contained process buildings, drip pads, support buildings, an office, and a laboratory. With the exception of the office building, which was outside the remediation area, these structures have been demolished or removed (Sevenson, 2011).

The site and surrounding area are served by municipal drinking water. Groundwater underlying the site is designated as Class III (non-potable) by the Commonwealth of Massachusetts. The remedy outlined in the ROD was based on an assumption that groundwater at the site is not available for drinking water by future users of the site (USEPA, 2005).

### History of Contamination

The land west of the Rumford River was owned by the Penn Central Railroad, who used it for bulk chemical transfer and storage of electric/utility poles and railroad ties, until the land was purchased by Hatheway & Patterson in 1978. The land south of the railroad tracks was purchased by Hatheway & Patterson in 1981 and was apparently not used between 1955 and 1971, but was reportedly used for coal storage prior to 1955 (USEPA, 2005).

Hatheway & Patterson reportedly began operations at the site in 1927, but did not begin wood treating until 1953. It is unknown what operations might have been conducted at the site between 1927 and 1953 (USEPA, 2005).

Wood treatment was accomplished by a variety of methods that changed over time. From 1953 through 1958, a solution of pentachlorophenol (PCP) in fuel oil, or creosote, was used for dipping lumber. After dipping, excess chemicals were allowed to drip off of the treated wood onto the ground surface. From 1958 through 1974, solutions of PCP in fuel oil and fluoro-chrome-arsenate-phenol (FCAP) salts in water were used in a pressure treatment process. From 1960 through 1984, PCP in mineral spirits was also used to pressure-treat lumber. From 1974 to 1984, operations incorporated PCP in fuel oil and chromated copper-arsenate (CCA) salts in water. From 1984 until operations ceased in 1993, solutions of CCA salts in water and PCP in water were utilized at the property. Wood was also infused with fire retardants, including Dricon™ (boric acid and anhydrous sodium tetraborate). The various wood-treating chemicals were stored in aboveground storage tanks (ASTs), underground storage tanks (USTs), and sumps located inside and outside of the former process buildings (USEPA, 2005). More detail on site history is provided in the Five Year Review Report.

**Remedial Action Objectives**

The EPA ROD for the site was signed on September 30, 2005. Remedial Action Objectives (RAOs) were developed for various media at the site based on the results of the RI and risk assessments. The RAOs were developed to aid in the development and screening of remedial alternatives.

The RAOs for the selected remedy for the site are:

- Surface Soil (Process Area) – Prevent current and future trespassers and future on-site residents (Foxborough parcel), commercial workers, town workers, and utility workers from ingestion of or dermal contact with Contaminants of Potential Concern (COPCs) (including arsenic, dioxin, and PCP) which would result in a cumulative excess cancer risk greater than $10^{-4}$ to $10^{-6}$ or HI=1;

- Subsurface Soil (Process Area) – Prevent future commercial workers and future on-site residents (Foxborough parcel) from ingestion of or dermal contact with COPCs (including arsenic, dioxin, and PCP) which would result in a cumulative risk greater than $10^{-4}$ to $10^{-6}$ or HI=1;

- Groundwater – Prevent discharge of pentachlorophenol and other COPCs from soil to groundwater and from groundwater to surface water at concentrations that would result in an in stream exceedence of the Ambient Water Quality Criteria (AWQCs) through source control. Prevent exposure to groundwater by future residents, recreational users, or commercial workers by monitoring extent of plume (to ensure it is remaining on-site) and implementing institutional controls to restrict groundwater use within the site boundary;

- Inter-Media Transfer – Eliminate or reduce potential for leaching through source control and inter-media transfer of COPCs from soil to groundwater and surface water;

- LNAPL – Minimize further contaminant transfer from LNAPL source material to groundwater by reducing LNAPL source material in soil excavation/treatment areas.

Minimize further migration of LNAPL free product to groundwater and surface water by removing free product “hotspots” to the extent feasible.

The primary components of the ROD included:

- Excavation of approximately 31,000 cubic yards of soil exceeding cleanup levels.
- Demolition of the buildings in and near Hatheway & Patterson’s former manufacturing area to allow excavation of underlying contaminated soils and replacement of the excavated soil with clean backfill.
- Excavation of soils containing PCP, SVOCs, and arsenic, testing for leachability and, if they fail, utilization of a stabilization/solidification agent(s). Consolidation of the stabilized/solidified soils on-site under a low-permeability cover.
- Off-site disposal of soils containing dioxin and oily material (LNAPL) at a licensed facility.
- Institutional controls to prohibit the use of site groundwater and restrict land uses in a manner that ensures the protectiveness of the remedy as described in this ROD, and ensures the integrity of the on-site low-permeability cover and other remedial components. Evaluation of risks from soil exposures within the area of the existing railroad right of way during design and implementation of appropriate action such as deed restrictions or other legal and administrative measures if necessary.
- Long term monitoring of groundwater, surface water, fish tissue and sediment.
- Five-year reviews, and operation and maintenance of remedial components, including the low permeability cover.

An ESD (USEPA, 2011), issued in August 2011, had three main purposes as summarized below.

- The remedy outlined in the ROD for the Foxborough parcel was based on future residential use of the parcel as the property was zoned for residential use in 2005. After the ROD was issued, the Town of Foxborough took ownership of the parcel through tax foreclosure with the intent of redeveloping the parcel as a parking lot. In connection with this plan, the town voted at the May 2008 Town Meeting to adopt a change in zoning of the lot from R-40 Residential and Agricultural District to “Limited Industrial.” The Town notified EPA of its intention to use the parcel as a parking facility for the nearby MBTA commuter rail station. Based on the change in zoning and intended reuse of the parcel, EPA and MassDEP determined that the Foxborough parcel should be remediated to a Reasonably Anticipated Future Use (RAMU) of commercial/open space and changed the cleanup level accordingly. EPA also determined that a consolidation area for soils in Foxborough contaminated with arsenic could be built on the Foxborough parcel and designed with an asphalt cover in order to facilitate reuse as a parking facility.
- EPA reevaluated the remedy for PCP and arsenic-contaminated soils excavated from the lots in the Mansfield portion of the site. The remedy chosen in the ROD called for on-site

consolidation of these soils, rather than disposal at an off-site facility. Subsequent to the signing of the ROD, the relative costs of off-site disposal decreased significantly. EPA reevaluated both options using criteria required under CERCLA to compare different remedial options. The criteria included overall protection, long-term effectiveness and permanence, community support, and cost. The remedy was changed since the costs were similar but the off-site disposal option offered the greatest overall protection, long-term protectiveness, and permanence.

- EPA clarified the extent of institutional controls to be placed on the site properties as called for in the ROD. Specifically, restrictions on future soil excavation, in the form of institutional controls, will be needed in the northeast quadrant of the site: 1) below the depth of the vertical extent of excavation reached during the remedial action (RA); and 2) at depths of two feet and below in a strip of land bordering the northeast quadrant and County Street to a distance about 5 feet laterally with the fence line. Institutional controls will also be necessary to protect the cover placed over the consolidated soils in the Foxborough parcel. In addition, institutional controls to eliminate on-site exposures to groundwater and to prevent residential use will be necessary on all four quadrants of the site property.

**Site Inspection**

On June 3, 2014, Kimberly White of the US EPA and Warren Diesl of AECOM performed an inspection of the Hatheway and Patterson site. Also present for part of the inspection was Garry Waldeck of MassDEP. The site inspection checklist and photos are included as Attachments 1 and 2, respectively.

As described above, the site is divided into four quadrants by two features: a wide (100 +/- feet) active railroad right-of-way, which is oriented NW-SE and divides the site into northern and southern sections, and by the Rumford River, which flows southwest (after entering the site in the NW Quadrant and flowing a short distance along County Road) and divides the site into eastern and western sections. The NE quadrant is a vegetated field except for the extreme eastern end, where the Town of Mansfield has its Emergency Management Agency building and a large storage building. The vegetation in the NE Quadrant is reportedly cut twice per year and was due to be cut shortly after the site inspection. The NW Quadrant is mostly covered with crushed rock except for a vegetated buffer along the Rumford River and a commuter parking lot for the Town of Foxborough in the extreme northwest corner. As described in the Site Inspection Checklist, the parking lot is well maintained, and the fencing and gates that surround the entire NW and NE Quadrants of the site are in good condition (except for very minor damage to the stockade fence on the northwest side of the commuter lot).

The monitoring wells that were observed were locked and appeared to be in good condition. The compliance boundary on the southwest side of the site is the backwash channel, which is in a vegetated marshy area which is difficult to traverse. Where observed near its confluence with the Rumford River, the amount of water in the backwash channel was miniscule, and no flow was observable. However, at the actual confluence, it was confirmed that the trickle of flow in the channel was moving northwest and discharging to the river. The wells along the compliance boundary had been sampled several weeks before the site inspection and were therefore not inspected.

**Interviews**

Representatives of the Town of Mansfield DPW and the Town of Foxborough, and the MassDEP Project Manager each responded to a request for an interview by providing written responses to a series of

interview questions. Attachment 3 includes a detailed summary of the interviews. In general, representatives from both towns were very pleased with the work conducted at the Site. The town representatives stated that they have been well informed throughout the process and that they have no concerns. The representative from the Town of Mansfield would like to see the institutional controls implemented so that the town can move forward with potential reuse of the property. Town of Mansfield personnel periodically inspect the Site. It was noted by the representative from Mansfield that, although vandalism has generally not been an issue at the Site, a few fence cuts in the deep woods have been found. The Project Manager for the MassDEP also stated that the project was a success, that he was well informed, and that he has no concerns.

**Technical Compliance Evaluation of Remedy Components**

The technical compliance evaluation is conducted to determine whether the individual components of the remedy are being maintained and operated in accordance with their intended functions.

*Evaluation of Intended Function:*

- The RAOs of preventing ingestion and dermal contact with surface and subsurface soils that would result in unacceptable risks have been achieved as a result of the remedial action. Institutional controls restricting inappropriate land uses and protecting the consolidation cell cover and other components of the remedy, as required by the 2011 ESD, need to be established to better ensure future protectiveness.

- The RAO of preventing discharge of pentachlorophenol and other COPCs from soil to groundwater and from groundwater to surface water at concentrations that would result in an in-stream exceedance of the Ambient Water Quality Criteria (AWQCs) was addressed via source control. The ROD and O&M Manual require annual surface water monitoring; however no surface water sampling has been conducted since the remedy was completed. Surface water sampling, in accordance with the ROD, is recommended in order to confirm that there are no in-stream exceedances of the AWQCs..

- The RAO of preventing exposure to groundwater by future residents, recreational users, or commercial workers by monitoring extent of plume (to ensure it is remaining on-site) is being addressed via the ongoing groundwater monitoring at existing monitoring wells. Institutional controls restricting the use of groundwater within the site boundary, as required by the 2011 ESD, need to be established to better ensure future protectiveness. Also, as recommended in the *Hydrogeologic Conditions Report* prepared by AECOM (2013), an expanded groundwater monitoring effort at private wells beyond the compliance boundary is also being implemented by EPA in response to the detection of contamination in monitoring wells at the boundary. Although not expected, if off-site plume migration is detected during monitoring of private wells, additional measures may be necessary to maintain protectiveness.

- The exposure pathways that were stated in the ROD and ESD are still valid. More detail is provided in the Assessment of Changes in Standards Memorandum.

- The zoning of the Foxborough Parcel was changed from Future Residential to “Limited Industrial”. This changed was addressed in the ESD, issued in 2011, and does not affect the protectiveness of the remedy.

## References

AECOM. 2013. Hydrogeologic Conditions Report. Letter report addressed to Mr. David Lederer of EPA-New England, Region 1. March 29, 2013.

Sevenson Environmental Services, Inc. 2011. Final Remedial Action Completion Report. Hatheway and Patterson Superfund Site. Mansfield, Massachusetts. September 2011.

U.S. Environmental Protection Agency (USEPA). 2005. Record of Decision. Hatheway & Patterson Superfund Site, Mansfield-Foxborough, Massachusetts. September 30, 2005.

U.S. Environmental Protection Agency (USEPA). 2011. Declaration for the Explanation of Significant Differences. Hatheway & Patterson Superfund Site, Mansfield/Foxborough, Massachusetts. August 2011.

# FIGURES

SITE LOCATION MAP

Hatheway and Patterson
Superfund Site
35 County Street
Mansfield, MA

Location of Facility

FIGURE 1.1

★ Site Location

N

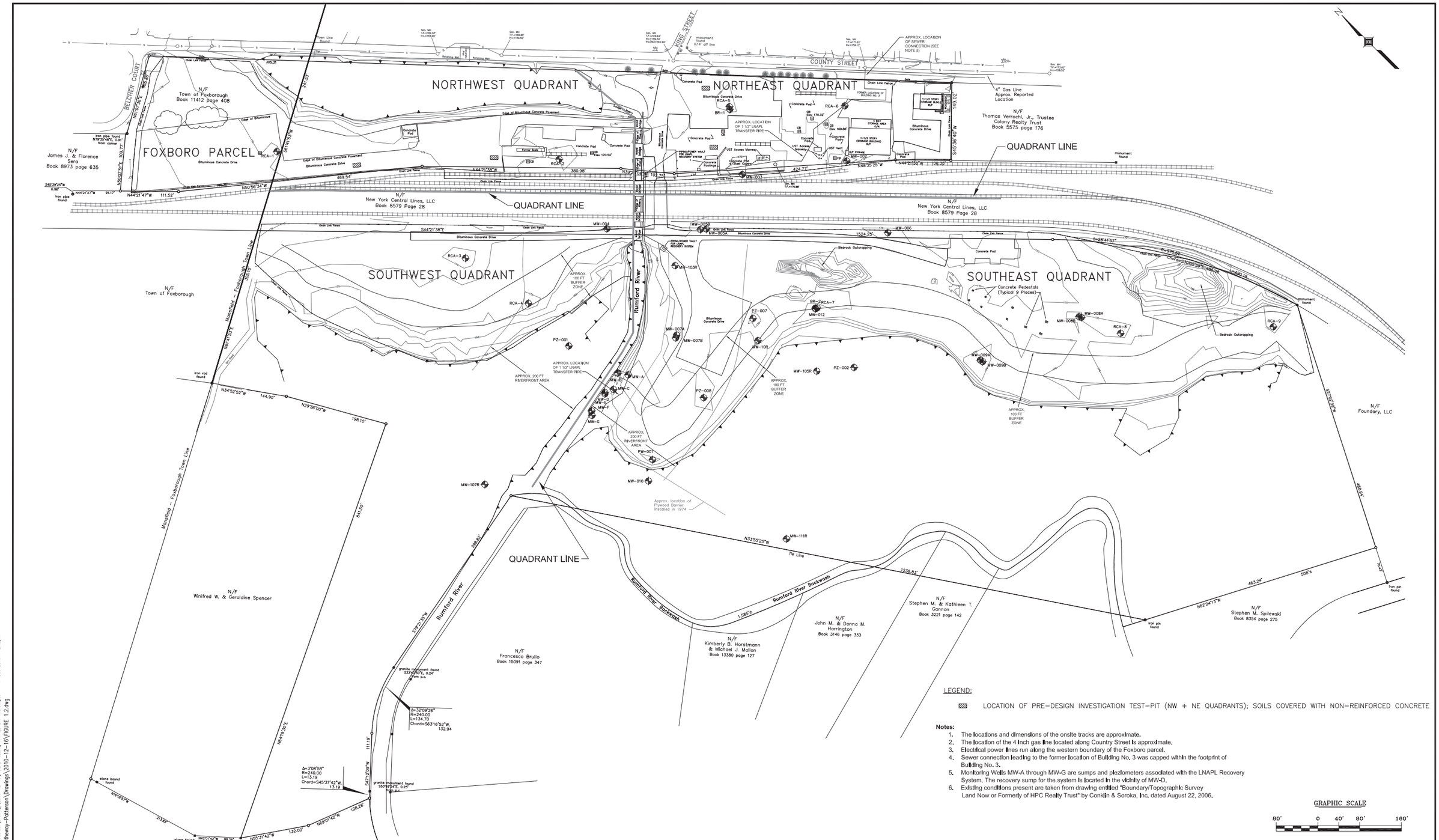
0 Feet 2,000

amec

AMEC Earth and Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090



Base Map Data from ESRI, 7/1/1989.




LEGEND:

▨ LOCATION OF PRE-DESIGN INVESTIGATION TEST-PIT (NW + NE QUADRANTS); SOILS COVERED WITH NON-REINFORCED CONCRETE

**Notes:**

1. The locations and dimensions of the onsite tracks are approximate.
2. The location of the 4 inch gas line located along Country Street is approximate.
3. Electrical power lines run along the western boundary of the Foxboro parcel.
4. Sewer connection leading to the former location of Building No. 3 was capped within the footprint of Building No. 3.
5. Monitoring Wells MW-A through MW-G are sumps and piezlometers associated with the LNAPL Recovery System. The recovery sump for the system is located in the vicinity of MW-D.
6. Existing conditions present are taken from drawing entitled "Boundary/Topographic Survey Land Now or Formerly of HPC Realty Trust" by Conklin & Soroka, Inc. dated August 22, 2006.

GRAPHIC SCALE

80' 0 40' 80' 160'

Sevenson Environmental Services, Inc.

SEVENSON ENVIRONMENTAL SERVICES, INC.
2749 LOCKPORT ROAD
NIAGARA FALLS, NY 14305

SOURCE DRAWING FROM *CONSTRUCTION SPECIFICATIONS, HATHEWAY & PATTERSON SUPERFUND SITE*, METCALF & EDDY, INC AND TRC ENVIRONMENTAL CORPORATION, 2008.

| REV | D | M | Y | ISSUE/REVISION DESCRIPTION | ENG. | APPR. |
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*Client Logos:*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

US Army Corps of Engineers

*Clients:*

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
UNITED STATES ARMY CORPS OF ENGINEERS

AMEC Earth & Environmental
2 ROBBINS ROAD
WESTFORD, MASSACHUSETTS 01886

amec

| | |
|---|---|
| DATUM: | N/A |
| PROJECTION: | N/A |
| DRAWN BY: | M. YAU |
| REVIEWED BY: | H. COLBY |
| ORIGINAL SCALE: | AS SHOWN |

PROJECT: PRE-REMEDIATION SITE FEATURES

TITLE: HATHEWAY AND PATTERSON SITE
35 COUNTY STREET
MANSFIELD, MASSACHUSETTS

| | |
|---|---|
| PROJECT NO.: | 774840002.0600 |
| REVISION NO. | A |
| DATE: | 17 DECEMBER 2010 |
| FIGURE NO.: | 1.2 |
| SHEET NO.: | 1 of 1 |

www.amec.com/earthandenvironmental

FILE: W:\Projects\Sevenson MARC\Hatheway-Patterson\Drawings\2010-12-16\FIGURE 1.2.dwg PRINTED BY: michael.yau - 17 Dec 2010 - 2:42pm
FILE: W:\Projects\Sevenson MARC\Hatheway-Patterson\Drawings\2010-12-16\FIGURE 1.2.dwg

# ATTACHMENT 1

# SITE INSPECTION CHECKLIST

# Five-Year Review Site Inspection Checklist

("N/A" refers to "not applicable.")

| I. SITE INFORMATION | |
|---|---|
| **Site name:** Hatheway & Patterson) Superfund Site | **Date of inspection:** June 3, 2014 |
| **Location and Region:** Mansfield, MA; Region I | **EPA ID:** MAD001060805 |
| **Agency, office, or company leading the five-year review:** USEPA/AECOM | **Weather/temperature:** Clear/80$^{o}$F |
| **Remedy Includes**: (Check all that apply)<br>□ Landfill cover/containment<br>X Access controls<br>X Institutional controls<br>□ Groundwater pump and treatment<br>□ Surface water collection and treatment<br>X Other Monitoring of groundwater, surface water, sediment, and fish; asphalt-paved parking lot on Foxborough portion of NW Quadrant of site<br>□ Monitored natural attenuation<br>□ Groundwater containment<br>□ Vertical barrier walls | |
| **Attachments:** □ Inspection team roster attached □ Site map attached | |
| **II. INTERVIEWS** | |
| Interviews were performed by USEPA/AECOM and are included separately. | |

| III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply) | | | | |
|---|---|---|---|---|
| 1. | **O&M Documents** | | | |
| | X O&M manual | X Readily available | ☐ Up to date | ☐ N/A |
| | X As-built drawings | X Readily available | ☐ Up to date | ☐ N/A |
| | X Maintenance logs | ☐ Readily available | X Up to date | ☐ N/A |
| | Remarks: O&M manual was included RA Report, along with as-built drawings. | | | |
| 2. | **Site-Specific Health and Safety Plan** | ☐ Readily available | ☐ Up to date | ☐ N/A |
| | ☐ Contingency plan/emergency response plan | ☐ Readily available | ☐ Up to date | ☐ N/A |
| | Remarks: Not seen or reviewed – presumably available at office of contractor who performs monitoring and inspection. | | | |
| 3. | **O&M and OSHA Training Records** | ☐ Readily available | ☐ Up to date | ☐ N/A |
| | Remarks: Not seen or reviewed – presumably available at office of contractor who performs monitoring and inspection. | | | |
| 4. | **Permits and Service Agreements** | | | |
| | ☐ Air discharge permit | ☐ Readily available | ☐ Up to date | X N/A |
| | ☐ Effluent discharge | ☐ Readily available | ☐ Up to date | X N/A |
| | ☐ Waste disposal, POTW | ☐ Readily available | ☐ Up to date | X N/A |
| | ☐ Other permits_____ | ☐ Readily available | ☐ Up to date | X N/A |
| | Remarks: | | | |
| 5. | **Gas Generation Records** | ☐ Readily available | ☐ Up to date | X N/A |
| | Remarks: | | | |
| 6. | **Settlement Monument Records** | ☐ Readily available | ☐ Up to date | X N/A |
| | Remarks: | | | |
| 7. | **Groundwater Monitoring Records** | X Readily available | X Up to date | ☐ N/A |
| | Remarks: | | | |
| 8. | **Leachate Extraction Records** | ☐ Readily available | ☐ Up to date | X N/A |
| | Remarks: | | | |
| 9. | **Discharge Compliance Records** | | | |
| | ☐ Air | ☐ Readily available | ☐ Up to date | X N/A |
| | ☐ Water (effluent) | ☐ Readily available | ☐ Up to date | X N/A |
| 10. | **Daily Access/Security Logs** | ☐ Readily available | ☐ Up to date | X N/A |
| | Remarks: | | | |

| IV. O&M COSTS | |
|---|---|
| 1. | **O&M Organization**<br>☐ State in-house X Contractor for State<br>☐ PRP in-house ☐ Contractor for PRP<br>☐ Federal Facility in-house ☐ Contractor for Federal Facility<br>☐ Other_____<br>_____ |
| 2. | **O&M Cost Records**<br><br>Not Reviewed |
| 3. | **Unanticipated or Unusually High O&M Costs During Review Period**<br>Describe costs and reasons:<br>_____<br>_____<br>_____<br>_____ |
| **V. ACCESS AND INSTITUTIONAL CONTROLS** X Applicable ☐ N/A | |
| **A. Fencing** | |
| 1. | **Fencing damaged** ☐ Location shown on site map X Gates secured ☐ N/A<br><br>Remarks: The cyclone fencing that surrounds most of the site appears to be in good condition. The two vehicle gates that provide access to the site off County Street are locked and in good condition, as are the two vehicle gates that isolate the site from the (active) railroad tracks that bisect the site and the vehicle gate that separates the Foxborough commuter parking lot from the rest of the NW Quadrant. |
| **B. Other Access Restrictions** | |
| 1. | **Signs and other security measures** ☐ Location shown on site map X N/A<br><br>Remarks_____<br>_____ |

**C. Institutional Controls (ICs)**

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

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

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

Remarks ICs are not yet in place.
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks ICs are not yet in place.

**D. General**

1. **Vandalism/trespassing** ☐ Location shown on site map X No vandalism evident

Remarks _____

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

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

**VI. GENERAL SITE CONDITIONS**

**A. Roads** X Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map X Roads adequate ☐ N/A
Remarks_____
_____

**B. Other Site Conditions**

Remarks The NE Quadrant of the site is a vegetated field except for a small paved area at its eastern end, where the Town of Mansfield has its Emergency Management Building and a large storage facility. Vegetation is reportedly cut twice per year and was due to be cut shortly after the site inspection.

The NW Quadrant of the site is covered with crushed rock, except for the buffer strip along the Rumford River and the commuter parking lot in the northwestern corner. The fencing that completely surrounds the NE and NW Quadrants of the site is in good condition, as are the two gates on County Street, the two gates at the railroad crossing, and the gate that isolates the commuter parking lot.

**VII. LANDFILL COVERS** ☐ Applicable X N/A

**A. Landfill Surface**

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks_____
_____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent_____ Depth_____

Remarks

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____
_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks_____
_____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

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

| | |
|---|---|
| 4. | **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting<br>Areal extent_____ Depth_____<br>Remarks_____<br>_____ |
| 5. | **Obstructions** Type_____ ☐ No obstructions<br>☐ Location shown on site map Areal extent_____<br>Size_____<br>Remarks_____<br>_____ |
| 6. | **Excessive Vegetative Growth** Type_____<br>☐ No evidence of excessive growth<br>☐ Vegetation in channels does not obstruct flow<br>☐ Location shown on site map Areal extent_____<br><br>Remarks: _____ |
| **D. Cover Penetrations** ☐ Applicable ☐ N/A | |
| 1. | **Gas Vents** ☐ Active ☐ Passive<br>☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled X Good condition<br>☐ Evidence of leakage at penetration ☐ Needs Maintenance<br>☐ N/A<br><br>Remarks: |
| 2. | **Gas Monitoring Probes**<br>☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition<br>☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A<br><br>Remarks: |
| 3. | **Monitoring Wells** (within surface area of landfill)<br>☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition<br>☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A<br>Remarks_____<br>_____ |
| 4. | **Leachate Extraction Wells**<br>☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition<br>☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A<br>Remarks_____<br>_____ |
| 5. | **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A<br>Remarks_____<br>_____ |

| | |
|---|---|
| **E. Gas Collection and Treatment** | ☐ Applicable ☐ N/A |
| 1. | **Gas Treatment Facilities**<br>☐ Flaring ☐ Thermal destruction ☐ Collection for reuse<br>☐ Good condition ☐ Needs Maintenance<br><br>Remarks: |
| 2. | **Gas Collection Wells, Manifolds and Piping**<br>☐ Good condition ☐ Needs Maintenance<br><br>Remarks: |
| 3. | **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)<br>☐ Good condition ☐ Needs Maintenance ☐ N/A<br>Remarks_____<br>_____ |
| **F. Cover Drainage Layer** | ☐ Applicable ☐ N/A |
| 1. | **Outlet Pipes Inspected** ☐ Functioning ☐ N/A<br><br>Remarks: |
| 2. | **Outlet Rock Inspected** ☐ Functioning ☐ N/A<br><br>Remarks: |
| **G. Detention/Sedimentation Ponds** | ☐ Applicable ☐ N/A |
| 1. | **Siltation** Areal extent_____ Depth_____ ☐ N/A<br>☐ Siltation not evident<br><br>Remarks: |
| 2. | **Erosion** Areal extent_____ Depth_____<br>☐ Erosion not evident<br>Remarks_____<br>_____ |
| 3. | **Outlet Works** ☐ Functioning ☐ N/A<br>Remarks_____<br>_____ |
| 4. | **Dam** ☐ Functioning ☐ N/A<br>Remarks_____<br>_____ |

| | | |
|---|---|---|
| **H. Retaining Walls** | ☐ Applicable ☐ N/A | |
| 1. | **Deformations** ☐ Location shown on site map ☐ Deformation not evident<br>Horizontal displacement_____ Vertical displacement_____<br>Rotational displacement_____<br>Remarks_____<br>_____ | |
| 2. | **Degradation** ☐ Location shown on site map ☐ Degradation not evident<br>Remarks_____<br>_____ | |
| **I. Perimeter Ditches/Off-Site Discharge** | ☐ Applicable ☐ N/A | |
| 1. | **Siltation** ☐ Location shown on site map X Siltation not evident<br>Areal extent_____ Depth_____<br>Remarks_____<br>_____ | |
| 2. | **Vegetative Growth** ☐ Location shown on site map ☐ N/A<br>☐ Vegetation does not impede flow<br>Areal extent_____ Type_____<br><br>Remarks: | |
| 3. | **Erosion** ☐ Location shown on site map ☐ Erosion not evident<br>Areal extent_____ Depth_____<br>Remarks_____<br>_____ | |
| 4. | **Discharge Structure** ☐ Functioning ☐ N/A<br><br>Remarks: | |
| **VIII. VERTICAL BARRIER WALLS** | ☐ Applicable X N/A | |
| 1. | **Settlement** ☐ Location shown on site map ☐ Settlement not evident<br>Areal extent_____ Depth_____<br>Remarks_____<br>_____ | |
| 2. | **Performance Monitoring** Type of monitoring_____<br>☐ Performance not monitored<br>Frequency_____ ☐ Evidence of breaching<br>Head differential_____<br>Remarks_____<br>_____ | |

| IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable X N/A | | | | |
|---|---|---|---|---|
| **A. Groundwater Extraction Wells, Pumps, and Pipelines** ☐ Applicable ☐ N/A | | | | |
| 1. | **Pumps, Wellhead Plumbing, and Electrical**<br>☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A<br><br>Remarks: | | | |
| 2. | **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**<br>☐ Good condition ☐ Needs Maintenance<br><br>Remarks: | | | |
| 3. | **Spare Parts and Equipment**<br>☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided<br><br>Remarks: | | | |
| **B. Surface Water Collection Structures, Pumps, and Pipelines** ☐ Applicable ☐ N/A | | | | |
| 1. | **Collection Structures, Pumps, and Electrical**<br>☐ Good condition ☐ Needs Maintenance<br>Remarks_____<br>_____ | | | |
| 2. | **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**<br>☐ Good condition ☐ Needs Maintenance<br>Remarks_____<br>_____ | | | |
| 3. | **Spare Parts and Equipment**<br>☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided<br>Remarks_____<br>_____ | | | |

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

| **D. Monitored Natural Attenuation** | | | |
|---|---|---|---|
| 1. **Monitoring Wells** (natural attenuation remedy)<br>☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition<br>☐ All required wells located ☐ Needs Maintenance ☐ N/A<br><br>Remarks: | | | |

**X. OTHER REMEDIES**

Bituminous Asphalt Cover. The portion of the NW Quadrant of the site that is within the Town of Foxborough was paved to create a commuter parking lot. The pavement appears to be in very good condition, with only minor cracks along joints in the pavement and near the southern corner of the lot. No settlement was observed. Silt fence at the outlet of the storm drainage system (possibly a relic from construction) is breached, and minor repairs are needed at two locations along the stockade fence that borders the northwest side of the lot. However, the overall condition of the lot is very good.

Monitoring Wells. The monitoring wells that were observed were locked and appeared to be in good condition. None were marked, but the markings may be under the protective covers. A monitoring round had been conducted a few weeks prior to the site inspection, and no deficiencies in the well network had been reported.

**XI. OVERALL OBSERVATIONS**

**A. Implementation of the Remedy**

The remedy is effective and functioning as designed. Access to the site is restricted. Institutional controls are not yet in place, but the site is inaccessible (except for along the railroad tracks) for activities that would involve excavation or drilling. Monitoring of groundwater, surface water, sediment, and fish are ongoing.

**B. Adequacy of O&M**

Other than maintenance of the fencing that surrounds most of the site, little O&M is required. The vegetation at the site is cut twice per year, and the portion of the site that is a commuter parking lot is in good condition.

**C. Early Indicators of Potential Remedy Problems**

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

None

| D. | Opportunities for Optimization |
|---|---|
| | Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.<br><br>None |

**ATTACHMENT 2**

**SITE PHOTOS**

**HATHEWAY AND PATTERSON SUPERFUND SITE**
**June 3, 2014 - SITE INSPECTION PHOTOGRAPHS**

**Photo #1. Easternmost Gate to Site off County Road**

**Photo #2. Looking Southeast across NE Quadrant of Site**

**Photo #3. Looking Southeast Across NW Quadrant of Site (NE Quadrant in distance)**

**Photo #4. Looking Southeast along Railroad Tracks that Bisect Site**

**Photo #5. Gates at RR Crossing Between Northern and Southern Quadrants of Site**

**Photo #6. Rumford River Flowing Southwest in Channel Between NW and NE Quadrants of Site (Railroad Bridges Across River in Background)**

**Photo #7. Rumford River Downstream of Railroad Bridges and Upstream of Confluence with Backwash Channel**

**Photo #8. Backwash Channel Flowing (<<1 gpm, from left to right, in rivulet that crosses mud-filled channel) into Rumford River**

**Photo #9. Commuter Parking Lot on Foxborough Portion of Site (Note minor crack in pavement in foreground along painted line)**

**Photo #10. Gate Separating Commuter Lot from NW Quadrant of Site (note flush-mount monitoring well along fence, with road box painted white)**

**ATTACHMENT 3**

**INTERVIEW RECORDS**

# INTERVIEW RECORD

| | | | |
|---|---|---|---|
| **Site Name:** Hatheway and Patterson Superfund Site (Mansfield, MA) | | **EPA ID No.:** MAD001060805 | |
| **Subject:** Five Year Review | | **Time:** | **Date:** |
| **Type:** ☐ Telephone ☐ Visit ☐ Other<br>**Location of Visit:** | | ☐ Incoming | ☐ Outgoing |
| **Contact Made By:** | | | |
| **Name:** | **Title:** | **Organization:** AECOM | |
| **Individual Contacted:** | | | |
| **Name:** Mike Ahern | **Title:** Department of Public Works | **Organization:** Town of Mansfield | |
| **Telephone No:** (508) 261-7335<br>**Fax No:** (508) 261-7452<br>**E-Mail:** mahern@mansfieldma.com | **Street Address:** 6 Park Row,<br>Mansfield, MA 02048 | | |

1. **What is your overall impression of the project? (general sentiment)**
   - *Project went very well. Town was very happy.*

2. **Do you feel well informed about site activities and progress?**
   - *Yes, the Town was kept very well informed throughout the process and was invited to attend various project meetings to stay current with job progress.*

3. **What are the current uses of the property?**
   - *Presently part of the property is used for Mansfield Emergency Management Agency and the rest is presently grassed areas and gravel parking.*

4. **What are the planned future uses of the property (if different from current uses)?**
   - *Town is looking at the property for future uses including business development and other potential uses.*

5. **Is there evidence or sightings of trespassers on the property? If yes, how often and what type of activities do they engage in?**
   - *Generally no, although there has been a few, mainly hunters only. Whereas the site has Emergency Management on site they constantly look at the site.*

6. **Have there been any events of vandalism at the property?**
   - *Generally no, except for few fence cuts in deep woods.*

**7. Have there been any unusual or unexpected activities or events at the site (e.g., flooding)? If so, what if anything was done to address these issues?**

- *In existing parking area there has been small ponding, but it is being addressed by the Town. (No issue)*

**8. Have any problems been encountered or changes in the site conditions that affect the current operations at the site?**

- *No.*

**9. Has the site been the subject of any community complaints (e.g., odor, noise, health, etc.)?**

- *No.*

**10. Are you aware of any community concerns regarding the site or remedial actions performed? If so, please provide details.**

- *No.*

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

- *We do general inspections and as stated in question 5, Mansfield Emergency Management watches the site.*

**12. Do you have any comments, suggestions, or recommendations regarding site management or operation?**

- *Generally no, everything is going well. The only thing would be the completion of the site specific activity use limitations so we can move forward with the potential uses of the property.*

**13. Is there any other information that you wish to share that might be of use?**

- *Overall, the project went very well. It was great working with the staff of the EPA and the Army Corps of Engineers. Dave Lenderer from the EPA, Chris Turek of the Army Corps of Engineers and Gary Waldeck from Mass DEP were all exceptional to work with.*

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|---|---|---|
| **Site Name:** Hatheway and Patterson Superfund Site (Mansfield, MA) | **EPA ID No.:** MAD001060805 | |
| **Subject:** Five Year Review | **Time:** 2:40pm | **Date: 6/25/2014** |
| **Type:** ☐ Telephone ☐ Visit X Other<br>**Location of Visit:** | ☐ Incoming X Outgoing | |

**Contact Made By:**

| | | |
|---|---|---|
| **Name:** | **Title:** | **Organization:** AECOM |

**Individual Contacted:**

| | | |
|---|---|---|
| **Name:** William R. Scollins, III | **Title:** Finance Director | **Organization:** Town of Foxborough |
| **Telephone No:** 508-543-1218<br>**Fax No:** 508-543-6278<br>**E-Mail:** rscollins@town.foxborough.ma.us | **Street Address:** 40 South Street, Foxborough, MA 02035 | |

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

We are very pleased with the result. To have a long standing hazardous waste site cleaned up in a residential neighborhood and then repurposed for the benefit of the Foxborough residents is incredibly positive for all.

**2. Do you feel well informed about site activities and progress?**

Yes. During the cleanup and reconstruction of the property, the project managers maintained a website that was kept updated with all activities and progress. When there were critical decisions to be made appropriate meetings were held with Town officials.

**3. What are the current uses of the property?**

A dedicated free commuter parking lot for Foxborough residents only who take the commuter rail from Mansfield, as per the site conditions.

**4. What are the planned future uses of the property (if different from current uses)?**

The Town is prohibited from changing the use from a parking lot to anything else, as per the conditions of the funding award.

**5. Is there evidence or sightings of trespassers on the property? If yes, how often and what type of activities do they engage in?**

The local police patrol all areas of the Town including this parking lot. No trespassers have been reported. The property is well lit and signed.

**6. Have there been any events of vandalism at the property?**

None have been reported.

**7. Have there been any unusual or unexpected activities or events at the site (e.g., flooding)? If so, what if anything was done to address these issues?**

None have been reported.

**8. Have any problems been encountered or changes in the site conditions that affect the current operations at the site?**

None.

**9. Has the site been the subject of any community complaints (e.g., odor, noise, health, etc.)?**

None.

**10. Are you aware of any community concerns regarding the site or remedial actions performed? If so, please provide details.**

No concerns, other than a preference for a dedicated pathway from the parking lot to the Mansfield commuter rail station, which is a half mile away. This would require a level of funding that Foxborough would find quite difficult to absorb. Further, the pathway would be primarily on property in the Town of Mansfield.

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

We have actively promoted the site to residents at the Foxborough Town Hall & website, as well as the Mansfield train station. The police dept patrols the site routinely as part of their rounds. The highway dept maintains the light fixtures, signage, fencing, and grounds, including plowing and striping.

**12. Do you have any comments, suggestions, or recommendations regarding site management or operation?**

None at this time.

**13. Is there any other information that you wish to share that might be of use?**

We are grateful that this site was chosen to be remediated. The neighbors are pleased and the commuters are also pleased to have this lot as an option.

# INTERVIEW RECORD

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| **Site Name:** Hatheway and Patterson Superfund Site (Mansfield, MA) | | **EPA ID No.:** MAD001060805 | |
| **Subject:** Five Year Review | | **Time:** | **Date:** |
| **Type:** ☐ Telephone ☐ Visit ☐ Other<br>**Location of Visit:** | | ☐ Incoming | ☐ Outgoing |

**Contact Made By:**

| | | |
|---|---|---|
| **Name:** | **Title:** | **Organization:** AECOM |

**Individual Contacted:**

| | | |
|---|---|---|
| **Name:** Garry Waldeck | **Title:** State Remedial Project manager | **Organization:** MassDEP |
| **Telephone No:** (617) 348-4017<br>**Fax No:**<br>**E-Mail Address:**<br>garry.waldeck@state.ma.us | **Street Address:**<br>1 Winter Street<br>Boston, MA 02108 | |

**1. What is your overall impression of the project? (general sentiment)**
**The construction of the remedy is complete and the project was a success.**

**2. Have there been routine communications or activities (site visits, inspections, reporting, etc.) conducted by your office at the site? If so, please give purpose and results.**
**Yes, MassDEP has been performing the O and M for the site, including groundwater and sediment sampling.**

**3. Have there been any complaints, violations, or other incidents related to the site requiring response by your office? If so, please give details of the events and results of the responses.**
**No.**

**4. Do you feel well informed about site activities and progress?**
**Yes**

**5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?**
**No**

**6. Are you aware of any problems or issues that will affect the progress or implementability of the proposed institutional controls?**
**No**

**7. Is there evidence or sightings of trespassers on the property, or evidence of vandalism? If yes, how often and what type of activities do they engage in?**
**No**

**8. Have there been any unusual or unexpected activities or events at the site (e.g., flooding)? If so, has this resulted in any damage or had an impact on operations at the site?**
**No**

**9. Has the site been the subject of any community complaints (e.g., odor, noise, health, etc.)?**
**No**

**10. Is there any other information that you wish to share that might be of use?**
**No**

**11. What are the annual system operation/O&M costs for OU-1 since the RA was completed? Please provide in the following format:**

| Dates | | Total Cost (rounded to nearest $1,000) |
|---|---|---|
| From | To | |
| 4/1/12 | 6/6/14 | $111,000 |
| | | |
| | | |
| | | |
| | | |

# APPENDIX E

# INTERVIEW RECORD FORMS

# INTERVIEW RECORD

| | | |
|---|---|---|
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| **Subject:** Five Year Review | **Time:** | **Date:** |
| **Type:** ☐ Telephone ☐ Visit X Other<br>**Location of Visit:** by email | ☐ Incoming | ☐ Outgoing |

**Contact Made By:**

| | | |
|---|---|---|
| **Name:** Cinthia McLane | **Title:** Project Manager | **Organization:** AECOM |

**Individual Contacted:**

| | | |
|---|---|---|
| **Name:** Garry Waldeck | **Title:** State Remedial Project manager | **Organization:** MassDEP |
| **Telephone No:** (617) 348-4017<br>**Fax No:**<br>**E-Mail Address:**<br>garry.waldeck@state.ma.us | **Street Address:**<br>1 Winter Street<br>Boston, MA 02108 | |

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| | | |
|---|---|---|
| **Name:** Cinthia McLane | **Title:** Project Manager | **Organization:** AECOM |

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| | | |
|---|---|---|
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| **Type:** ☐ Telephone ☐ Visit ☐ Other<br>**Location of Visit:** | | ☐ Incoming | ☐ Outgoing |
| **Contact Made By:** | | | |
| **Name:** | **Title:** | **Organization:** AECOM | |
| **Individual Contacted:** | | | |
| **Name:** Mike Ahern | **Title:** Department of Public Works | **Organization:** Town of Mansfield | |
| **Telephone No:** (508) 261-7335<br>**Fax No:** (508) 261-7452<br>**E-Mail:** mahern@mansfieldma.com | **Street Address:** 6 Park Row,<br>Mansfield, MA 02048 | | |

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**9. Has the site been the subject of any community complaints (e.g., odor, noise, health, etc.)?**

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**10. Are you aware of any community concerns regarding the site or remedial actions performed? If so, please provide details.**

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- *Overall, the project went very well. It was great working with the staff of the EPA and the Army Corps of Engineers. Dave Lenderer from the EPA, Chris Turek of the Army Corps of Engineers and Gary Waldeck from Mass DEP were all exceptional to work with.*

# APPENDIX F

# RISK CALCULATIONS

# Post-Excavation Soil Sample Locations

## Hatheway and Patterson Superfund Site
35 County Street
Mansfield, MA

## Legend

- Confirmatory Soil Sample Location (Hatheway-Patterson Site)
- Post Excavation Soil Sample Location (CSX Right of Way)
- Limit of Excavation

## Location of Facility

# FIGURE 4.1

0 115
Feet

amec

AMEC Environment & Infrastructure, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090

H:\Sevenson\Hath&Pat\Task6\MXD\Fig_4-1.mxd August23, 2011 DWN: JDP APC CHKD: AKN

Aerial Imagery Source: MassGIS, 2008

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**Region 1**
**5 Post Office Square, Suite 100**
**BOSTON, MA 02109-3912**

**Date:** June 18, 2014

**From:** Chau Vu, Human Health Risk Assessor, Technical & Enforcement Support Section

**To:** Kimberly White, RPM, MA Superfund Section

**Subject:** Update on Risks from Railroad Right-of-Way Exposures, Hatheway and Patterson Superfund Site

The purpose of this memorandum is to update Margaret McDonough's May 24, 2007 and March 31, 2011 memoranda on risk evaluation for the railroad right-of-way exposures at the Hatheway and Patterson Superfund Site (Appendix L of the September 2011 Final Remedial Action Completion Report for the Hatheway and Patterson Superfund Site). This update is performed to reflect the new release of the OSWER Directive 9200.1-120 dated February 6, 2014 on the Update of Standard Default Exposure Factors and the finalization of dioxin non-cancer oral reference dose (RfD) in February 2012 on EPA Integrated Risk Information System (IRIS). Prior to the final dioxin RfD value on IRIS, non-cancer health effects from exposures to dioxin were not usually evaluated due to the lack of a non-cancer toxicity value. This memorandum also includes the use of the default relative bioavailability value of 60% or 0.6 of arsenic in soil according to the December 2012 OSWER Directive 9200.1-113 Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil. Due to the changes of standard default exposure factors, relative bioavailability for arsenic, and new dioxin RfD value, risk estimates for receptors exposed to contaminated subsurface soils at the railroad right-of-way on the Site have changed.

Similar to the 2007 and 2011 memos, risk screening and risk evaluation are performed in this memorandum using the maximum detected concentrations of pentachlorophenol (PCP), dioxin, and arsenic presented in the September 2011 Final Remedial Action Completion Report. The maximum detected concentrations are used from the 2010 dataset for post-excavation soil from the Report because these are soils closest to the railroad tracks and there are no samples collected from the railroad tracks themselves. Although there are five samples, including a duplicate sample, from the adjacent Northeast quadrant, and four samples from the Northwest quadrant, there are not sufficient samples to calculate a statistically significant 95$^{th}$ upper confidence limit (95% UCL) value for exposure point concentration. In this situation, it is EPA's practice to use the maximum detected concentration in the dataset to be conservative.

Risks are calculated for utility workers who are assumed to conduct repairs and maintenance at the railroad right-of-way area and exposed to contaminated subsurface soils via incidental

ingestion and dermal contact pathways. Table 1 below presents the default exposure factors for utility worker previously used in the 2007 and 2011 memos along with the currently recommended values from the 2012 and 2014 OSWER Directives and the 2012 dioxin IRIS update. For those exposure values not currently recommended, the values are kept the same as those used in previous memos.

**Table 1 – Utility Worker Exposure Factors and Toxicity Values**

| **Exposure Factors and Toxicity Values (units)** | **Symbol** | **Previous Default Value** | **Currently Recommended Value** |
|---|---|---|---|
| Soil/sediment ingestion rate – intense contact (mg/day) | $IR_{worker}$ | 200 | 200 |
| Default relative bioavailability for arsenic (%) | $RBA_{arsenic}$ | 100 | **60** |
| Exposure frequency (days/year) | EF | 66 | 66 |
| Body weight (kg) | $BW_{worker}$ | 70 | **80** |
| Skin surface area ($cm^2$) | $SA_{worker}$ | 3300 | **3470** |
| Adherence factor ($mg/cm^2$) – utility worker | AF | 0.2 | **0.12** |
| Absorption factor for PCP (unitless) | $ABS_{PCP}$ | 0.13 | **0.25** |
| Absorption factor for dioxin (unitless) | $ABS_{dioxin}$ | 0.13 | **0.03** |
| Absorption factor for arsenic (unitless) | $ABS_{arsenic}$ | 0.13 | **0.03** |
| Cancer slope factor for PCP $(mg/kg\text{-}day)^{-1}$ | $CSF_{PCP}$ | 0.4 | 0.4 |
| Reference dose for PCP (mg/kg-day) | $RfD_{PCP}$ | 5E-03 | 5E-03 |
| Cancer slope factor for dioxin $(mg/kg\text{-}day)^{-1}$ | $CSF_{dioxin}$ | 1.5E+05 | 1.5E+05 |
| Reference dose for dioxin (mg/kg-day) | $RfD_{dioxin}$ | Not Available | **7E-10** |
| Cancer slope factor for arsenic $(mg/kg\text{-}day)^{-1}$ | $CSF_{arsenic}$ | 1.5 | 1.5 |
| Reference dose for arsenic (mg/kg-day) | $RfD_{arsenic}$ | 3E-04 | 3E-04 |
| Averaging time for cancer risk (year) | $AT_{cancer}$ | 70 | 70 |
| Averaging time for non-cancer risk – utility worker (year) | $AT_{noncancer}$ | 1 | 1 |

**Bold** text represents the exposure values changed since 2011.

**Risk screening for 2010 subsurface soil data**

Following EPA's risk assessment practice, the maximum detected concentrations of the 2010 dataset for post-excavation soil from the 2011 Final Remedial Action Completion Report are used to screen against the risk-based screening levels. Table 2 below presents the maximum concentrations and screening levels.

**Table 2 – Maximum Concentrations near Railroad Right-of-Way Compared to EPA Risk-Based Screening Levels**

| Maximum Detected PCP (mg/kg) | EPA PCP Screening Level (mg/kg) | Maximum Detected Dioxin (mg/kg) | EPA Dioxin Screening Level (mg/kg) | Maximum Detected Arsenic (mg/kg) | EPA Arsenic Screening Level (mg/kg) |
|---|---|---|---|---|---|
| 152 | 4 (1E-06 risk) | 6.76E-03 | 2.2E-05 (1E-06 risk) | 309 | 3 (1E-06 risk) |

The EPA screening levels are developed based on a target cancer risk level of 1E-06 or an HI of 0.1 for each contaminant for commercial/industrial exposure scenario, using the standard EPA risk methodology. These chemical-specific values are selected from the May 2014 EPA Regional Screening Levels (RSLs) available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/. Since the maximum detected concentrations of PCP, dioxin, and arsenic in subsurface soils near the railroad right-of-way exceed their respective screening levels, further risk evaluation is performed for these detected subsurface soil levels for utility worker and construction worker.

**Risk evaluation for utility worker**

The following equations are used to estimate cancer risks and non-cancer hazards for utility worker exposed to PCP, dioxin, and arsenic in subsurface soils at the railroad right-of-way area. Please refer to Table 1 above for more detailed descriptions of the values used in the equations.

Ingestion Pathway

*Equation 1*

$$\text{Cancer Risk} = \frac{\text{CSF} \times \text{RBA} \times \text{C} \times 10^{-6}\ \text{kg/mg} \times \text{IR} \times \text{ED} \times \text{EF}}{\text{BW} \times \text{AT}_{\text{cancer}} \times 365\ \text{days/year}}$$

Where:
CSF = cancer slope factor
RBA = default relative bioavailability for arsenic
C = maximum detected concentration
IR = ingestion rate
ED = exposure duration
EF = exposure frequency
BW = body weight
$AT_{cancer}$ = averaging time for cancer

*Equation 2*

$$\text{Hazard Index} = \frac{\text{C} \times \text{RBA} \times 10^{-6}\ \text{kg/mg} \times \text{IR} \times \text{ED} \times \text{EF}}{\text{RfD} \times \text{BW} \times \text{AT}_{\text{noncancer}} \times 365\ \text{days/year}}$$

Where:

| | |
|---|---|
| C | = maximum detected concentration |
| RBA | = default relative bioavailability for arsenic |
| IR | = ingestion rate |
| ED | = exposure duration |
| EF | = exposure frequency |
| RfD | = reference dose |
| BW | = body weight |
| $AT_{noncancer}$ | = averaging time for non-cancer |

Dermal Pathway

*Equation 3*

$$\text{Cancer risk} = \frac{CSF \times RBA \times C \times 10^{-6}\ kg/mg \times ED \times EF \times ABS \times AF \times SA}{BW \times AT_{cancer} \times 365\ days/year}$$

Where:

| | |
|---|---|
| CSF | = cancer slope factor |
| RBA | = default relative bioavailability for arsenic |
| C | = maximum detected concentration |
| ED | = exposure duration |
| EF | = exposure frequency |
| ABS | = absorption factor |
| AF | = adherence factor |
| SA | = skin surface area |
| BW | = body weight |
| $AT_{cancer}$ | = averaging time for cancer |

*Equation 4*

$$\text{Hazard Index} = \frac{C \times RBA \times 10^{-6}\ kg/mg \times ED \times EF \times ABS \times AF \times SA}{RfD \times BW \times AT_{noncancer} \times 365\ days/year}$$

Where:

| | |
|---|---|
| C | = maximum detected concentration |
| RBA | = default relative bioavailability for arsenic |
| ED | = exposure duration |
| EF | = exposure frequency |
| ABS | = absorption factor |
| AF | = adherence factor |
| SA | = skin surface area |
| RfD | = reference dose |

BW = body weight
$AT_{noncancer}$ = averaging time for non-cancer

Similar to the 2007 and 2011 memos, utility workers are assumed to be exposed to contaminated subsurface soils at the railroad right-of-way area via incidental ingestion and dermal exposure pathways. Inhalation of subsurface soils is not considered an exposure pathway for this receptor.

*Equation 5*

Total Cancer Risk = Ingestion Risk + Dermal Risk

*Equation 6*

Total Hazard Index = Ingestion HI + Dermal HI

Applying the values from Tables 1 and 2 to these equations, the risk and hazard estimates for utility worker exposed to pentachlorophenol, dioxin, and arsenic in subsurface soils at the railroad right-of-way area are presented in Table 3 below.

**Table 3 – Utility Worker Estimated Cancer Risk and Hazard Index**

| **Subsurface Soil Contaminant** | **Maximum Concentration in Subsurface Soil (mg/kg)** | **Cancer Risk for Utility Worker** | **Hazard Index for Utility Worker** |
|---|---|---|---|
| Pentachlorophenol | 152 | 5E-07 | 0.02 |
| Dioxin | 6.76E-03 | 7E-06 | **4.7** |
| Arsenic | 309 | 2E-06 | 0.3 |
| Total | | 1E-05 | **5.0** |

Table 3 shows that by using the updated exposure values and toxicity values with the 2010 subsurface soil data, total cancer risk estimate for utility workers from exposures to maximum detected concentrations of PCP, dioxin, and arsenic in subsurface soil is similar to the total cancer risk of 1E-05 calculated in the previous memo and is within EPA's acceptable risk range of 10-4 to 10-6. However, the non-cancer total hazard index of 5.0 would exceed the acceptable hazard index level of 1, mainly due to dioxin in soil.

**Risk evaluation for construction worker**

The 2007 memo stated that a construction worker scenario is unlikely because it is based on the assumption that the railroad tracks will be removed in the future. However, risks are still estimated for a construction worker. Similar to the 2007 memo, a construction worker is assumed to be exposed to contaminated soil on the railroad right-of-way for about180 days or 6 months, approximately 3 times longer than assumed for the utility worker. Thus, the total risks for construction worker would be 3 times greater than those estimated for utility worker presented in Table 3 above. These risk estimates are shown in Table 4 below.

**Table 4 – Construction Worker Estimated Cancer Risk and Hazard Index**

| **Subsurface Soil Contaminant** | **Maximum Concentration in Subsurface Soil (mg/kg)** | **Cancer Risk for Construction Worker** | **Hazard Index for Construction Worker** |
|---|---|---|---|
| Pentachlorophenol | 152 | 2E-06 | 0.06 |
| Dioxin | 6.76E-03 | 2E-05 | **14.1** |
| Arsenic | 309 | 6E-06 | 0.9 |
| Total | | 3E-05 | **15.0** |

Table 4 shows that the total cancer risk estimate of 3E-05 for construction worker scenario is within EPA's acceptable risk range of 10-4 to 10-6. However, the non-cancer total hazard index of 15.0 would exceed the acceptable hazard index level of 1, mainly due to dioxin in soil.

**Conclusion**

The potential estimated non-cancer hazard to a utility worker, the most likely scenario in the railroad right-of-way, exceeds the acceptable level of 1 for hazard index based on the assumption that concentrations bordering the tracks are representative of this exposure. The potential estimated non-cancer hazard to a construction worker is higher, but the construction worker scenario is considered unlikely to occur at the railroad right-of-way.

# APPENDIX G

# ARARs REVIEW TABLES

| Chemical-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements and Status** | **Requirement Synopsis** | **Action to Attain ARAR** | **Five Year Review** |
| **All Media** | | | | |
| Federal Criteria, Advisories, and Guidance | American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLVs)<br><br>**ROD Status: To Be Considered (TBC)**<br>**5-Yr Status: Not ARAR** | Health-based guidelines for exposure limit represented in terms of exposure over a workday (8 hours) or a work week (40 hours). These standards were issued as consensus standards for controlling air quality in work place environments. | TLVs will be used for assessing site inhalation risks for site remediation workers. | These guidelines were To Be Considered (TBC) for air monitoring during active phases of the remedial construction. No further land disturbing activities are anticipated, thus these guidelines are no longer ARAR unless further land disturbing activities are conducted. This ARAR is more appropriate as an Action-Specific ARAR. |
| | EPA Risk Reference Dose (RfDs) and EPA Carcinogen Assessment Group Potency Factors<br><br>**ROD Status: TBC**<br>**5-Yr Status: TBC** | Reference dose is an estimate of a daily oral exposure to human populations that is likely to be without an appreciable risk of non-cancer effects. The Cancer Group Potency factors are used as qualitative weight-of-evidence judgment as to the likelihood of a chemical being a carcinogen. | Risks due to carcinogens and noncarcinogens with EPA RfDs and carcinogens with Cancer Potency factors were used to develop target cleanup levels and evaluate remedial alternatives. | These values were used in the risk assessment and development of soil cleanup levels and any future risk calculations are expected to use these values. |
| | EPA Carcinogenicity Slope Factors<br><br>**ROD Status: TBC**<br>**5-Yr Status: TBC** | Slope factors are developed by EPA from health effects assessments. Carcinogenic effects present the most up-to-date information on cancer risk. | Risks due to carcinogens as assessed with slope factors were used to develop target cleanup levels and evaluate remedial alternatives. | These values were used in the risk assessment and development of soil cleanup levels and any future risk calculations are expected to use these values. |
| | OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils<br><br>**ROD Status: TBC**<br>**5-Yr Status: TBC** | This draft guidance establishes a methodology for assessing indoor air risks to human health. | Risks associated with future residential exposure to indoor air were evaluated consistent with this guidance. | Vapor intrusion was evaluated in the risk assessment consistent with the draft guidance. This guidance has not yet been finalized. Once finalized, potential impacts related to the institutional controls (not yet implemented) should be evaluated. |
| | US EPA Guidance: Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites<br><br>**ROD Status: TBC**<br>**5-Yr Status: Not ARAR** | Recommends PRG's or points of departure for cleanup levels for dioxin in soils and sediments at CERCLA sites. Recommended cleanup levels are based on direct exposure pathway. | This guidance was used in setting cleanup levels for dioxin-contaminated soils. | The cleanup level for dioxin in soil was based on the recommended level in this 1998 EPA guidance. Since the 2005 ROD, an RfD was developed for dioxin and is now the recommended toxicity value "to be considered" in developing dioxin cleanup levels under CERCLA. Refer to the response to "Question B" in the five-year review text for the discussion of the potential impacts of the change. |

| Chemical-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements and Status** | **Requirement Synopsis** | **Action to Attain ARAR** | **Five Year Review** |
| Other Guidance | Ontario Ministry of Environment and Energy (OMEE) Lowest and Severe Effect Levels (LELs and SELs) for Freshwater Sediments (Persaud *et al*.. 1993)<br><br>**ROD Status: TBC**<br>**5-Yr Status: TBC** | The LEL value is the concentration at which the majority of the sediment-dwelling organisms are not affected. | The LEL value was used for selecting Chemicals of Potential Concern and for characterizing ecological effects for all alternatives and to assist in setting soil/sediment cleanup levels. | These values were used as screening values for the baseline ecological risk assessment and any future risk calculations are expected to use these values. Note that no cleanup levels were developed for sediment and these sediment criteria were not used in setting soil cleanup levels. |

| Location-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to Attain ARAR** | **Five-Year Review** |
| **All Media** | | | | |
| Federal Regulatory Requirements | Executive Order 11990; "Protection of Wetlands" (40 CFR Part 6, Appendix A)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. Action to avoid, whenever possible, the long-and short-term impacts on wetlands and to preserve and enhance wetlands. If activity takes place, impacts must be minimized to the maximum extent. | Wetlands have been identified on the site and excavation, consolidation and installation of monitoring wells occur in or around wetlands. Because high levels of contamination exist in or near wetlands areas, there is no practicable alternative to excavating or consolidating in these areas. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by remedial activities will be mitigated, restored, or preserved. The Proposed Plan will solicit specific comments on this work. | Buffer zone adjacent to the Rumford River was impacted by the remedial construction and subsequently restored by grading and replanting with native species, followed by a one-year monitoring period that resulted in some additional replanting in 2011. This requirement remains applicable to any future activities, such as installation of monitoring wells, if determined to be needed in or around wetlands. |
| | Fish and Wildlife Co-ordination Act (16 U.S.C. §661 et seq.); Fish and wildlife protection (40 CFR §6.302(g))<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Any modification of a body of water requires consultation with the U.S. Fish and Wildlife Services and the appropriate state wildlife agency to develop measures to prevent, mitigate or compensate for losses of fish and wildlife. | The Site includes streams and rivers. These alternatives may require discharge of treated water into Rumford River resulting from dewatering activities. Consultation will be undertaken with appropriate agencies in this case. | During remedial construction, no discharge of treated water occurred into the Rumford River. Some treated water was discharged to the ground on-site. |
| | Executive Order 11988; "Floodplain Management" (40 CFR Part 6, Appendix A)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Actions will avoid, whenever possible, the long- and short-term impacts associated with the occupancy and modifications of floodplains development, wherever there is a practical alternative. Promotes the preservation and restoration of floodplains so that their natural and beneficial value can be realized. | The Site includes areas defined to be within the 100-year floodplain. These alternatives all involve installation of monitoring wells, some include excavation, and/or consolidation and cap construction possibly in the floodplain areas. All practicable means will be followed to minimize harm and avoid adverse effects as much as possible. Actions will be taken to restore and preserve the natural and beneficial values of the floodplain. | This requirement would be applicable to any future activities, such as installation of monitoring wells, if determined to be needed within the 100-year floodplain. |

| Location-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to Attain ARAR** | **Five-Year Review** |
| Federal Regulatory Requirements (continued) | Standards for Owners and Operators Of RCRA Hazardous Waste Treatment, Storage, and Disposal Facilities, 40 C.F.R. Part 264.18(b)k General Facility Standards, Subpart B<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Requires that hazardous waste treatment, storage, or disposal facilities within a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout unless an alternative demonstration is made to the Regional Administrator. | The Site includes areas defined to be within the 100-year floodplain. Consolidation and capping will be designed, constructed and maintained to prevent washout by a 100-year flood. | The on-site consolidation area that was originally envisioned in the 2005 ROD for arsenic and pentachlorophenol contaminated soils from the Mansfield parcel was not constructed and these soils were disposed off-site. A low permeability asphalt cover was placed across the majority of the Foxboro parcel. |
| | Endangered Species Act, 16 U.S.C. 1531 et seq.; 50 C.F.R. Parts 17.11-12<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Requires site action to be conducted in a manner that avoids harming threatened or endangered species or their habitat. | Transient bald eagles have been sited. Work will be conducted to avoid harming the bald eagle or its habitat. | The requirement remains applicable. |
| State Regulatory Requirements | Wetlands Protection Act (Mass. Gen. Laws ch. 131, §40); Wetlands Protection Regulations (310 CMR §10.00)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Sets performance standards for dredging, filling, altering of inland wetlands and within 100 feet of a wetland. The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. Resource areas at the site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, riverfront, and estimated habitats of rare wildlife. Under this requirement available alternatives must be considered that minimize the extent of adverse impacts and mitigation including restoration and/or replication are required. | Wetlands have been identified on the site and excavation, consolidation and installation of monitoring wells occur in or around wetlands and the 100 foot buffer zone. Because high levels of contamination exist in or near wetlands areas, there is no practicable alternative to excavating or consolidating in these areas. All practicable means will be used to minimize harm to the wetlands including erosion and sedimentations controls and stormwater management. Wetlands disturbed by remedial activities will be mitigated, restored, or preserved. | Buffer zone adjacent to the Rumford River was impacted by the remedial construction and subsequently restored by grading and replanting with native species, followed by a one-year monitoring period that resulted in some additional replanting in 2011. This requirement remains applicable to any future activities, such as installation of monitoring wells, if determined to be needed in or around wetlands. |

| Location-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to Attain ARAR** | **Five-Year Review** |
| | Massachusetts Endangered Species Act (Mass. Gen. Laws ch. 131 §40); Massachusetts Endangered Species Act Regulations, Part III: Alteration of Significant Habitat (321 CMR §§10.30-10.43<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | The MESA establishes State's list of threatened and endangered species and species of special concern. Habitat of such species is protected by the regulations promulgated under the MA Wetlands Protection Act. | The Site is noted as being near the habitat of "species of special concern" (see letter in Appendix B); further review will be conducted to determine applicability of this requirement. Should endangered or threatened species or species of special concern be determined to be present at the site, the substantive requirements of this regulation will be met. | The requirement remains applicable. |
| Federal Criteria, Advisories and Guidance | Policy on Floodplains and Wetland Assessments for CERCLA Actions (EPA OSWER, 8/8/1985)<br><br>**ROD Status: TBC**<br>**5-Yr Status: TBC** | Floodplain and wetlands assessments must be incorporated into analysis conducted during planning of remedial action; public participation requirements must also be met.<br><br>Restates requirement that remedial action may only be located in wetlands if no practicable alternative exists. Potential harm or adverse effects to wetlands or floodplains must be minimized and/or mitigated as required by law/regulation | Floodplain and wetlands assessments and associated considerations were incorporated into RI/FS process.<br><br>Public participation requirements were met through Proposed Plan.<br><br>Substantive requirements for decision-making will be met when selecting and designing remedy. | The substantive requirements of this policy were met. |

| Action-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to be Taken to Attain ARAR** | **Five-Year Review** |
| **Surface Water, Wetlands** | | | | |
| Federal Regulatory Requirements | Clean Water Act (33 U.S.C. §1251 *et seq.*); Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230, 231 and 33 CFR Parts 320-323)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Controls discharges of dredged or fill material to protect aquatic ecosystems. | Wetlands have been identified on the site coincident with contamination. Excavation, consolidation, and installation of monitoring wells will occur in and around the site wetlands. These actions will be designed to minimize adverse effects and to preserve, mitigate, and restore disturbed areas. | Buffer zone adjacent to the Rumford River was impacted by the remedial construction and subsequently restored by grading and replanting with native species, followed by a one-year monitoring period that resulted in some additional replanting in 2011. This requirement remains applicable to any future activities, such as installation of monitoring wells, if determined to be needed in or around wetlands. |
| | Rivers and Harbors Act of 1899 (33 U.S.C. §401 *et seq.*); (33 CFR Part 320)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Protects navigable rivers from unauthorized discharges or from unauthorized obstruction or alteration. | Discharges to the Rumford River resulting from dewatering activities, if any, will occur via a piping system that will not obstruction or alter the River. | During remedial construction, no discharge of treated water occurred into the Rumford River. Some treated water was discharged to the ground on-site. |
| | Clean Water Act, Section 402, National Pollutant Discharge Elimination System (NPDES), 33 USC 1342 (4- CFR 122-125, 131)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | These standards govern discharge of water into surface waters. | Groundwater resulting from dewatering activities, if any, will be treated to the required standards before discharge to the Rumford River. | During remedial construction, no discharge of treated water occurred into the Rumford River. Some treated water was discharged to the ground on-site. |
| State Regulatory Requirements | Massachusetts Surface Water Quality Standards – Vernal Pools, 314 CMR §4.06(1)(d)(11) and 314 CMR 9.08 (variance)<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Relevant and Appropriate** | Prohibits discharge of dredged or fill material to a vernal pool certified by the Massachusetts of Division of Fisheries and Wildlife, unless a variance is granted under 314 CMR 9.08.)(11) – Vernal Pools | Wetland features exist, which, although not officially classified, may be characteristic of vernal pools. If further studies indicate an ecological risk exists, it will be considered an overriding public interest to address the risk. Dredging and/or filling activities will be conducted to avoid, minimize and mitigate adverse effects and restoration/replication will be conducted. | Vernal pools were not filled as part of the remedial construction. This requirement remains relevant and appropriate to any future activities, such as installation of monitoring wells, if determined to be needed in or around vernal pools. |

| Action-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to be Taken to Attain ARAR** | **Five-Year Review** |
| | Surface Water Quality Standards (314 CMR 4.00)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Surface water in the vicinity of the Site are classified as Class B and designated as habitat for fish, other aquatic and wildlife, and for primary and secondary contact recreation. The state surface water minimum criteria for Class B waters are consistent with federal AWQC. | Surface water standards will be used as performance criteria to measure the effectiveness of the Site remedy at preventing degradation of surface water below these standards. | AWQC for pentachlorophenol, arsenic, and chromium were used in calculating onsite groundwater performance standards for protection of surface water. The AWQC for these compounds have not changed since the ROD. Groundwater monitoring results are compared to these performance standards. |
| | 401 Water Quality Certification for Discharge of Dredged or Fill Material, 314 CMR 9.00<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Applicable** | Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, adverse impacts must be minimized. Controls discharges of dredged or fill material to protect aquatic ecosystems. | Wetlands have been identified on the site coincident with contamination. Excavation, consolidation, and installation of monitoring wells will occur in and around site wetlands. These actions will be designed to minimize adverse effects and to preserve, mitigate, and restore disturbed areas. | Buffer zone adjacent to the Rumford River was impacted by the remedial construction and subsequently restored by grading and replanting with native species, followed by a one-year monitoring period that resulted in some additional replanting in 2011. This requirement remains applicable to any future activities, such as installation of monitoring wells, if determined to be needed in or around wetlands. |
| | Massachusetts DEP Surface Water Discharge Permit Program (314 CMR 3)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | These standards govern discharge of water into surface waters. | Groundwater resulting from dewatering activities, if any, will be treated to the required standards before discharge to the Rumford River. | During remedial construction, no discharge of treated water occurred into the Rumford River. Some treated water was discharged to the ground on-site. |
| **Groundwater** | | | | |
| Federal Regulatory Requirements | Federal Safe Drinking Water Act – Maximum Contaminant Levels (MCLs) and non-zero MCLs 40 CFR 141<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Relevant and Appropriate** | These levels regulate the concentration of contaminants in public drinking water supplies but may also be considered appropriate for groundwater aquifers potentially used for drinking water. | These standards will be used during groundwater monitoring to measure the performance of the remedy to ensure that groundwater migrating off the Site does not exceed MCLs and non-zero MCLs. | These standards remain relevant and appropriate. The MCLs for pentachlorophenol, arsenic, and chromium are used as performance standards for long-term monitoring of groundwater beyond the compliance boundary. |

| Action-Specific ARARs | | | | |
|---|---|---|---|---|
| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to be Taken to Attain ARAR** | **Five-Year Review** |
| | Resource Conservation and Recovery Act (42 U.S.C. §6901 *et seq*.);(40 CFR 264.94 and 95) Subpart F<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Relevant and Appropriate** | Establishes maximum concentration limits for RCRA groundwater monitoring and response requirements for solid waste management units. Standards for 14 toxic compounds have been adopted as part of RCRA groundwater protection standards. | These standards will be used during groundwater monitoring to measure the performance of the remedy to ensure that groundwater migrating off the Site does not exceed RCRA groundwater concentration levels for Site contaminants. Compliance boundary is south of the Rumford River and will be established more specifically during remedial design. | These requirements remain relevant and appropriate. Arsenic and chromium groundwater monitoring results for wells located beyond the compliance boundary should be compared to these standards. Note that the limit for arsenic (0.05 mg/l) is higher than the MCL (0.01 mg/l); however, the limit from chromium (0.05 mg/l) is lower than the MCL (0.1 mg/l). Long-term monitoring results for 2011, 2012, and 2013 met these standards. |
| | Resource Conservation and Recovery Act (42 U.S.C. §6901 *et seq*.);(40 CFR 264.100) Subpart F<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Relevant and Appropriate** | Requires that corrective action be taken in the event groundwater is migrating offsite in excess of RCRA groundwater concentration levels set out in 40 CFR 264.94. | Corrective action will be taken should offsite monitoring wells demonstrate that groundwater is migrating offsite in excess of RCRA groundwater concentration levels. | These requirements remain relevant and appropriate. |
| State Regulatory Requirements | Massachusetts Ground Water Quality Standards (314 CMR §6.00)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Establishes groundwater quality criteria necessary to sustain the designated uses, and regulations necessary to achieve the designated uses or maintain the existing groundwater quality. Groundwater at the site is classified as Class II and III, non-potable uses. | These standards will be used during groundwater monitoring to measure the performance of the remedy to ensure that groundwater migrating off the Site does not exceed MCLs and non-zero MCLs that are more stringent that federal standards for Site contaminants. | These regulations were rescinded after the 2005 ROD and are no longer applicable. Federal SDWA MCLs for pentachlorophenol, arsenic, and chromium are used as performance standards for long-term monitoring of groundwater beyond the compliance boundary. |
| **Air** | | | | |
| Federal Regulatory Requirements | National Emission Standards for Hazardous Air Pollutants (NESHAPs) 40 CFR Part 61 Subparts H&I<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Not ARAR** | Regulates air emissions of VOCs from regulated source categories. | VOC emission levels will be met during soil treatment processes through carbon filtering and/or other engineering controls. | No soil treatment was performed during remedial construction and no activities are anticipated that would trigger this requirement. |

| Action-Specific ARARs | | | | |
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| **Media/Authority** | **Requirements** | **Requirement Synopsis** | **Action to be Taken to Attain ARAR** | **Five-Year Review** |
| | RCRA Air Emissions Standards for Process Vents (40 CFR Part 264, Subpart AA)<br><br>**ROD Status: Relevant and Appropriate if threshold concentrations are met**<br>**5-Yr Status: Not ARAR** | Contains air pollutant emission standards applying to solvent extraction and air stripping facilities that treat RCRA wastes with total organics concentrations of 10 parts per million by weight or greater. | Treatment components treating wastes with regulated levels of organic constituents will be designed to meet the criteria set forth in this subpart if threshold levels are met. | No treatment was performed during remedial construction and no activities are anticipated that would trigger this requirement. |
| | RCRA Air Emissions Standards for Equipment Leaks (40 CFR Part 264, Subpart BB)<br><br>**ROD Status: Relevant and Appropriate if treatment involves groundwater with organics at concentrations of at least 10% by weight**<br>**5-Yr Status: Not ARAR** | Sets emission standards for equipment that contains or contacts RCRA wastes with organic concentrations of at least 10% by weight. | Treatment components treating wastes with regulated levels of VOCs will be designed to meet the criteria set forth in this subpart if threshold levels are met. | No treatment was performed during remedial construction and no activities are anticipated that would trigger this requirement. |
| | RCRA Air Emissions Standards for Tanks and containers (40 CFR Part 264, Subpart CC)<br><br>**ROD Status: Relevant and Appropriate if threshold levels are met**<br>**5-Yr Status: Not ARAR** | Requires specific organic emissions controls on tanks and containers having VOC concentrations equal to or greater than 500 parts per million by weight. | Treatment facility components treating wastes with regulated levels of VOCs will be designed to meet the criteria set forth in this subpart if threshold levels are met. | No treatment was performed during remedial construction and no activities are anticipated that would trigger this requirement. |
| State Regulatory Requirements | Ambient Air Quality Standards (310 CMR 6.00)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Sets primary and secondary standards for emissions of Sulfur Oxides, particulate matter, CO, ozone, Nitrogen Dioxide, and Lead. | Remedies will be designed, constructed, and operated in accordance with these rules. No air emissions from remedial treatment will cause ambient air quality standards to be exceeded. Dust standards will be complied with during any and all excavation of materials at the Site. | No treatment was performed during remedial construction. A Perimeter Air Monitoring and Emissions Control Plan was developed and air monitoring for fugitive dust, VOCs, and hydrogen sulfide was performed during active phases of the remedial construction. No further land disturbing activities are anticipated, thus these requirements are no longer ARAR unless further land disturbing activities are conducted. |

| Action-Specific ARARs | | | | |
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| | Massachusetts DEP Air Pollution Control Regulations (310 CMR 7.00)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Regulates dust, particulates and fugitive emissions. Establishes emissions limitations for various processes and regions within the state. | Excavation and treatment processes will be designed, constructed, and operated in accordance with these rules. Air monitoring will be conducted to ensure levels are met. | No treatment was performed during remedial construction. A Perimeter Air Monitoring and Emissions Control Plan was developed and air monitoring for fugitive dust, VOCs, and hydrogen sulfide was performed during active phases of the remedial construction. No further land disturbing activities are anticipated, thus these requirements are no longer ARAR unless further land disturbing activities are conducted. |
| Massachusetts Criteria, Advisories, and Guidance | Massachusetts Threshold Effects Exposure Levels (TELs) and Allowable Ambient Limits (AALs) for Air (December 1995)<br><br>**ROD Status: To Be Considered**<br>**5-Yr Status: Not ARAR** | Establishes exposure concentrations for air contaminants developed and recommended by the Office of Research and Standards to protect public health. | Evaluation of air emissions will consider AALs and TELs. | A Perimeter Air Monitoring and Emissions Control Plan was developed and air monitoring for fugitive dust, VOCs, and hydrogen sulfide was performed during active phases of the remedial construction. No further land disturbing activities are anticipated, thus these guidelines are no longer ARAR unless further land disturbing activities are conducted. |
| **Soil** | | | | |
| Federal Regulatory Requirements<br><br>RCRA program has been delegated to Massachusetts; therefore, only State references appear as ARARs unless particular provision not contained in State program. | | | | |
| State Regulatory Requirements | RCRA Hazardous Waste Management – Identification and Listing of Hazardous Waste (310 CMR 30.100)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Establishes standards for identifying and listing hazardous waste. | Testing as appropriate will assess whether hazardous wastes are present in excavated soil, sediments (if any) and groundwater generated during remedial activities. | This ARAR has been met. Pre-excavation waste characterization was performed on the contaminated soils to be disposed off-site and the soil was determined to be non-characteristic under RCRA. Some wastes generated during remedial construction, including liquid and solid contents of certain USTs, were characterized and disposed as RCRA characteristic waste. |

| Action-Specific ARARs | | | | |
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| | Hazardous Waste Management – Requirements for Generators of Hazardous Waste (310 CMR 30.300)<br><br>**ROD Status: Applicable to any action that generates hazardous waste**<br>**5-Yr Status: Not ARAR** | Generator requirements outline waste characterization, management of containers, packaging, labeling, and manifesting. Generator requirements apply to contaminated substances meeting the definition of hazardous under 310 CMR 100. | Waste generated during excavation, treatment processes and well drilling that are characteristic waste will be managed in accordance with the substantive requirements of this regulation. | This ARAR has been met. RCRA characteristic wastes generated during remedial construction were characterized and managed in accordance with these requirements. |
| | Hazardous Waste Management – Landfill Closure and Post Closure Care (310 CMR, 30.633(1)(a-d), 2(a), (d), (e))<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Relevant and Appropriate** | Establishes performance standards for low permeability covers and for post closure care and for groundwater monitoring. | Consolidated waste will be covered on-site with a low permeability cover that meets these standards. Post-closure care of cover will meet these standards. | This ARAR remains relevant and appropriate and is being complied with. An asphalt parking lot was constructed on the Foxboro parcel to provide a low permeability cover over contaminated soils. Long-term inspection and maintenance of the asphalt cover as well as long-term groundwater monitoring are being conducted in accordance with the O&M Manual (EPA Region 1, September 2011). |
| | Hazardous Waste Management – Closure and Post Closure (310 CMR 30.582, 30.585, 30.592)<br><br>**ROD Status: Relevant and Appropriate**<br>**5-Yr Status: Relevant and Appropriate** | Establishes performance standards for closure and post closure care and groundwater monitoring | All equipment, structures, and soil will be properly decontaminated and disposed of during the remedial action. Post closure care will meet substantive standards as determined by EPA. | This ARAR remains relevant and appropriate. Long-term inspection and maintenance of the asphalt cover as well as long-term groundwater monitoring are being conducted in accordance with the O&M Manual (EPA Region 1, September 2011). |
| | Hazardous Waste Management – General Requirements for ignitable, reactive, or incompatible waste (310 CMR 30.560)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | General requirement for handling hazardous waste | Hazardous wastes will be handled in accordance with these requirements. | No ignitable, reactive, or incompatible wastes were encountered during remedial construction. |

| Action-Specific ARARs | | | | |
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| | Hazardous Waste Management – Tanks (310 CMR 30.343)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Establishes management procedures tanks uses to store hazardous waste. | Any hazardous waste stored in containers will meet substantive requirements of this subpart, including condition and management of containers. | Hazardous wastes were not stored in tanks during remedial construction. |
| | Hazardous Waste Management – Containers (310 CMR 30.342)<br><br>**ROD Status: Applicable**<br>**5-Yr Status: Not ARAR** | Specifies conditions under which hazardous waste may be stored in containers. | Any hazardous waste stored in containers will meet substantive requirements of this subpart, including condition and management of containers. | Hazardous wastes were not stored in containers during remedial construction. |
| Federal Criteria, Advisories and Guidance | Revised Alternative Cap Design Guidance Proposed for Unlined, Hazardous Waste Landfills in the EPA Region 1 (EPA OSRR 2/5/01).<br><br>**ROD Status: TBC**<br>**5-Yr Status: Not TBC**<br><br>USEPA Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments (EPA/530-SW-89-047)<br><br>**ROD Status: TBC**<br>**5-Yr Status: Not TBC** | Provides guidance for landfill cap design for unlined, hazardous waste landfills at Superfund landfill sites in EPA Region 1.<br><br>Presents technical specifications for the design of multi-barrier covers for landfills at which hazardous wastes were disposed. | Guidance will be considered when designing low permeability cover for consolidated material on-site.<br><br>Technical specifications in guidance will be considered when designing low permeability cover for consolidated material on-site. | These guidance documents would have been considered during design the asphalt cover on the Foxboro parcel, but are no longer to be considered for the on-going operation, maintenance, and monitoring activities. |