Schmenk, Colin R - DNR

From: Gielniewski, Margaret <gielniewski.margaret@epa.gov>
Sent: Wednesday, October 4, 2017 4:00 PM
To: Dombrowski.Frank
Cc: Steve Genisot; Louise Stemper; Brian Miller; Warren Howard; Ken Keller; DuFresne, Kristin I - DNR; Brian F Bartoszek (BFBartoszek@integrysgroup.com); Jennifer Knoepfle
Subject: WPSC Marinette MGP Signed ROD
Attachments: WPSC_Marinette_Signed_ROD_09.27.2017.pdf

Hello Frank,

EPA signed the Record of Decision for the WPSC Marinette MGP Site on September 27, 2017. Please find a copy, attached, for your records.

Best regards,
Margaret

Record of Decision

Wisconsin Public Service Corporation Marinette Former Manufactured Gas Plant Site Marinette, Wisconsin

EPA ID: WIN000509952

United States Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604

September 2017

Acronyms and Definitions

°F	Degrees Fahrenheit
§ NR	Wisconsin Administrative State Statute from the Department of Natural Resources
µg/L	Micrograms per liter (also equals parts per billion)
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BaP	Benzo(a)pyrene
BERA	Baseline Ecological Risk Assessment
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act also known as Superfund
CERCLIS	Comprehensive, Environmental Response, Compensation, And Liability Information System
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
City	City of Marinette
CO	Continuing Obligation
COC	Contaminant of Concern
CR	Cancer Risk
CWG	Carbureted Water Gas
CY	Cubic Yards
ELCR	Excess Lifetime Cancer Risk
EPA	United States Environmental Protection Agency
FS	Feasibility Study
ft	feet
ft^3	Cubic Feet
GIS	Geographic Information System
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
ICs	Institutional Controls
M	Million
MCL	Maximum Contaminant Level
mg/kg	Milligrams per kilogram
MGP	Manufactured Gas Plant
msl	Mean Sea Level
NAPL	Non-aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

NPL	National Priorities List
NR 140	Wisconsin NR 140 Groundwater Enforcement Standard
NRT	Natural Resource Technology, technical contractor to WPSC
NTCRA	Non-time Critical Removal Action
O&M	Operation and Maintenance
PAHs	Polycyclic Aromatic Hydrocarbons
PEC	Probable Effects Cause
POTW	Publically Owned Treatment Works
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
PVOC	Petroleum Volatile Organic Compounds
RAL	Remedial Action Level
RAO	Remedial Action Objectives
RBC	Risk-based Concentration
RCM	Reactive Core Mat
RD	Remedial Design
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	Slope Factor
TBC	To-be Considered
USGS	United States Geologic Survey
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Corporation (the PRP; now owned by WEC Business Services, LLC)
WWTP	Waste Water Treatment Plant

Table of Contents

Part 1. Declaration

A. Site Name and Location

Wisconsin Public Service Corporation Marinette Former Manufactured Gas Plant Superfund Alternative Site
Marinette, Wisconsin
Comprehensive, Environmental Response, Compensation, And Liability Information System (CERCLIS) ID# WIN000509952

B. Statement of Basis and Purpose

This Record of Decision (ROD) presents the U.S. Environmental Protection Agency's (EPA) selected remedy for the Wisconsin Public Service Corporation (WPSC) Marinette Former Manufactured Gas Plant (MGP) Superfund Alternative Site, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document addresses MGP waste, including non-aqueous phase liquid (NAPL) and polycyclic aromatic hydrocarbons (PAHs) in soil, groundwater, soil gas, and sediment. This is the final remedy for the WPSC Marinette MGP site.

This decision is based on the information contained in the Administrative Record for the WPSC Marinette MGP Site. The Administrative Record Index (see Appendix A) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based. The Administrative Record file is available for review at the Stephenson Public Library and at the EPA Region 5 Records Center in Chicago, Illinois. Information on the Site can also be found at Wisconsin Department of Natural Resources' (WDNR's) Green Bay Office in Green Bay, Wisconsin.

The State of Wisconsin (Wisconsin DNR) has indicated concurrence with the selected remedy. EPA will place the State's concurrence letter into the Site Administrative Record upon receipt.

C. Assessment of Site

EPA has determined that the response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. Description of Selected Remedy

EPA has selected and modified Alternative 3 to effectively treat NAPL- and PAH-contaminated soil, which constitutes the principal threat waste. Modified Alternative 3 will consist of excavation and off-site disposal of accessible source material located within the Boom Landing Zone and the waste water treatment plant (WWTP) Zone; installation of horizontal engineered barriers over surficial soil exceeding preliminary remediation goals (PRGs); in-situ treatment of affected groundwater; effectiveness monitoring of the existing reactive core mat (RCM) and dredge inventory remaining after the Non-time Critical Removal Action (NTCRA); and

implementation of institutional controls (ICs) to manage remaining potential soil, groundwater, soil gas, and sediment risks.

The modification to Alternative 3 will limit the extent of excavation across WWTP Zone based on soil sample results. If the top two feet of soil show industrial screening level exceedances that could pose direct contact concerns, horizontal engineered barriers and ICs will be needed to prevent risk.

The selected remedy is estimated to cost $7.63 million (M), which includes an estimated capital cost of $6.18M and an estimated present-worth operation and maintenance (O&M) cost of $1.45M. Actual costs may vary, but are expected to remain in the range of -30% and +50% of the estimated costs.

The selected remedy consists of the following components:

1. ***Excavation and off-site disposal of accessible source material located within the Boom Landing Zone***
    a. Complete predesign investigation to further define horizontal and vertical extent of excavation and provide waste characterization sampling.
    b. Obtain access agreements and demolish/remove parking lot, fish house, utilities, and existing concrete and asphalt pavements in the Boom Landing Zone.
    c. Install temporary shoring to support deeper excavations.
    d. Install a temporary dewatering system to lower the water table within the excavation footprint.
    e. Excavate non-affected overburden soil and stockpile on-site for use as post-excavation backfill.
    f. Excavate MGP-source material and transport to Subtitle D Landfill.
    g. Backfill excavation to surrounding grades with granular backfill and stockpiled overburden material.
    h. Restore Site to previous conditions.

2. ***Excavation and off-site disposal of accessible source material located within the Waste Water Treatment Plant (WWTP) Zone***
    a. Complete predesign investigation and waste characterization sampling to further define horizontal and vertical extent of excavation and define areas requiring horizontal engineered barriers.
    b. Obtain access agreement from the City of Marinette (City).
    c. Install temporary shoring to support deeper excavations.
    d. Install a temporary dewatering system to lower the water table within the excavation footprint.
    e. Excavate non-affected overburden soil and stockpile on-site for use as post-excavation backfill.
    f. Excavate MGP-source material and transport to Subtitle D Landfill.
    g. Backfill excavation to surrounding grades with granular backfill and stockpiled overburden material.
    h. Restore Site to previous conditions.

3. ***Horizontal Engineered Surface Barriers at Boom Landing and WWTP Zones***
    a. Monitor and maintain existing engineered surface barriers including paved parking lots and paved roadways.
    b. Assess and mitigate potential exposure to surficial soil containing contaminants of concern (COCs) above PRGs by backfilling the two feet depth of excavated areas with 18 inches of clean fill and six inches of clean topsoil. Alternative barrier approaches, including gravel and/or asphalt, will be evaluated during the remedial design (RD) phase.

4. ***In-situ Groundwater Treatment***
    a. Perform bench-scale testing of Site soils and groundwater with varying types and percentages of reagents to determine the most effective approach to address COCs in groundwater.
    b. One-time placement of oxidant into the exposed saturated zone resulting from excavation of Boom Landing and WWTP Zones.
    c. Groundwater monitoring until groundwater PRGs are achieved.

5. ***Sediment Monitoring***
    a. Regular effectiveness monitoring of the Reactive Core Mat (RCM) to check for ebullition or migration of MGP source materials that were not addressed during the 2012 removal action.
    b. Monitor the 160 cubic yards (CY) of dredge inventory that remained after the NTCRA to ensure at least six inches of clean sand remain over those areas with MGP-residuals remaining, and that the 0-6 inch zone remains below remedial action levels (RALs).

6. ***Institutional Controls (ICs) for Soil, Soil Gas, Groundwater, and Sediment***
    a. Boundaries for ICs will be based on delineation of MGP COCs on affected parcels to PRGs. Wisconsin DNR' s Geographic Information System (GIS) Registry will be used to implement institutional controls; however, alternate continuing obligation mechanisms, including deed restrictions, may be considered as part of the remedial design. Requirements, limitations, or conditions relating to restrictions of sites listed on the Wisconsin DNR GIS database are required to be met by all property owners [Wisconsin State Statutes (§) 292.12(5)]. As a result, the statute requires that the GIS database conditions be maintained for a property, regardless of changes in ownership. A violation of Section 292.12 is enforceable under Wisconsin § 292.93 and 292.99.

E. Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements (ARAR) to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy in that the selected remedy uses treatment to reduce the toxicity, mobility, and/or volume of hazardous substances, pollutants, or contaminants.

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure.

The principal threat waste at the WPSC Marinette MGP Site is PAH- and NAPL- contaminated soil because the toxicity of the material poses a potential risk of 10-3 or greater and contributes to groundwater contamination, as defined in *A Guide to Principal Threat and Low Level Threat Wastes*, Office of Solid Waste and Emergency Response 9380.3-06FS, November 1991.

This remedy addresses remaining site-wide contamination, and will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure until remedial action objectives are achieved. A statutory review will be conducted every five years after initiation of remedial action, until remedial action objectives are achieved, to ensure that the remedy is, or will be, protective of human health and the environment.

F. ROD Data Certification Checklist

The following information is included in the Decision Summary (Part 2) of this ROD, while additional information can be found in the Site Administrative Record file:

- Chemicals of concern (COCs) and their respective concentrations (see Part 2.E.2.e. and 2.E.3.f.);
- Baseline risk represented by the COCs (see Part 2.G.1 - Summary of the Human Health Risk Assessment);
- Remediation goals (i.e., cleanup goals) established for the COCs and the basis for the goals (see Part 2.H - Remedial Action Objectives);
- How source materials constituting principal threats are addressed (see Part 2.K - Principal Threat Wastes Selected Remedy);
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the Human Health Risk Assessment and this ROD (see Part 2.F – Current and Future Site and Resource Uses);
- Potential land and groundwater use that will be available at the Site as a result of the Selected Remedy (see Part 2.F – Current and Future Site and Resource Uses and Part 2.H - Remedial Action Objectives);
- Estimated capital, lifetime O&M, and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Part 2.I – Description of Alternatives); and
- Key factor(s) that led to selecting the remedy (see Part 2.J - Comparative Analysis of Alternatives).

G. Authorizing Signature

EPA, as the lead agency for the Site, formally authorizes this ROD.

Margaret M. Guerriero, Acting Director
Superfund Division
U.S. EPA - Region 5

September 27, 2017
Date

Wisconsin DNR, as the support agency for the WPSC Marinette MGP Site, indicated concurrence with this ROD. The state's concurrence letter will be added to the Administrative Record upon receipt.

Part 2. Decision Summary

A. Site Name, Location, and Brief Description

The 4-acre former WPSC Marinette MGP property, located at 1603 Ely Street, is currently owned by the City of Marinette (City) and 1428 Main Street Holdings (Figure 1). The 1428 Main Street Holdings property was previously owned by Goodwill Industries and may also be referred to as the "former Goodwill property" in this and other Site-related documents. Currently, the City operates a WWTP (WWTP) at the property. The portion of the former MGP facility located on the 1428 Main Street Holdings property is currently a parking lot for the commercial building located on the property. The former MGP property is within 700 feet of the Menominee River. The former MGP property is bounded on the north by Mann Street and railroad tracks, on the southwest by Ludington Street, and on the southeast by Ely Street (Figure 2).

The approximate area of the of the Site, illustrated in Figure 2, is 15 acres and includes properties owned by WPSC, Canadian National Railroad, Marinette Central Broadcasting, and the City, which owns Boom Landing, the WWTP, the Fire Station, and City rights-of-way. The upland portion of the Site is primarily located within heavy manufacturing and park districts; however, small portions of the Site also fall within community business and waterfront overlay districts. Most of the upland Site is covered with pavement, buildings, or manicured lawns.

The City has constructed a public boat launch (Boom Landing) along the Menominee River adjacent to the former MGP property where a former slough/logrun had passed through the property. The boat landing is located approximately 2 miles from the mouth into Lake Michigan. The Menominee River, which separates Wisconsin from Michigan's Upper Peninsula, is a gaining stream that receives groundwater and surface water from the Marinette area and discharges into Lake Michigan (Green Bay). According to the bathymetric surveys, water depths near the Site range from 1 to 20 feet. The river is nearly 1,075 feet wide near the Site.

B. Site History and Enforcement Activities

B.1. Site History

MGPs were industrial facilities that were found in every sizable town or city in the U.S. from the 1820s to right after World War II (WWII). MGPs heated coal in large industrial ovens to produce manufactured gas used for street and home lighting, heating, and cooking. After the war, natural gas use replaced manufactured gas use because it was abundant, lower priced, and overall cleaner for the environment. Some MGPs continued to operate after WWII, and most ceased operations by the 1960s and were torn down. Typically, the aboveground structures, such as buildings, tar/oil tanks, and storage sheds, were demolished and the foundations were backfilled, leaving hardly any visible traces of the former operations. Belowground structures such as traces of underground piping and storage tanks, along with residual contaminants, were often left behind.

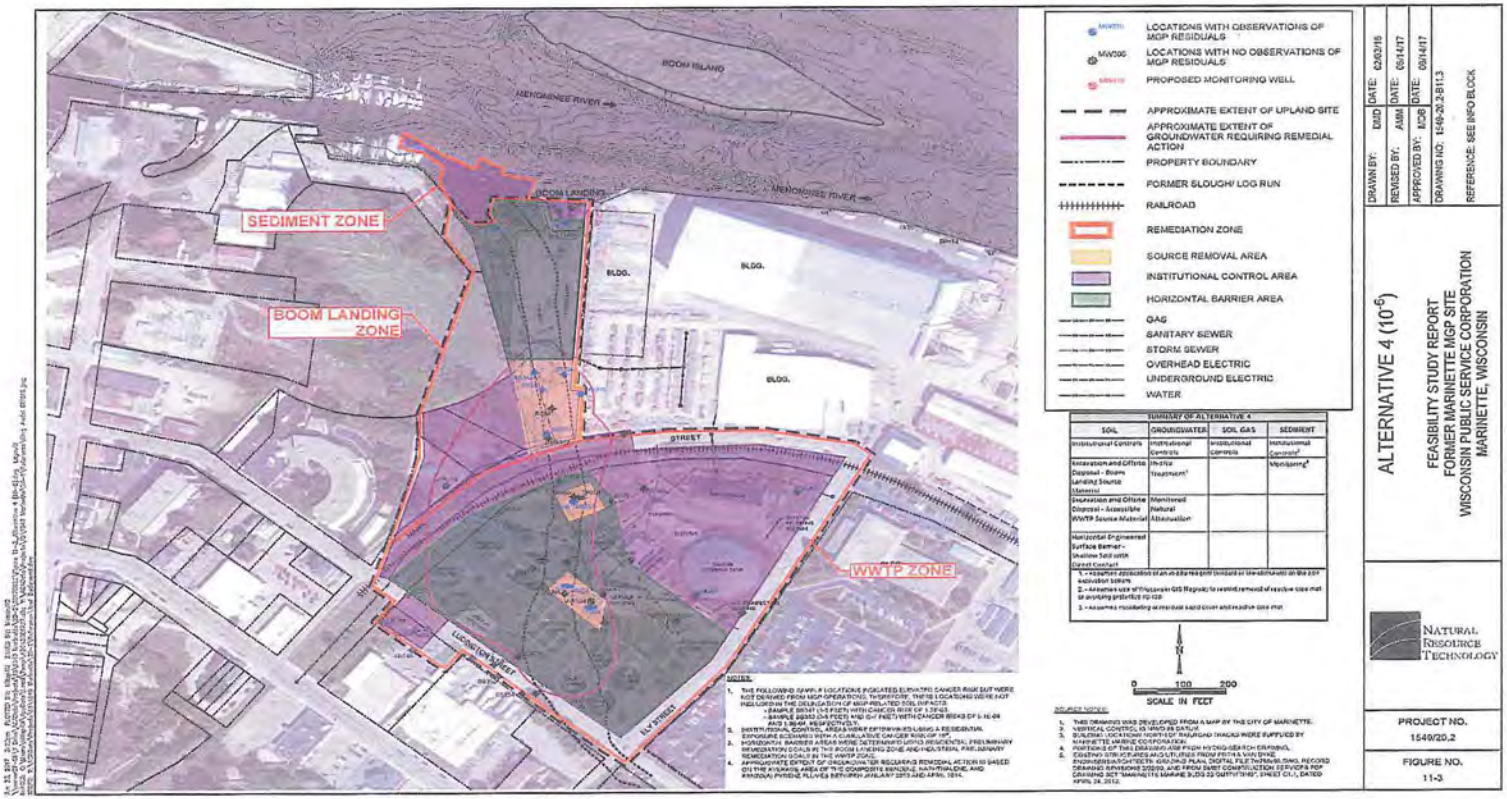
Figure 1. Site Location Map

SOURCE NOTES:

1. NATIONAL GEOGRAPHIC TOPO. 1:24,000-SCALE MAPS FOR THE UNITED STATES. THE TOPO! MAPS ARE SEAMLESS, SCANNED IMAGES OF UNITED STATES GEOLOGICAL SURVEY (USGS) PAPER TOPOGRAPHIC MAPS. FOR MORE INFORMATION ON THIS MAP, VISIT US ONLINE AT HTTP://GOTO.ARCGISONLINE.COM/MAPS/USA_TOPO_MAPS COPYRIGHT:© 2011 NATIONAL GEOGRAPHIC SOCIETY, I-CUBED
2. COORDINATE SYSTEM IS WISCONSIN COUNTY COORDINATE SYSTEM, MARINETTE COUNTY, US FOOT.

QUADRANGLE LOCATION

Figure 2. Site Map and Extent of Contamination



The former WPSC Marinette MGP facility was constructed between 1901 and 1910 and operated through 1960. Prior to 1903, the Marinette Lighting Company owned the former MGP property. In 1903, electric and gas utilities in Marinette, Wisconsin, and Menominee, Michigan, were merged to form the Menominee and Marinette Light and Traction Company.

In 1922, WPSC acquired control of the Menominee and Marinette Light and Traction Company and operated it as a wholly owned subsidiary. In 1953, the subsidiary was merged with the parent company. In 1962, the former MGP property was sold to the City of Marinette under a land contract. The City subsequently used the property to expand the WWTP facilities.

The MGP facility operated with two methods of coal gas production. Coal gas production from construction of the facility to 1928 was by retort, while coal gas production from 1928 to 1960 used the carbureted water gas (CWG) process. Coal tar was a valuable commodity and typically sold as a chemical feedstock and for wood treatment; the timber industry thrived in the Marinette area. Based on the location of the tar tanks adjacent to the railroad tracks, it is reasonable to presume that a significant amount of tar produced at the MGP facility was shipped off-site.

Coal gas production from construction of the facility to 1928 involved heating and volatilizing coal in an airtight chamber (retort). At retort temperatures (about 2,200 degrees Fahrenheit [°F]), the coal decomposed into gas and tar. The gas was then passed through a purifier to remove impurities such as sulfur, carbon dioxide, cyanide, and ammonia. Dry purifiers used trays and sieves containing lime or hydrated iron oxide mixed with wood chips. The gas was then stored in large holders at the facility prior to distribution for lighting and heating.

Coal gas production from 1928 to 1960 used the CWG process. This process involved passing air and steam over incandescent coal in a brick-filled vessel to form a combustible gas, which was then enriched by squirting a fine mist of oil over the bricks. The gas was then purified and stored in holders prior to distribution. In 1948, propane was introduced as a fuel and used in combination with CWG to meet the demand for gas for space heating. Natural gas pipelines subsequently replaced the need for propane and manufactured gas, and the MGP in Marinette ceased operation in 1960.

The City's WWTP was originally constructed east of the former slough in 1938 and was expanded twice—approximately in 1945 and again in 1952. When the City purchased the former MGP property in 1962, it expanded the WWTP again in 1972 and 1989 to its current size.

B.2. History of Enforcement Actions

In 2006, Wisconsin Public Service Corporation (WPSC) entered into an Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (EPA). Under the AOC, WPSC agreed to prepare and perform a remedial investigation (RI) and feasibility study (FS) at each of six Sites: WPSC Marinette MGP, WPSC Manitowoc MGP, WPSC Green Bay MGP, WPSC Two Rivers MGP, and WPSC Oshkosh MGP Superfund Alternative Sites. The AOC is a voluntary settlement agreement to enter the six aforementioned Sites into the Superfund Alternative Sites Approach, that follows the requirements of the Superfund law and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) without listing the Site on the EPA's National Priorities List (NPL).

In 2012, WPSC entered into an AOC with EPA to perform a Non-Time Critical Removal Action (NTCRA) to address contaminated sediments and near-shore NAPL.

From October 2012 through March 2013, WPSC conducted the NTCRA and removed approximately 14,799 cubic yards of MGP-impacted sediments down to 22.8 parts per million (ppm) Total (13) PAHs. An additional 422 cubic yards were removed for navigational purposes as part of an access agreement between WPSC and the Nestegg Marine, an adjacent property. The removal action objective was to mechanically excavate contaminated sediments in areas with total PAH concentrations and NAPL until post-dredge verification samples indicated that the remaining sediments contained Total (13) PAH concentrations less than the remedial action level (RAL) of 22.8 ppm and no visual NAPL remaining. The figure 22.8 ppm was selected because it is Wisconsin DNR's probable effects cause at which PAHs impact microorganisms.

Dredging progressed upland into the shoreline in areas where NAPL was observed to be present. Due to upland land use and associated space constraints, not all upland NAPL was able to be removed. Consequently, reactive core mat (RCM) was placed along the shoreline in these areas to prevent future migration of upland NAPL into the river. This RCM extends out onto the riverbed from the shoreline and covers some of the residual sediments on the irregular bedrock surface with concentrations of Total (13) PAH greater than 22.8 ppm. Upland dredging and excavation required removal and replacement of an existing sewer outfall structure on the shoreline. In this area, RCM was placed on the side slope of the upland excavation prior to backfill to prevent contamination of clean backfill adjacent to the replacement outfall structure.

Sediment removed from the river was mixed with stabilization additives on a geomembrane-lined, asphalt pad before being transported to Waste Management's Menominee, Michigan, Landfill for disposal. Debris encountered during dredging activities and from removal of the former outfall structure was also disposed of at the aforementioned landfill under a separate waste profile. Sediment contact water collected at the stabilization pad was treated on a batch basis with an on-site treatment system in accordance with the substantive requirements of the Wisconsin Pollution Discharge Elimination System (WPDES).

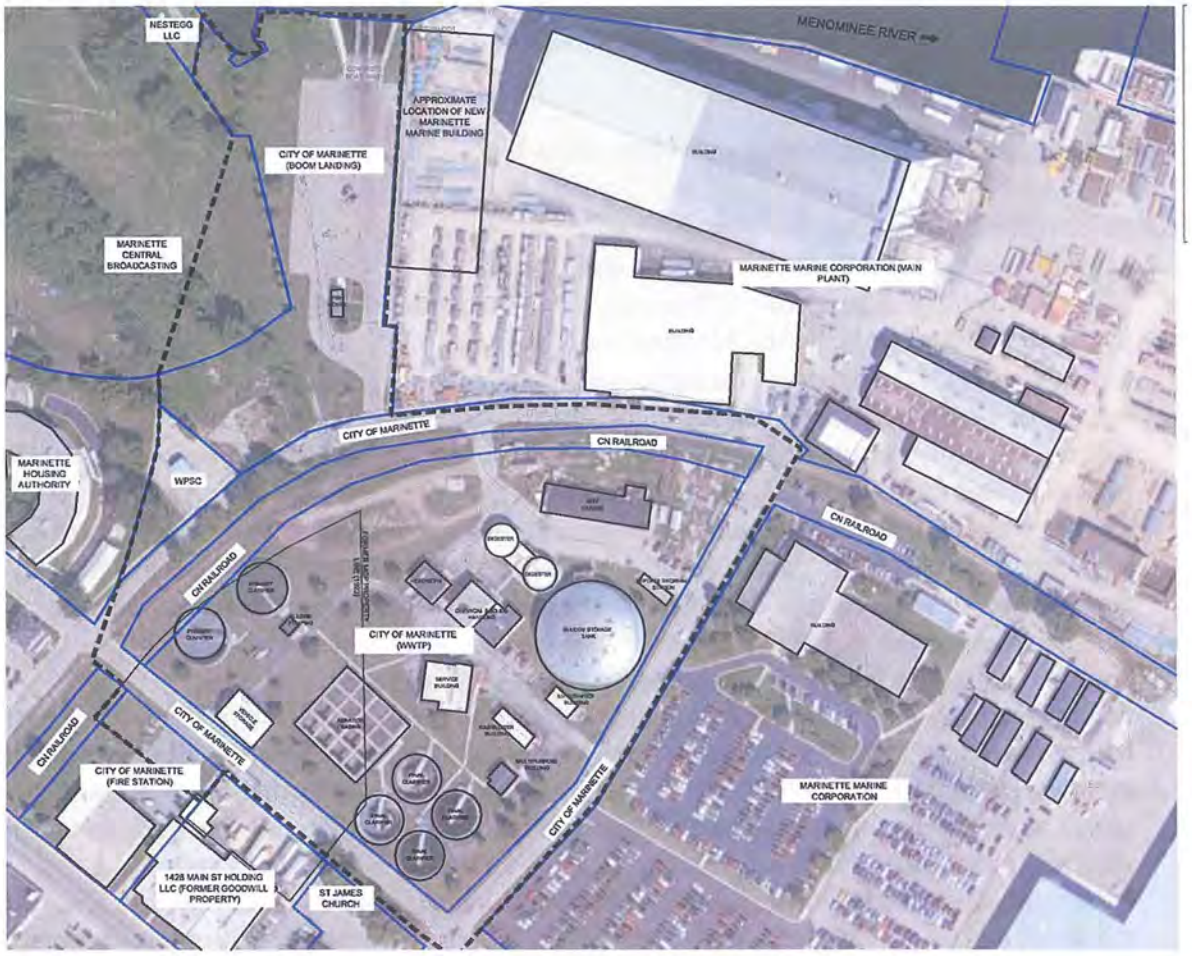
C. Community Participation

Since 2006, EPA conducted community interviews, created a community involvement plan, and participated in one public meeting to present the alternative selected for the Non-Time Critical Removal Action (NTCRA) of NAPL in sediments and near-shore soils.

EPA made the RI and FS Reports and the Proposed Plan available to the public in May and July 2017. These documents are found in the Administrative Record file and the information repository maintained at the Stephenson Public Library.

EPA published a notice of availability of these three documents in the *EagleHerald* on July 16, 2017 and held a public comment period on the Proposed Plan from July 17 to August 16, 2017. EPA indicated that it would accept public comments via mail, email, and electronic submissions through its website. The agency received four public comments on the Proposed Plan. Comments and responses can be found in the Responsiveness Summary at the end of this document.

Figure 3. WPSC Marinette MGP Current Site Layout



D. Scope and Role of Response Action

This ROD addresses site-wide MGP contaminants and will be the final RA for the WPSC Marinette MGP Site. The selected remedy will actively treat the COCs in the soil, soil gas, and groundwater. Although the majority of COCs in sediment were addressed during the 2012 NTCRA, the remedy includes components to monitor remaining COCs under the RCM and in the sediment.

E. Site Characteristics

The WPSC Marinette MGP Site is located in Marinette, Wisconsin, at 1603 Ely Street, Marinette, Marinette County. The Site spans approximately 15 acres, which includes the four acres of the former MGP property currently owned by the City of Marinette (City) and 1428 Main Street Holdings, and 11 acres of MGP-impacted soil, groundwater, and sediment spanning from the former MGP property through Boom Landing Park and into the Menominee River sediments. The Site includes properties owned by WPSC, Canadian National Railway Company, Marinette Central Broadcasting, the City of Marinette (Boom Landing Park, the waste water treatment plant, fire station, and City right-of-ways (Figure 2, page 2-7).

The former MGP property is within 700 feet of the Menominee River. The WWTP property is bounded on the north by Mann Street and railroad tracks, on the southwest by Ludington Street, and Ely Street on the southeast. The City built Boom Landing Park along the Menominee River, adjacent to the property through which a former slough ran, approximately two miles from the mouth of Lake Michigan.

The following sections present a brief overview of the Site.

E.1. Environmental Setting

E.1.a. Regional Setting, Demography, and Land Use

- Marinette is located in northeast Wisconsin and is separated from Menominee, Michigan, in the Upper Peninsula, by the Menominee River.
- Marinette County, Wisconsin encompasses approximately 1,402 square miles of area, with agricultural land use being the dominant classification. The population of Marinette County is 41,749 people (2010 Census). The greatest concentrations of people are located in and around the City of Marinette.
- The City of Marinette encompasses approximately 8 square miles, and has a population of approximately 10,968 people (2010 Census). The City of Marinette has a mixture of agricultural, residential, and industrial land use, with residential use being dominant.
- The land around the former MGP facility has been zoned for residential, commercial/industrial (including communications/utilities and governmental/institutional), and park district uses (Figure 3). According to the Marinette City Assessor's Public Assess website for Marinette, the former MGP facility is zoned as communications/utilities use. Most of the land surrounding the former MGP facility is zoned as heavy manufacturing or business district. Residential zoning can be found to the east/northeast across the street from the WWTP on the corner of Mann Street and Ludington Street. Additional residential zoning is located approximately a block away to the south and southeast along Main Street. This zoning information was obtained through the Bay Lakes Regional Planning Commission GIS website and the August 3, 2009 city of Marinette zoning map.
- As discussed above, groundwater is not used as a drinking water source for the city of Marinette. The City collects surface water from intake pipes located on the Green Bay to supply potable water.

E.1.b. Topography

Based on the United States Geologic Survey (USGS) Marinette West Quadrangle, relief within one mile of the Site is approximately 30 feet, ranging from approximately 575 feet mean sea level (msl) at the Menominee River to approximately 605 feet msl northeast of the Site in the City of Marinette. The ground surface elevation for the majority of existing groundwater monitoring wells ranges between 584 and 598 feet msl; the Site slopes towards the Menominee River. The elevation of the Menominee River is closely tied to the elevation of Lake Michigan and was ranges between 578 feet msl in October 2003 [Natural Resource Technology (NRT), June 2004] and 577 feet msl under normal conditions (note the October 2012 staff gauge reading was affected by sediment removal activities). Surface water readings collected during sediment sampling in April 2012 averaged 576.16 feet.

E.1.c. Geology

The regional geology of Marinette consists of sedimentary deposits with unconsolidated deposits over the top. Fill is encountered on top of these unconsolidated deposits, at or near the surface over much of the Site. At locations in or adjacent to the former slough, the fill layer is as great as 18 feet thick. The fill material typically consists of fine sands with discontinuous clay, silt, and gravel. Glass, wood, brick, and concrete were also found, especially in the area of the former slough and the former MGP building locations. Within the former slough, the fill was often black in color and occasionally exhibited strong odors. In the vicinity of the former MGP facility, the fill material consists of fine sand, silt, and clay with occasional bedrock fragments and the aforementioned debris.

Beyond the immediate vicinity of the slough, glacial till deposits were found below the fill. The glacial deposits consist of fine sand, silt, and clay and may inhibit the movement of NAPL and/or groundwater. Bedrock occurs approximately 20 feet below ground surface (bgs) and appears to slope towards the Menominee River.

The Wisconsin-Lake Michigan basin contains three main aquifers, the unlithified sand and gravel aquifer, the Niagara dolomite aquifer, and the Cambrian sandstone aquifer. The sand and gravel glacial alluvium in the basin is a significant source of water. Generally, groundwater flow in the Niagara and Cambrian aquifers is north, northeast toward Lake Michigan. Recharge to the aquifers is local, and paths of movement are short.

The Site groundwater is monitored in three different zones including the shallow sand wells screened at 580 feet elevation, deep sand wells screened at 555 feet to monitor the deep sand above bedrock, and the bedrock wells screened at 525 feet and monitor the shallow bedrock.

E.1.d. Hydrogeology

Four aquifer systems have been identified in the Marinette area (Oakes and Hamilton, 1973). These aquifers are: 1) the sand-and-gravel aquifer of the unconsolidated glacial deposits; 2) the Galena-Platteville aquifer; 3) the sandstone aquifer of the Ordovician and Cambrian bedrock; and 4) the crystalline bedrock aquifer. The sand and gravel aquifer is very thin and produces less than 100 gallons per minute in the southern portion of Marinette County. Generally, groundwater flow in the Quaternary sand and gravel is toward rivers and streams eventually discharging into Green Bay (Lake Michigan). Recharge is local from precipitation and surface water bodies.

E.1.e. Surface Water Hydrology

The Menominee River at Marinette forms the boundary between the southern tip of Michigan's Upper Peninsula and Wisconsin's northeast corner. The river is approximately 118 miles long as it flows into Lake Michigan. The drainage area for the Menominee River is 4,070 square miles according to the USGS.

The USGS had a stream monitoring station (USGS 04067651) in the mouth of the river until October 1995. The total flow from November 1994 until October 1995 was 36,933 cubic feet per second (cfs) with the greatest monthly flow of 5,585 cfs (May 1995) and the lowest monthly flow of 1,920 cfs (February 1995). The average daily flow during this period was 3,085 cfs.

Currently, the closest USGS stream monitoring station (USGS 04067500) to the Site is 18 miles upstream. The total flow at this station from October 1994 till September 1995 was 35,522 cfs with the greatest monthly flow of 5,391 cfs (May 1995) and the lowest monthly flow of 1,854 cfs (February 1995).

The average daily flow during this period was 2,570 cfs. The total flow from September 2007 till September 2008 (most recent data) was 31,199 cfs with the greatest monthly flow of 7,786 cfs (April 2008) and the lowest monthly flow of 1,170 cfs (September 2008). The average daily flow during this period was 2,668 cfs.

The 1978 Federal Emergency Management Agency map provided in Appendix A of the site-specific workplan for RI/FS indicates the 100-year floodplain is at Elevation 585 msl.

E.2. Climate

The Site is located in northeast, Wisconsin, which has a continental climate characterized by moderate winters and warm summers. Cold winters and warm summers are moderated by the thermal mass of Lake Michigan.

Climate conditions for the Marinette area were gathered at Weather Station 475091 of the Wisconsin State Climatology office website1. The weather station is located at latitude 45° 5' N, longitude 87°38' W, elevation 610 feet, in Marinette County, Wisconsin. Monthly temperatures, precipitation, and snowfall from 1971 – 2000 are summarized in the tables below, and taken from the Wisconsin State Climatology Office website, http://www.aos.wisc.edu/~sco.

Temperature Summary
Station ID: 475091 Marinette, WI
1971 – 2000 Averages

Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Max °F	24.7	28.9	39.2	52.6	66.2	76.1	81.3	78.5	69.4	56.9	42.3	29.6	53.8
Min °F	8.2	12.4	22.0	33.2	44.8	54.2	59.7	58.1	50.4	39.4	27.5	15.0	35.4
Mean °F	16.5	20.7	30.6	42.9	55.5	65.2	70.5	68.3	59.9	48.2	34.9	22.3	44.6

°F—Degrees Fahrenheit

Precipitation Summary
Station ID: 475091 Marinette, WI
1971-2000 Averages

Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Precipitation (inches)	2.00	1.33	2.39	2.75	3.06	3.60	3.44	3.35	3.53	2.47	2.69	1.79	32.40

Snowfall Summary
Station ID: 475091 Marinette, WI
1971-2000 Averages

Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Snow (inches)	15.8	9.9	9.1	2.7	0.1	0.0	0.0	0.0	0.0	0.1	3.2	12.8	53.7

E.2.a. Ecology

The WPSC Marinette MGP Site is located in the northern Lake Michigan coastal ecoregion. This ecoregion encompasses 2,004 square miles (1,282,877 acres) in Marinette, Oconto, Shawano, and Door counties and represents 3.6% of the area of the state of Wisconsin.

Historically, the uplands were almost entirely covered by maple-basswood and aspen-birch forests. Today, more than 64% is now un-forested with 51% covered by agricultural crops, 6% grassland, 6% non-forested wetlands, 0.1% shrubland, and 1% urbanized areas.

A review of the Natural Heritage Inventory Database for and within one mile of the Site resulted in the identification of a federally protected bird species. However, the identified bird species is located a significant distance from the former MGP Site and the species will not be adversely affected from projected Site activities. No other state or federally threatened or endangered species were identified. Additionally, no documented wetlands were identified.

E.3. Remedial Investigation Results

RI activities occurred from November 2011 through RI Report completion in October 2016. The Regional screening levels (RSLs) presented below do not reflect the RSL updates released by EPA in May 2016 and corresponding June 2016 updates from Wisconsin DNR. Additional sampling will be completed as part of the Remedial Design phase to further define areas of remediation.

E.3.a. Soil Investigation Summary

Of the 78 soil samples analyzed for Benzene, 3 exceeded industrial screening level (SL) of 5.1 mg/kg. Of the 71 soil samples analyzed for Ethylbenzene, 4 exceeded the industrial SL of 25 mg/kg. Of the 64 samples analyzed for Total Xylenes, 0 exceeded the industrial SL of 2,500 mg/kg.

Of the 82 soil samples analyzed for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, and Naphthalene, 22 samples exceeded the industrial SL of 2.9 mg/kg; 37 exceeded the industrial SL of 0.29 mg/kg; 22 exceeded the industrial SL of 2.9 mg/kg; 11 exceeded the industrial SL of 29 mg/kg; 3 exceeded the industrial SL of 290 mg/kg; and 12 exceeded the industrial SL of 17 mg/kg for each listed parameter respectively.

E.3.b. Groundwater Investigation Summary

Of the 163 groundwater samples analyzed for Benzene and Ethylbenzene, 27 samples exceeded the residential SL of 5 µg/L for Benzene and four exceeded the residential SL of 700 µg/L for Ethylbenzene.

Of the 163 groundwater samples analyzed for Benzo(a)anthracene, Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, and Naphthalene, 49 samples exceeded the residential SL of 0.029 µg/L; 23 exceeded the residential SL of 0.2 µg/L; 20 exceeded the residential SL of 0.2 µg/L; 14 exceeded the residential SL of 0.29 µg/L; 25 exceeded the residential SL of 0.2 µg/L; and 16 exceeded the residential SL of 100 µg/L for each listed parameter respectively.

E.3.c. Soil Gas Investigation Summary

Of the 46 groundwater samples analyzed for Benzene, Ethylbenzene, Total Xylenes, and Naphthalene, 5 samples exceeded the industrial SL of 16 µg/m³ for Benzene, 3 exceeded the industrial SL of 49 µg/ m³ for Ethylbenzene, 1 exceeded the industrial SL of 4,400 µg/m³ for Total Xylenes, and 8 exceeded the industrial SL of 3.6 µg/m³ for Naphthalene.

E.3.d. Surface Water and Sediment Investigations Summary

Prior to the 2012-2013 NTCRA performed on PAH-contaminated sediment and near-shore non-aqueous phase liquid (NAPL), more than half of the 249+ sediment samples collected had petroleum volatile organic compounds (PVOCs) and Site-specific PAHs above ecological SLs. Of the 234 sediment samples analyzed for Total PAHs, 55 samples exceeded the Sediment NTCRA goal of 22.8 mg/kg. After the NTCRA, only 8 samples exceed the NTCRA cleanup range between 22.8 mg/kg and 50 mg/kg as taken on the surface weighted average concentration. After sediment removal, a minimum thickness of ten inches of clean sand was placed in areas where samples exceeded the cleanup goals, to promote mixing and dilution of sediments and prevent ecological risk to benthic macroinvertebrates in the top six inches of habitat zone. Monitoring of the sediment and RCM will continue until no ecological exposure risks remain.

Detailed sampling results can be found in the June 21, 2013 *Final Report: NAPL and Sediment Removal Action for the Marinette Former Manufactured Gas Plant Site, Marinette, Wisconsin* authored by NRT on behalf of WPSC.

E.3.e. Site Contaminants of Concern (COCs)

EPA identified polycyclic aromatic hydrocarbons (PAHs), most notably chrysene, benzo(a)pyrene, benzo(b)fluoranthene, and naphthalene, and PVOCs, including benzene and ethylbenzene, as COCs at the Site. Based on historical investigations and results from the RI, the source of the PAH and PVOC contamination is the manufacturing of gas processes undertaken at the WPSC Marinette MGP operations from the 1900's through the 1960's. COCs spread from the MGP down to the Marinette River via a former logrun/slough.

E.3.f. Contaminant Levels by Specific Media

Table 1: COCs in Soil with Remediation Goals

Constituents of Concern	Minimum to Maximum Range in PPM	CR>1×10–6; HQ>1 in PPM
Ethylbenzene	ND-288	37
Benzo(a)pyrene	ND-534	2.11
Naphthalene	ND-1630	26

Notes: CR-Cancer Risk HQ-Hazard Quotient PPM-Parts Per Million ND-Non-Detect

Table 2: COCs in Groundwater with Remediation Goals

Contaminant of Concern	Minimum to Maximum Range in µg/L	PRG in µg/L	Basis for PRG
Benzene	ND-580	5	MCL and NR140
Ethylbenzene	ND-1,700	700	MCL and NR140
Benzo(a)pyrene	ND-80	0.2	MCL and NR140
Benzo(b)fluranthene	ND-45	0.2	NR140
Chrysene	ND-59	0.2	NR140
Naphthalene	ND-3,200	100	NR140

Notes: µg/L-micrograms per liter ND-Non-Detect MCL-Maximum Contaminant Level

E.3.g. Geochemical Results

Groundwater samples were evaluated for the geochemical parameters to determine whether conditions in the aquifers are favorable for natural attenuation of the COCs. Samples concluded that natural attenuation processes are occurring as supported by a reducing environment with anaerobic degradation occurring through methanogenesis within the groundwater contaminant plume.

Deeper, bedrock groundwater has not indicated exceedances of COCs.

E.4. Conceptual Site Model

A conceptual site model (CSM) was developed for WPSC Marinette MGP Site based on Site characteristics and results from the RI investigations. The CSM tells the story of how and where the PAH contamination moved and what impacts such movement may have had upon human health and the environment (Figure 4 and 5).

As described in the CSM, NAPL and PAHs are the primary contaminants of concern (COCs). Site data shows that exposure to PAHs will drive risks at the Site, and that the management of risks due to PAH exposure will also address risks associated with other non-PAH constituents.

The media of concern at the Site are soil and groundwater. PAH-contaminated soil and groundwater both can lead to PAH exposure to future Site workers. The targeted remediation areas at the Site are soil and groundwater exceeding human health risk criteria.

F. Current and Potential Future Site and Resource Uses

F.1. Current and Potential Future Land Uses

The land around the former MGP facility has been zoned for residential, commercial/industrial (including communications/utilities and governmental/institutional), and park district uses. According to the Marinette City Assessor's Public Assess website for Marinette, the former MGP facility is zoned as communications/utilities use. Most of the land surrounding the former MGP facility is zoned as heavy manufacturing or business district. Residential zoning can be found to the east/northeast across the street from the WWTP on the corner of Mann Street and Ludington Street. Additional residential zoning is located approximately a block away to the south and southeast along Main Street.

This zoning information was obtained through the Bay Lakes Regional Planning Commission GIS website and the August 3, 2009 city of Marinette zoning map.

F.2. Current and Potential Future Groundwater Uses

The groundwater below the Site is classified as a drinking water aquifer but is not currently in use as a drinking water source. The City provides potable water to the surrounding area from Lake Michigan. The use of groundwater as a future potential drinking water source is highly unlikely, and its use will be restricted as part of the selected remedy until RAOs are achieved.

G. Summary of Site Risks

The following section establishes the basis for taking action at the WPSC Marinette MGP Site and briefly summarizes the relevant portions of the Human Health Risk Assessment (HHRA) and Baseline Ecological Risk Assessment (BERA), both found as appendices in the 2013 RI Report.

G.1. Summary of the Human Health Risk Assessment (HHRA)

The HHRA was prepared to assess human health risks the Site contaminants would pose if no cleanup actions were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The HHRA is included as an appendix of the RI Report.

A four -step process is used for assessing Site-related human health risks:

- **Hazard identification** uses the analytical data collected to identify the COCs at the Site for each medium based on such factors as toxicity, frequency of occurrence, fate and transport of the COCs into the environment, concentration, mobility, persistence, and bioaccumulation.
- **Exposure assessment** evaluates the different exposure pathways through which people might be exposed to contaminants based on media-specific contaminant concentrations, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed (e.g. dermal contact with contaminated soil or groundwater, etc.)
- **Toxicity assessment** determines the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).
- **Risk characterization** summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of Site-related cancer risks and noncancer hazards. The risk characterization also identifies contamination with concentrations that exceed acceptable levels, identified in the NCP and EPA guidance as an excess lifetime cancer risk greater than 10^{-6} to 10^{-4} (1 in 1,000,000 to 1 in 10,000) or a noncancer Hazard Index (HI) greater than 1. Contaminants at these concentrations are considered COCs and are typically those that will require remediation at a site. This section includes a discussion of the uncertainties associated with these risks.

G.1.a. Hazard Identification

The HHRA identified COCs present in soil, groundwater, soil vapor, and river sediment at the Site. The data used in the HHRA by medium are summarized below:

- **Soil:** Soil data were used to perform evaluations related to human health only because the lack of ecological habitat in the upland area made an evaluation of wildlife receptors unnecessary. Soil data were segregated into surface and subsurface soils. Soils collected within the top 2ft of soil are referred to as surface soils and soils collected below 2 ft bgs are referred to as subsurface soils.
- **Groundwater:** Groundwater data from 2012-2013 were included for evaluation in the risk assessment. The groundwater data from all wells were used collectively to evaluate groundwater quality at the Site.
- **Soil vapor:** Four rounds of soil vapor samples were collected in August 2012, May 2013, April 2014 and August 2014.
- **River sediment:** The sediment data collected during the RI were used to perform an ecological assessment. No sediment data were evaluated for the human health risk assessment because all areas of potential exposure have been remediated under the 2012 NTCRA. The RI sediment data were considered of sufficient quality for risk assessment.
- **Surface water:** Seven surface water samples were collected from the Menominee River prior to the NTCRA. Prior to the sediment Removal Action that occurred in the Menominee River, surface water samples were collected to evaluate if contaminated sediments were impacting the water quality. The surface water quality was not found to pose a health concern to either human or ecological receptors based on screening assessments performed on these data; further, the sediment Removal Action would have improved the current water quality.

G.1.b. Exposure Assessment

Consistent with EPA risk assessment guidance (EPA 1989, 1991), the HHRA serves as a baseline and assumes no remediation or institutional controls to mitigate or remove hazardous substance releases. Cancer risks and noncancer HIs were calculated based on estimates of reasonable maximum exposures (RME) to describe the magnitude and range of exposures that might be incurred by receptor groups under current and future conditions at the Site. The RME is defined as the highest exposure that is reasonably expected to occur at a site. Decisions are based on the RME, consistent with the NCP.

G.1.b.i. Conceptual Site Model

The CSM describes potential contaminant sources, transport mechanisms, potentially exposed populations, exposure pathways, and routes of exposure. The CSMs are presented as Figures 4 and 5 on pages 2-20 and 2-21.

G.1.b.ii. Identification of Potentially Exposed Populations

Populations were identified that could be exposed to contaminants through a variety of activities consistent with current and potential future uses of the Site. The HHRA evaluated potential exposures of human receptors to COCs in soil, groundwater, and soil gas. Risks and hazards were characterized on an exposure area-specific basis for residents and commercial/industrial workers based on current and reasonably anticipated future land use.

Risks for future industrial or commercial workers include:

- Incidental ingestion of soil (surface and subsurface).
- Dermal contact with soil (surface and subsurface) as a result of soil disturbance.

- Inhalation of vapors as a result of vapor intrusion from visual observations of MGP residuals and groundwater into commercial/industrial buildings on the Site.
- Ingestion of groundwater.
- Dermal contact with groundwater.

Risks for construction workers include:

- Incidental ingestion of soil (surface and total) and groundwater associated with excavation activities.
- Dermal contact with soil and groundwater associated with excavation activities.
- Inhalation of vapors and dust derived from soil and groundwater associated with excavation activities.

Risks for recreational visitors include:

- Incidental ingestion of surface soil.
- Dermal contact with surface soil

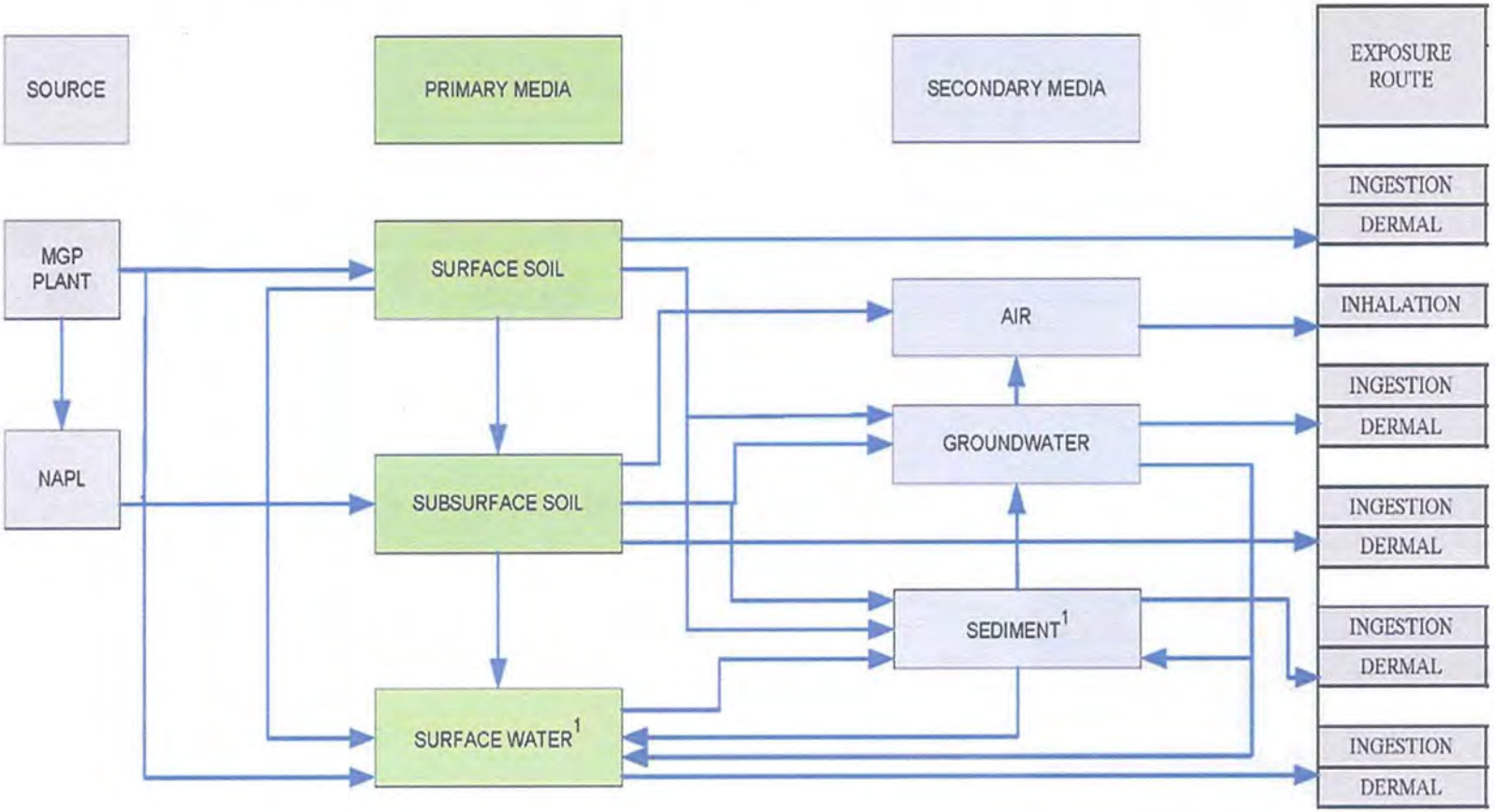
Risks for residents, under a hypothetical future land-use scenario, including the unlikely possibility of significant disturbance of subsurface soils, include:

- Incidental ingestion of soil (surface and subsurface)
- Dermal contact with soil (surface and subsurface) as a result of soil disturbance
- Inhalation of vapors and dust as a result of soil disturbance
- Inhalation of vapors as a result of vapor intrusion from subsurface soils and
- groundwater into a future residential building constructed on the Site
- Ingestion of groundwater
- Dermal contact with groundwater

G.1.c. Toxicity Assessment

The toxicity assessment determines whether exposure to COCs may result in adverse health effects in humans and the relationship between the magnitude of exposure (dose) and incidence and/or severity of adverse effects (response). For risk assessment purposes, chemicals are generally separated into categories based on whether a chemical exhibits carcinogenic or noncarcinogenic health effects. As appropriate, a chemical may be evaluated separately for both effects. Noncancer effects are evaluated using a reference dose (RfD), which is the dose below which adverse health effects are not expected. Carcinogenic effects are assessed using the cancer slope factor (SF), which is typically expressed in units of mg/kg-day. The SF represents an upper bound estimate on the increased cancer risk. SFs are generally accompanied by a weight of evidence descriptor, which expresses the confidence as to whether a specific chemical is known or suspected to cause cancer in humans.

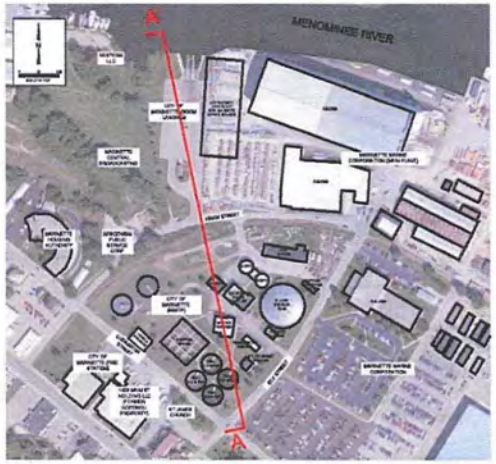
Figure 4. Conceptual Site Model Chart for the WPSC Marinette Former MGP Site

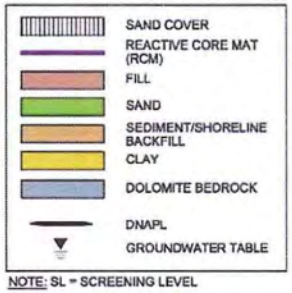


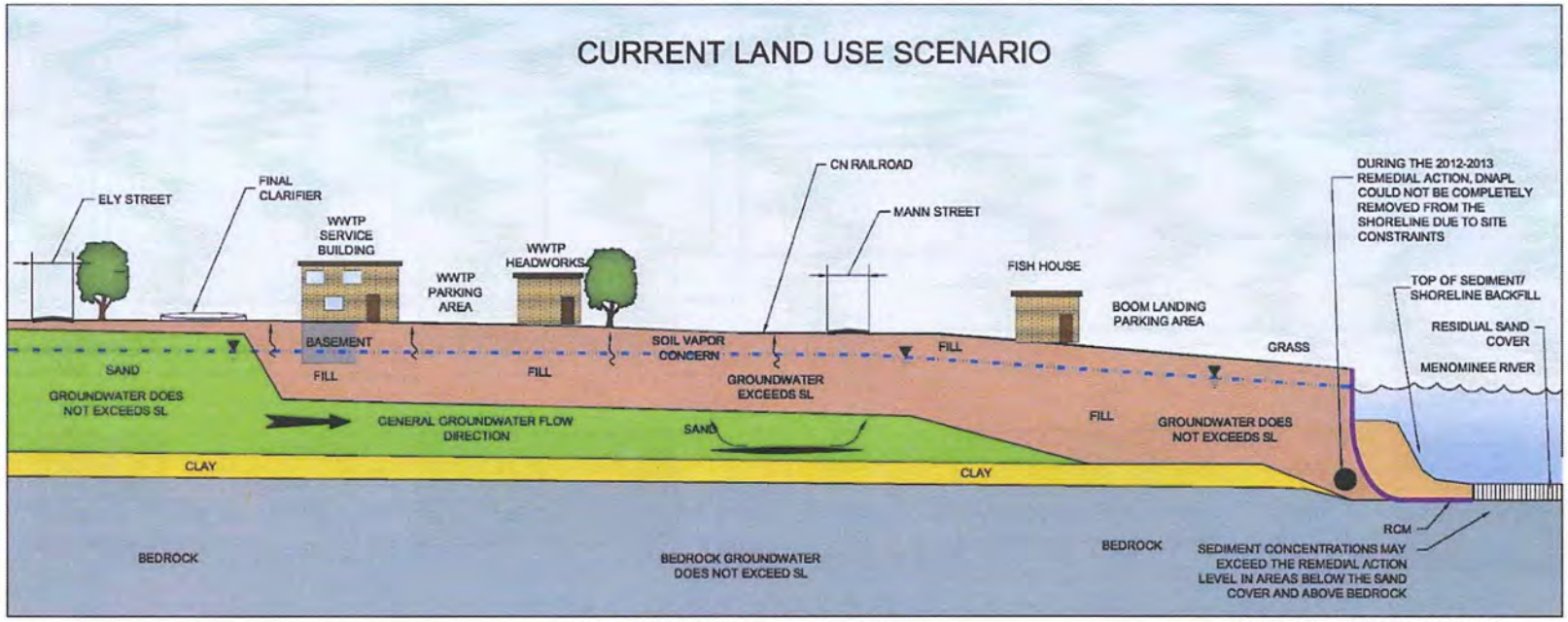
GENERAL NOTES:
This site-specific Conceptual Site Model was developed based on the Generalized Conceptual Site Model Revision 0 (August 5, 2007) and observations made during the July 17, 2009 site reconnaissance, and the results of the sediment remediation and remedial investigation.

[1] A qualitative exposure assessment found this pathway to be incomplete or insignificant under current and future scenarios. Refer to Section 2.3.4 Potential Exposure to Surface Water and Sediment of the BLRA for the details of this assessment.

Figure 5 Visual Conceptual Site Model







SECTION A-A'

GRAPHICAL REPRESENTATION WITH VERTICAL EXAGGERATION NOT TO SCALE

G.1.c.i.Cancer Assessment

Potential cancer effects are expressed as the probability that an individual will develop cancer over a lifetime based on the exposure assumptions described in Section G.1.b. The cancer SF is a plausible upper bound estimate of carcinogenic potency used to calculate cancer risk from exposure to carcinogens by relating estimates of lifetime average chemical intake to incremental probability of an individual developing cancer over a lifetime.

For carcinogenic compounds, risk is given as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen. Values are expressed as "excess lifetime cancer risk" (ELCR) because the risk would be in addition to the risk of developing cancer from other causes such as smoking or exposure to too much sun. ELCRs are often expressed in scientific notation (e.g., $1x10^{-6}$); an ELCR of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum chemical exposure estimate has an extra 1 in 1 million chance of developing cancer as a result of site-related exposure. The chance of an individual developing cancer from all other causes has been estimated to be as high as 1 in 3. EPA's target risk range for site-related exposures is $1x10^{-4}$ to $1x10^{-6}$ ELCR.

ELCR is calculated using the following equation: ELCR = CDI x SF

where: ELCR = a unitless probability (e.g., 2×10^{-5})
CDI = chronic daily chemical intake averaged over 70 years (mg/kg-day)
SF = cancer slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

A COC is considered to present a current and/or future potential unacceptable risk if the calculated ELCR is greater than EPA's target risk range.

G.1.c.ii. Noncancer Assessment

Noncancer health effects were evaluated using RfDs. A RfD is an estimate of a daily oral exposure for a given duration to the human population (including susceptible subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime. Chronic RfDs are specifically developed to be protective against long-term exposure to COCs.

For non-carcinogens, EPA calculates a hazard quotient (HQ) for each COC. The HQ is the ratio of the estimated exposure level to a chemical compound over a specified period of time to a RfD of the same substance that may cause deleterious health effects over the same exposure period. The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a HQ. An HQ>1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows: HQ = CDI/RfD

where: CDI = Chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, sub-chronic, or short-term).

G.1.d. Risk Characterization

Risk characterization integrates the information from the exposure assessment and toxicity assessment, using a combination of qualitative and quantitative information. Risk characterization involves estimating the magnitude of the potential adverse health effects associated with the COCs. It also involves making judgments about the nature of the human health threat to the defined receptor populations. The risk characterization combines the results of the dose-response (toxicity assessment) and exposure assessment to calculate cancer risks and noncancer health hazards. In accordance with EPA's guidelines, this assessment assumes that the effects of all contaminants are additive through a specific pathway within an exposure scenario.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk (ELCR, a unitless probability of an individual's developing cancer) is calculated by multiplying the chronic daily intake averaged over 70 years (mg/kg-day) and the SF (per mg/kg-day). These risks are probabilities that usually are expressed in scientific notation (e.g.1 x 10^{-6}). An excess lifetime cancer risk of 1 x 10^{-6} indicates a probability that the RME individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other exposures. The upper-bound excess lifetime cancer risks derived in this assessment are compared to the risk range of 10^{-4} to 10^{-6} established in the NCP.

EPA's goal of protection for cancer risk is 10^{-6}, and risks greater than 10^{-4} typically will require remedial action. The potential for noncancer health effects is estimated by comparing the average daily dose of a chemical for adult, adolescent, and child with the RfD for the specific route of exposure (e.g., oral). The ratio of the intake (average daily dose, or ADD) to reference dose (ADD/RfD) for an individual chemical is the HQ. When an RfD is available for the chemical, these ratios are calculated for each chemical that elicits a noncancer health effect. Typically, chemical-specific HQs are summed to calculate an HI value for each exposure pathway. EPA's goal of protection for noncancer health effects is an HI equal to 1. When the HI exceeds 1, there may be a concern for health effects. This approach can result in a situation where HI values exceed 1 even though no chemical-specific HQs exceed 1 (i.e., adverse systemic health effects would be expected to occur only if the receptor were exposed to several contaminants simultaneously). In this case, chemicals are segregated by similar effect on a target organ, and a separate HI value for each effect/target organ is calculated. If any of the separate HI values exceed 1, adverse, noncancer health effects are possible. It is important to note, however, that an HI exceeding 1 does not predict a specific disease.

G.2. Conclusions from the HHRA

The likelihood of any kind of cancer resulting from exposure to carcinogens at a Superfund site is generally expressed as an upper bound incremental probability, such as a "1 in 10,000 chance" (expressed as 1 x 10^{-4}). In other words, for every 10,000 people exposed to the site contaminants under reasonable maximum exposure conditions, one extra cancer may occur as a result of site-related exposure.

This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risk of cancer individuals face from other causes such as smoking or too much sun. The risk of cancer from other causes has been estimated to be as high as one in three. The potential for non-cancer health effects is evaluated by comparing an exposure level over a specified time period (such as a lifetime) with a "RfD" derived for a similar exposure period. A RfD represents a level that is not expected to cause any harmful effect. The ratio of exposure to toxicity is called a HQ. An HQ < 1 indicates that the dose from an individual contaminant is less than the RfD, so non-cancer health effects are unlikely. The HI is generated by adding the HQs for all COCs that affect the same target organ (such as the liver). An HI < 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, non-cancer health effects from all contaminants are unlikely. An HI > 1 indicates that site-related exposures may present a risk to human health. EPA's acceptable risk range is defined as a cancer risk range of 1×10^{-6} to 1×10^{-4} and an HI < 1. Generally, remedial action at a site is warranted if cancer risks exceed 1×10^{-4} and/or if non-cancer hazards exceed an HI of 1.

The HHRA for the Site presented estimated cancer risks and non-cancer hazards for residential and recreational receptors exposed to surface and subsurface soils, groundwater and soil vapor, and sediments. Sediment risks were addressed through the 2012 NTCRA and detailed risk analysis can be found in the 2013 NTCRA Completion Report.

Surface soils in Boom Landing and the WWTP and surrounding properties were associated with estimated cancer risks above the risk management range under a residential scenario, but within the risk management range for an industrial scenario. Under current conditions, recreational visitors would be unlikely to be exposed to surface soils in Boom Landing, because the unpaved area is small, and the soils in this area are covered with a manicured lawn. The presence of pavement, buildings, and manicured landscaping in the WWTP and surrounding properties also results in very low potential for exposure to chemicals in soil under present conditions. If some degree of surface soil exposure were assumed for a recreational user under current conditions, the exposure frequency for a recreational visitor would be expected to be at least an order of magnitude less than that of a hypothetical resident (i.e., less than 35 days/year rather than 350 days/year), which would correspond to cancer risk estimates within the risk management range. For a construction worker, risks are anticipated to be within the risk management range, given that estimated cancer risks for the industrial worker scenario were within the risk management range, and the potential level of chemical exposure is anticipated to be similar for these two potential receptors based on Site-specific conditions. No observations of MGP-residuals in the surface soils (i.e., less than 2 ft) were documented in the RI that would present a special condition for construction workers.

Subsurface soils in Boom Landing and the WWTP and surrounding properties do not currently pose a risk to human receptors, because they are not available for contact and buildings are not present near the subsurface soil contamination. However, estimated potential risks would be above the risk management range if future construction disturbed the soil sufficiently to allow exposure similar to either a residential or a generic industrial worker scenario. Considering the results for the industrial worker and residential scenario, there is a potential for risks to construction workers or recreational visitors above the risk management range as well.

Direct exposure to MGP residuals, which have been observed in the subsurface soils in this area, would also pose a potential risk above the risk management range.

Groundwater is not currently used as drinking water within the City of Marinette, and there are no known current users of groundwater for any other purpose in proximity to the Site. Based on the groundwater results, concentrations would not meet the legally enforceable standards for drinking water. There were numerous exceedances of the drinking-water standards and tap water regional screening levels, including benzene, ethylbenzene, xylenes, PAHs, iron, and manganese. Although the groundwater is not used as the drinking water source, the NCP's expectation is that groundwater will be restored to beneficial use. The groundwater is classified by the State of Wisconsin as a Class II drinking water aquifer; therefore, the Site groundwater needs to be restored to the Safe Drinking Water Act maximum contaminant limits (MCLs) for all contaminants of concern.

If future construction in the area would result in workers having direct physical contact with groundwater or inhaling associated vapors in excavations at or below the water table, there would be some potential for exposure to the contaminated groundwater. However, contact with groundwater is likely to be infrequent, because of safety considerations when entering excavations with standing water that are unrelated to the potential presence of chemical contamination in that groundwater. In addition, groundwater would not be encountered until a minimum of 2 ft bgs near the Menominee River, with depths more commonly ranging from 4–10 ft bgs. Intrusive work occurring at depths less than this would not result in groundwater exposure. Based on results of the RI, groundwater in specific areas of the Site may be contaminated with MGP residuals (i.e., Boom Landing and focused areas within the WWTP). If MGP residuals were encountered in an excavation by a construction worker, exposure to the groundwater would represent risks above the risk management range, due to the potential for direct contact with the MGP residuals and the inhalation of chemical vapors formed due to the presence of the MGP residuals.

Soil vapor data were screened against Vapor Intrusion Screening Levels (VISLs) obtained using the EPA's vapor intrusion screening level calculator (U.S. EPA 2014b).

- For soil vapor samples taken beneath the Vehicle Storage building in the WWTP, the majority of results were non-detect, and all chemical concentrations were below the industrial worker VISLs, and thus associated with risks below the risk management range. All but one sample was also below residential VISLs, and the estimated risk for a hypothetical residential scenario for this one sample was at the low end of the risk management range.
- For soil vapor samples collected directly beneath the Service Building, all results were below industrial VISLs, and thus associated with risks below the risk management range. The estimated cancer risks for soil gas samples under a hypothetical residential scenario were within or below the risk management range. One sample had a noncancer hazard (2) above the risk management criterion. For exterior soil gas samples near the Service Building, estimated risks for either a hypothetical future industrial building or a residence were within the risk management range.

- For soil vapor samples collected in Boom Landing where inhabited buildings do not exist at present, estimated risks for either a hypothetical future industrial building or residence were estimated to be within the EPA's risk management range.
- For soil vapor samples collected in the WWTP area in areas where no buildings currently are present, estimated risks for either a hypothetical future industrial building or residence were within the risk management range except for a single location (SG05). Considering, collectively, the results of the soil vapor sampling that was performed on-site, if construction workers performed maintenance or redevelopment activities involving excavations, the air quality in the excavation would not be expected to pose a health concern due to chemical concentrations in air. Based on the low concentrations of COCs in soil vapors other than in an isolated location in the WWTP area, the concentrations of chemicals in air inside an excavation would be expected to be low as well, considering the amount of dilution that would occur when soil vapors are mixed with ambient air, as long as MGP residuals are not encountered. As pointed out earlier in this report, if MGP residuals are encountered in excavations, soil vapor concentrations would potentially result in risks above the risk management range.

The following conclusions were made in the HHRA, and the summary of human health risks by medium and area can be found below in Table 3.

- Soils: Surface soils in Boom Landing and WWTP zones were estimated to be associated with risks within the risk management range for an industrial worker, a construction worker, or for the limited exposure of a recreational visitor. Estimated risks would be above the risk management range under a hypothetical future residential scenario. Subsurface soils do not currently pose a risk to human receptors because they are not available for contact; however, under the assumption of potential future exposure to these soils, estimated risks are above the risk management range for all receptors.
- Groundwater: Although the groundwater at the Site is not a drinking water source due to exceedances of the drinking water standards, it is deemed a Class II drinking water aquifer and must be cleaned up to Safe Drinking Water Act standards. If future construction in the area would result in workers having direct physical contact with groundwater or associated vapors in excavations at or below the water table, there would be potential risks above the risk management range due to the presence of MGP residuals.
- Soil vapor: For soil vapor samples collected in Boom Landing and the WWTP zones where no buildings currently are present, estimated risks for either a hypothetical future industrial building or residence were within the risk management range except for a single location within the WWTP zone.
- Sediment: The human health risks associated with exposure to contaminated sediments was addressed during the 2012 NTCRA.
- Surface Water: No human-health risks associated with surface water.

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances and pollutants or contaminants into the environment.

Table 3. Summary of Human Health Risks by Medium and Area

Surface Soil (0-2 ft)	Residential	Industrial
Boom Landing	Cancer risks above risk management range with any statistic used (2E-4 using mean, and 4E-4 with max), driven by BaP, with no noncarcinogenic chemicals screening in.	Cancer risks within risk management range with any statistic used (9E-6 using mean, and 2E-5 with max), driven by BaP, with no noncarcinogenic chemicals screening in.
WWTP	Cancer risks above risk management range with any statistic used (2E-4 using mean, and 6E-4 with max), driven by BaP, with noncancer hazards below the criterion.	Cancer risks within risk management range with any statistic used (1E-5 using mean, and 3E-5 with max), driven by BaP, with noncancer hazards below the criterion.
Subsurface Soil (2-16 ft)	**Residential**	**Industrial**
Boom Landing	Cancer risks above risk management range with any statistic used (2E-3 using mean, and 1E-2 with max), driven by BaP, with noncarcinogenic hazards above risk management criterion (2 using mean and 8 using maximum, driven by naphthalene).	Cancer risks near to or above risk management range (1E-4 using mean, and 7E-4 using max) driven by BaP, with noncarcinogenic hazards at the risk management criterion for the maximum (1, driven by naphthalene) but below the risk management criterion for the mean.
WWTP	Cancer risks above risk management range with any statistic used (5E-3 using mean, and 3E-2 with max), driven by BaP, with noncarcinogenic hazards at or above risk management criterion (1 using mean and 15 using maximum, driven by naphthalene).	Cancer risks above risk management range with any statistic used (2E-4 using mean, and 2E-3 with max), driven by BaP, with noncarcinogenic hazards above risk management criterion for the maximum (3, driven by naphthalene), but below the criterion for the mean.
Groundwater	**Residential**	**Industrial**
All Wells	Multiple exceedances of drinking water standards.	Multiple exceedances of drinking water standards. Direct contact with groundwater in excavations has the potential for risks above the risk management range due to the presence of MGP residuals in some wells.

Soil Vapor Sub-surface Samples	Residential	Industrial
Boom Landing	Cancer risks within risk management range (max 6E-5), with risks driven by benzene and naphthalene, and noncancer hazards at cutoff (1), driven by naphthalene.	Cancer risks within risk management range (max 1E-5), with risks driven by benzene, and noncancer hazards below the criterion.
WWTP Service Building	All risks within or below the risk management range.	All risks within or below the risk management range.
Headworks Building	All risks within or below the risk management range.	No COCs identified.
Other Exterior	One location (SG05, 6.5–7 ft) is associated with cancer risks (up to 8E-3, driven by benzene) and noncancer hazards (up to 200, driven by naphthalene) above risk management range, but all other samples are within or below risk management range.	One location (SG05, 6.5–7 ft) is associated with cancer risks (up to 2E-3, driven by benzene) and noncancer hazards (up to 40, driven by naphthalene) above risk management range, but all other samples are within or below risk management range.
Soil Vapor Sub-slab Samples	**Residential**	**Industrial**
Boom Landing	No inhabited buildings present.	No inhabited buildings present.
WWTP Vehicle Building	All risks within or below the risk management range.	No COCs identified.
Service Building	All cancer risks were within or below the risk management range. One sample had a concentration of 1,2,4-trimethylbenzene associated with a noncancer hazard above the cutoff (2).	No COCs identified.
Sediments—Wadeable areas have been remediated.		
Surface Water—After removal action, no MGP-related impacts to the river are expected.		

NOTES: Yellow highlighting indicates that a cancer risk is at or above 1×10–4 or a noncancer hazard index is above 1.
The risk management range for cancer risks is 1×10–6 to 1×10–4. The risk management criterion for noncancer hazards is 1.
BaP – benzo[a]pyrene COC – Contaminant of Concern
See Appendix C for further information

G.3. Summary of the Baseline Ecological Risk Assessment (BERA)

As part of the RI, NRT prepared a BERA that identified terrestrial and aquatic receptors and exposure pathways.

The BERA was conducted to evaluate potential adverse effects aquatic ecological receptors associated with PAH exposures in surface water and sediment of the Menominee River. The ecological screening evaluation of the Menominee River sediments collected during the RI showed that total PAH concentrations were elevated above the generic screening level benchmark or probable effects cause (PEC) of 22.8 mg/kg.

The PEC was used as a conservative screening tool. There were also isolated exceedances of metals above their PEC, but these exceedances did not appear to be related to the former MGP operations as they were, for the most part, in different locations than the total PAH exceedances. There was a focused area of sediment contamination near the boat ramp and the marina that was above the generic total PAH PEC. During the RI, sediment samples were also collected to perform Site-specific toxicity testing to develop total PAH concentration limits using testing methods and statistical evaluations similar to those performed at other WPSC Sites (i.e., Campmarina, Manitowoc) that would be protective of ecological receptors.

Prior to completion of the RI, WPSC decided to perform a non-time critical removal action of MGP-affected sediments and near-shore NAPL. The decision was made to use the total PAH PEC as the remedial action level to define the area of sediments to be removed. The remediation successfully removed most sediments with concentrations above the remedial action level.

Sediments with total PAH concentrations above the remedial action level remained at three isolated locations outside of the footprint of the remediation. Two of these locations had concentration only slightly above the remedial action level and the third had an anomalously high concentration of total PAHs, as indicated by the confirmation sample that had a total PAH concentration below the remedial action level. Site-specific sediment toxicity testing, described below, yielded a total PAH concentration limit that would be protective of sensitive ecological receptors, which was higher than the conservative remedial action level of 22.8 mg/kg that was used to guide the limits of the sediment remediation. Because the Site-specific sediment toxicity testing was not used to refine the total PAH concentration limit for guiding the remediation, a larger area of sediments was removed than would have been required if the sediment toxicity results had been considered.

The results of the Site-specific sediment toxicity testing showed that the lowest concentration of total PAHs that resulted in a statistically significant decrease in survival of the test organism (the amphipod Hyalella azteca) was 61 mg/kg, which is well above the remedial action level of 22.8 mg/kg. Based on further statistical analyses, this concentration limit was selected as the upper limit of the no significant risk zone. With the exception of the anomalously high sediment sample, the total PAH sediment concentrations remaining in the river after the remediation are all below this concentration limit of 61 mg/kg. Thus, the sediments remaining in the Menominee River do not pose a risk to sensitive aquatic ecological receptors (e.g., benthic invertebrates).

Some areas of the river where pockets of sediment within the undulating bedrock surface contained total PAHs above the remedial action level of 22.8 mg/kg that could not be completely removed were covered with a minimum of ten inches of sand to manage dredge residuals. Total PAH concentrations in and just below the sand have been sampled as part of a post-remediation monitoring program. Based on the results of four rounds of post-remediation monitoring sampling, the concentrations of total PAHs in the surface sand cover material are below the remedial action level and do not pose a risk to sensitive ecological receptors, such as benthic invertebrates. Sand cover sampling will resume to inform the five-year review.

Evaluation of the ecological risks at the Site concluded that the upland area does not support habitat for ecological receptors due to the developed nature of the Site, consistent with the commercial/industrial zoning of the land. The BERA also concluded that for aquatic environment, including sediment and surface water COC concentrations in the Menominee River, risks exceeded ecological benchmarks, and required a NTCRA to address risks. The NTCRA remediated those risks.

G.4. Basis for Taking Action

Under current conditions, the Site does not appear to pose health concerns to human receptors based on potential exposures to contaminated soil, surface water, or sediment. However, under hypothetical future uses, exposure to groundwater and subsurface soil present unacceptable risks.

It is EPA's current judgment that the selected remedy identified in this ROD is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

H. Remedial Action Objectives

Remedial action objectives (RAOs) provide a general description of what the cleanup will accomplish, and typically serve as the design basis for the remedial alternatives which will be presented below. RAOs for the Site were developed based on COCs, pathways, receptors, and an acceptable constituent level (risk-based concentrations, PRG, chemical-specific ARAR, or to-be-considered criteria) for each medium assuming future residential use of the Site. RAOs provide the basis to evaluate the remedial alternatives, and the following address current and reasonably anticipated future land use:

- **Soil/Soil Vapor:**
  - **RAO-1:** Prevent human exposure, including dermal contact and incidental ingestion of particulates and vapor to NAPL-saturated soil and subsurface soil containing MGP-related contaminants greater than PRGs.
- **Groundwater:**
  - **RAO-2:** Prevent human exposure including dermal contact, ingestion, and inhalation (as a result of vapor intrusion) of groundwater containing MGP residuals exceeding the PRGs.
  - **RAO-3:** Restore groundwater to PRGs for MGP-related contaminants within a reasonable timeframe.
  - **RAO-4:** Minimize, to the extent practicable, the potential for migration of groundwater with MGP-related constituents above the PRGs to surface water.
- **Sediment**
  - **RAO-5:** Demonstrate the RCM remains effective at preventing NAPL from migrating into the Menominee River and that at least six inches of clean sand remains over areas with remaining MGP-residuals.
  - **NTCRA RAO:** Remove NAPL and PAH-contaminated sediment that have the potential to affect human health and ecological receptors. Was satisfied to the extent practicable as part of the NTCRA activities.

H.1. Remediation Goals

Preliminary Remediation Goals (PRGs) are risk-based or ARAR-based chemical-specific concentrations that help further define the RAOs. PRGs are considered "preliminary" remediation goals until a remedy is selected in a ROD. The ROD establishes the final remedial goals and/or cleanup levels. Remediation Goals are also used to define the extent of contaminated media requiring remedial action, and are the targets for the analysis and selection of long-term remedial goals.

The HHRA developed a series of risk-based concentrations (RBCs) for total PAHs intended to be protective of future workers. The RBCs are calculated, chemical-specific concentrations below which no significant health effects are anticipated for a receptor. For human receptors, the site RBCs correspond to a target risk for carcinogenic effects of 1×10^{-6} and a target HI of 1 for non-carcinogenic effects. For ecological receptors, RBCs correspond to a target HQ of 1. RBCs for ecological receptors represent a risk range based on "No Observed Adverse Effects Level" and "Lowest Observed Adverse Effects Level" risk estimates for each receptor group.

The proposed Remediation Goals (RGs) for soil are generally based on EPA default exposure parameters and factors representing reasonable maximum exposure conditions for long-term/chronic exposures for cancer risk of 10^{-6} with a corresponding hazard quotient of 1 under a hypothetical residential and industrial exposure scenario. Remediation to residential RGs will result in unrestricted use and unrestricted exposures. Remediation to industrial RGs will be protective, if there are corresponding controls to prevent residential land use, unless additional remedial action is undertaken. As specified by Wisconsin DNR's Update to RR-890 and RCL Spreadsheet (Wisconsin DNR, June 2014), certain EPA default exposure parameters were modified to match current Wisconsin DNR requirements.

During implementation of a remedy, flexibility will be provided to modify the RGs by conducting a post-remedy risk assessment following the risk assessment framework as negotiated in the 2006 Order on Consent. If the post-remedy risk assessment concludes cumulative site risk is below the target cancer risk and noncancerous hazard index for the targeted exposure scenario, then no additional remedial action will be required.

Groundwater Remediation Goals

EPA Tap-Water regional screening levels are a screening tool and are not appropriate or enforceable cleanup levels. Therefore, the selected groundwater RGs will be based on enforceable federal or state groundwater standards. For groundwater at the site, the RGs will be the more conservative of Wisconsin NR 140 Groundwater Enforcement Standard (NR 140) or the National Primary Drinking Water Regulations Maximum Contaminant Level as presented in the Multi-Site Risk Assessment Framework Addendum Revision 3 (Exponent, July 2014, found in the AR).

I. Description of Alternatives

Three alternatives were developed and evaluated for addressing the current and potential risks to human health or the environment. Detailed information about the remedial alternatives are provided in the FS Report (NRT 2017).

CERCLA mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants at a Site. CERCLA § 121(d), 42 U.S.C. § 9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA § 121(d)(4), 42 U.S.C. § 9621(d)(4).

Alternative 1 – No Further Action
The "No Further Action" alternative is required under CERCLA, and it serves as a baseline comparison with other alternatives. This alternative entails no remedial action at the Site and does not include remediation or monitoring to minimize potential exposures to media and associated COCs present at the Site. $50,000 in costs were assumed for this alternative for the Five-Year Review process.

Capital Costs:	$0
Periodic Costs:	$50,000
Present Value:	$50,000
Construction Duration:	0 years

Alternative 2 – Excavation and Off-site Disposal at Boom Landing Zone; Horizontal Engineered Barriers at Boom Landing and WWTP Zones; In-situ Treatment of Groundwater, Sediment Monitoring; and ICs

Alternative 2 will consist of excavation and off-site disposal of accessible source material located within the Boom Landing Zone, installation of horizontal engineered barriers over surficial soil that exceeds PRGs, in-situ treatment of affected groundwater, effectiveness monitoring of the existing RCM and residual sand cover and implementation of institutional controls to manage remaining potential soil, groundwater, soil gas, and sediment risks.

Capital Costs:	$6,040,000
Periodic Costs:	$830,000
Present Value:	$6,870,000
Construction Duration:	three to six months

Source material was identified between 6-11 ft bgs over 1 acre and between 6-17 ft bgs over approximately 0.4 acres.

<u>Presumptive major elements of source material excavation include:</u>

- Completing pre-design investigations to further define horizontal and vertical extent of excavation and provide waste characterization sampling.
- Obtain access agreements for the Boom Landing Zone and demolition/removal of the parking lot, fish house, utilities and existing concrete and asphalt pavements.
- Install temporary shoring, as necessary, to support deeper excavations.

- Install temporary dewatering system to lower the water table within the excavation footprint.
- Excavating non-affected overburden soil and stockpiling on-site for use as post-excavation backfill.
- Excavating MGP-source material and transporting to a Subtitle D landfill.
- Backfilling excavation to surrounding grades with granular backfill and stockpiled overburden material
- Restoring the Site to previous conditions.

Presumptive major elements of the horizontal engineered surface barrier at Boom Landing and WWTP zones:

- Pre-design activities including investigations and obtaining access agreements.
- Monitoring and maintaining existing surface barriers that currently mitigate potential exposure to surficial soil containing COCs above commercial PRGs.
- Install barriers in locations not currently limited by existing barriers:
    - Excavate top two feet of affected soil, backfill excavation with 18 inches of clean fill and 6 inches of either clean topsoil, gravel, or asphalt.

A total of 242,000 ft^2 of barriers will exist on-site after implementation of the remedy. Currently, there are 131,000 ft^2 of existing barrier to maintain and 111,000 ft^2 of barriers would be installed.

Presumptive major elements of in-situ groundwater treatment:

- Performing a pre-design investigation to further define horizontal and vertical extent of affected groundwater and collecting samples for bench-scale testing.
- Performing bench-scale testing of Site soils and groundwater with varying types and percentages of reagents to determine the most effective oxidant to address COCs in groundwater and overcome the natural soil oxidant demand.
- One-time placement of oxidant into the exposed saturated zone resulting from excavation of Boom Landing Zone source area. It is estimated that the approximately 12 pounds of oxidant per square yard of excavation bottom will be required, resulting in an estimated 25,000 pounds of oxidant in the Boom Landing Zone.
- Installation of permanent injection wells using direct push technology in the WWTP Zone. Injection wells are anticipated to be constructed using Schedule 80 chlorinated polyvinyl chloride and will be installed in a transect pattern within the delineated benzene and naphthalene plume. This will result in approximately 50 injection points. Due to the relatively low concentration of benzo(a)pyrene in recent groundwater sampling events (plume centerline well average of 3.2 µ/L compared to the PRG of 0.2 µ/L), injections are not warranted and natural attenuation processes will be relied upon to achieve PRGs.
- Installation of permanent vapor extraction wells using direct-push technology. Approximately 15 vapor extraction wells are anticipated to be constructed using Schedule 80 chlorinated polyvinyl chloride throughout the treatment area.
- Injection of catalyzed hydrogen peroxide solution, matching the target concentration determined during the bench scale task. For FS-level cost estimating purposes, it is estimated that approximately 400,000 pounds of 34% hydrogen peroxide solution will be required to fully remediate the groundwater plume over an estimated two injections events.

Injection events will be spaced at approximately 2 years to allow for completion of quarterly groundwater sampling to highlight areas where addition oxidant injection is required.
- Frequent monitoring of subsurface soil, groundwater, and vapor to assess oxidant performance and provide information to guide modifications to injection procedures.
- Injection well abandonment and restoration of Site to surrounding grades.

It is anticipated that injection and monitoring activities will continue for approximately five years to reduce COCs to the selected PRGs.

Presumptive major elements of sediment monitoring:
- Maintaining the 19,500 ft^2 of RCM and perform sheen monitoring to evaluate function
- Monitor the 160CY of dredge inventory that remained after the NTCRA to ensure at least six inches of clean sand remain over those areas with MGP-residuals remaining, and that the 0-6-inch zone remains below RALs.

Presumptive major elements of Institutional Controls (ICs):
- Delineate MGP-COCs on affected parcels to residential PRGs.
- Use Wisconsin DNR's Geographic Information System (GIS) Registry to implement ICs.
- Apply alternate continuing obligation mechanisms including deed restrictions.

Approximately 15 acres will be subject to restrictions including:
- 1.2 acres owned by Canadian National Railroad-railroad
- 3.8 acres owned by City of Marinette-Boom Landing
- 1.0 acres owned by City of Marinette-Rights-of-Way
- 0.5 acres owned by WPSC-storage
- 8.6 acres owned by City of Marinette-WWTP-waste water treatment and public works

ICs will place the following restrictions for:
- **Soil**-Any subsurface activity must be conducted in accordance with a Soil Management Plan, and in some instances a Maintenance Plan, to ensure proper management of subsurface soil disturbed through future Site development, utility repairs, and other intrusive activities.
- **Soil Gas/Vapor Intrusion**- Vapor intrusion risks must be reassessed should any of the following conditions be satisfied:
    - Modification of land use;
    - Construction of a new buildings
    - Modification to existing buildings that may negatively affect the vapor intrusion pathway.
- **Groundwater**-Construction of potable water wells and consumption of groundwater will be prohibited.
- **Sediment**-Notification of residual sediment above RALs located under the residual sand cover. Further, removal of RCM and overlaying riprap must be completed in accordance with a Sediment Management Plan, and potentially a Maintenance Plan.

Alternative 3 – Excavation and Off-site Disposal at Boom Landing and WWTP Zones; Horizontal Engineered Barriers at Boom Landing and WWTP Zones; In-situ Treatment of Groundwater, Sediment Monitoring; and ICs.

Capital Costs:	$6,180,000
Periodic Costs:	$1,450,000
Present Value:	$7,630,000
Construction Duration:	three to six months

Alternative 3 consists of the same presumptive elements as Alternative 2 with the addition of excavation and disposal of accessible source material at the WWTP zone and the in-situ groundwater treatment will involve a one-time placement of a reagent within the excavation, with no permanent injection wells installed or used. Source material was identified between 5.5-9 ft bgs over 02. acres and between 8-15.5 ft bgs over approximately 0.6 acres.

The PRP, WPSC, will undertake the same major presumptive elements necessitated in the other soil excavation activities under Alternative 2 with the exception of installing injection wells in the WWTP zone.

J. Comparative Analysis of Alternatives

EPA uses nine criteria to evaluate remedial alternatives for the cleanup of a site. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met for an alternative to be eligible for selection. The threshold criteria are overall protection of human health and the environment and compliance with ARARs.

- Overall Protection of Human Health and the Environment - This criterion describes how the alternative as a whole achieves and maintains protection of human health and the environment.
- Compliance with ARARs - This criterion assesses how the alternative complies with ARARs unless a waiver is provided, in which case this criterion describes why the waiver is justified.

The balancing criteria are used to weigh major tradeoffs among alternatives. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost.

- Long-Term Effectiveness and Permanence - This criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after RAOs have been achieved.
- Reduction of Toxicity, Mobility, and Volume through Treatment - This criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ.
- Short-Term Effectiveness - This criterion assesses the effectiveness of the alternative in protecting human health and the environment during the construction and implementation of a remedy until RAOs have been met. This criterion also evaluates the time required to implement and achieve the RAOs.

- Implementability - This criterion assesses the technical and administrative feasibility of the alternative as well as the availability of goods and services required to implement the remedy.
- Cost - This criterion assesses the capital and O&M costs of each alternative. In addition, the present worth of annualized costs associated with each alternative is calculated using a discount rate of 7 percent before taxes and after inflation. Costs are compared on a present-worth basis. The level of detail in these cost estimates is appropriate for evaluating among alternatives, but the estimates are not intended for use in budgetary planning.

The modifying criteria are state acceptance and community acceptance.

- State Acceptance – This criterion reflects comments from all Wisconsin agencies with an interest in the Site.
- Community Acceptance - This criterion reflects the community's apparent preferences and/or concerns regarding the alternatives.

The following is a comparative analysis of the remedial alternatives other than the No Further Action Alternative.

J.1. Overall Protectiveness of Human Health and the Environment

Alternative 1 is not protective of human health and the environment because no further action would be taken to reduce the presence of MGP source material and MGP-affected media. Further, this alternative will not implement institutional controls, monitoring programs, or contingencies to ensure that human health and the environment will be protected.

Alternatives 2 and 3 would be protective of human health with respect to potential risks from soil, groundwater, soil gas and sediment. Both alternatives will remove accessible MGP source material from Boom Landing, and Alternative 3 will remove source material from the WWTP area. Direct contact, ingestion and inhalation of soil with COCs above the PRGs will be prevented through maintenance of existing pavement and building slabs, installation of soil barriers, and implementation of soil institutional controls with an associated Soil Management Plan. Both alternatives will also address the groundwater plume through *in-situ* treatment and controls to prevent use of Site groundwater within a defined zone. Potential future soil gas and potential vapor intrusion risks will be controlled through requirements to complete additional assessment should land use change. Finally, both Alternatives 2 and 3 will implement controls to restrict the removal of the RCM, regular sheen monitoring, and the combination of restrictions and monitoring of sediments.

J.2. Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as ARARs, unless ARARs are waived under CERCLA section 121(d)(4). Compliance with ARARs addresses whether a remedy will meet all of the ARARs or provides a basis for invoking a waiver.

In addition to ARARs, EPA may identify other relevant information, criteria, or guidance to be considered (TBC). TBCs may not be legally binding or enforceable but may be useful for consideration when developing remedial alternatives. Both ARARs and TBCs may be chemical-specific, location-specific, or action-specific. Appendix B summarizes preliminary federal and state ARARs and TBCs. ARARs and TBCs may be modified until a Record of Decision (ROD) is issued and may be reexamined during the five-year review process.

The NCP defines applicable requirements as:

> "...those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

The NCP defines relevant and appropriate requirements as:

> "...those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws, that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate."

Alternative 1 would not meet ARARs related to soil, soil gas, and groundwater standards.

Alternatives 2 and 3 would meet all potential chemical, location, and action-specific. The ARARs would be met through:

- Maintenance and installation of direct contact barriers to prevent human exposure to affected soil and groundwater.
- Use of the Institutional Control Implementation Plan, Soil Management Plan, and Maintenance Plan to restrict modification to the direct contact barriers and to current land use.
- Application of active measures to reduce accessible source material through excavation and in-situ groundwater treatment.
- Placement of engineering controls to manage surficial soil exceedances.
- On-going monitoring of the RCM to provide long-term assurance that dissolved-phase MGP constituents in groundwater do not discharge into the Menominee River at concentrations greater than the site-specific discharge limit.
- Monitoring of the post-NTCRA dredge inventory to ensure that at least six inches of clean sand remains over areas with MGP-residuals, and that the 0-6" zone remains below RALs.

J.3. Long-Term Effectiveness and Permanence

Alternative 1 may not provide effective protection of human health and the environment over time. The COCs in soil and groundwater will not naturally attenuate, there will be no monitoring provided to determine if protective levels are reached, and no ICs are implemented to provide protection.

Alternatives 2 and 3 will provide long-term effectiveness and permanent control of potential human health risks from exposure to source material and soil with COCs above PRGs through removal of accessible source material; installation of horizontal direct-contact barriers in the Boom Landing Zone and at the WWTP Zone for Alternative 3, exclusively; restriction of land use and intrusive activities; and injection of on-site treatment reagents in combination with monitoring to restore groundwater to PRGs.

J.4. Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 1 does not include treatment. Source material, soil, and groundwater will naturally attenuate, but attenuation alone is unlikely to reduce concentrations below PRGs in a reasonable timeframe. In addition, risk resulting from toxicity is not reduced, as Alternative 1 does not involve any engineering or administrative controls. As a result, this alternative will not achieve any of the RAOs.

Alternatives 2 and 3 will involve excavation and off-site disposal of source area of Boom Landing, and Alternative 3 will involve excavation and off-site disposal of source material from the WWTP Zone, that reduces the volume of the most toxic material at the Site. Although off-site disposal does not constitute treatment under this criterion, relocation of affected soil from the Site to a permitted disposal facility will control risk from toxicity and reduce contaminant mobility. In addition, source material at Boom Landing is collocated with the well with the highest historical concentrations of benzene and naphthalene. Removal of source material will remove the primary on-going source contributing to the dissolved-phase groundwater plume, and thereby, reducing contaminant mobility.

After surface soil removal, direct contact barriers will be installed, which will reduce the volume of affected surficial soil that is on-site, and reduce the mobility of affected soil by minimizing the potential windward erosion of affected soil. Risk from toxicity will be mitigated through the installation of the horizontal barrier and requiring continuing obligations to ensure long-term risk mitigation. Active measures involving limited *in-situ* groundwater treatment and monitoring will be undertaken to restore the groundwater plume to PRGs.

J.5. Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and achieve RAOs; and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternative 1 would have no effect during remedy implementation.

Alternatives 2 and 3 will create a potential for direct contact exposure, fugitive volatile organic emissions, and nuisance odors during excavation. Transporting affected soil to a landfill creates a short-term impact on the community due to increased truck traffic, noise, and potential for increased accidents. With respect to excavation of Boom Landing source material, closure of this public space will be required. However, impact will be minimized by performing the excavation outside of the regular boating season, and completing the activities within three to six months.

For Alternative 3, excavation of surficial soil on the WWTP zone will temporarily impact the standard operations and maintenance of the WWTP and other City of Marinette activities (maintenance garage activities and construction material storage). Excavation and installation of soil barriers is expected to take three to six months, and will be conducted in phases to minimize surface area of open excavations and short-term impact to the City.

For Alternatives 2 and 3, the in-situ groundwater treatment component has the potential to generate fugitive emissions and release vapors to the atmosphere during injection activities. Construction workers and nearby building occupants may have the potential for exposure to airborne contaminants. The exposure will be controlled through best management practices, engineering controls, and adhering to task-specific health and safety procedures. In addition, the oxidant injections will temporarily modify the aquifer geochemistry, and elements that make up oxidants and catalysts will remain in the aquifer following the conclusion of treatment activities. During remedial implementation, it is necessary to monitor dissolve-phase inorganics at the downgradient extent of the plume so that injection activities can be suspended or modified to minimize the potential for off-site migration of byproducts resulting from oxidant injection activities.

Also, large quantities of reactive and concentrated chemical reagents will be required for in-situ treatment, which pose a risk to construction workers and surrounding parties during transportation, handling, storage, and treatment application. Several administrative and procedural requirements could be used to minimize risk, including shipping and storage, selection of highly experienced contractors to administer treatment, selection of slower-reacting and safer reagents, and engineering controls. Reagent injection activities will occur in three events over approximately five years until groundwater PRGs are met.

J.6. Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternative 1 would be implementable, though it does not address the Site risks.

Alternative 2 is partially technically and administratively implementable.

Alternative 3 is partially technically and administratively implementable.

For both Alternatives 2 and 3, there are numerous potential constraints to lateral expansion of the source material excavation. Several utilities are near the source material in Boom Landing, including sizable storm and sanitary discharge pipes along the western property line of Boom Landing. Mann Street and the associated utilities are present to the south. In addition, there is a recently-constructed building on Marinette Marine property, immediately east of the Boom Landing Property Line. WWTP Zone has several restrictions related to existing process units, subsurface utilities, and the Canadian Northern Railroad. The pre-design investigation will identify practical extents of source area removal; however, there are several constraints that may limit lateral expansion of excavation during construction. Even though the extent of excavations may be constrained, unexcavated residual material and dissolved-phase groundwater will be positively affected by the addition of a chemical oxidation reagent into the open excavation during backfill placement.

For Alternative 2, the installation of a horizontal barrier in the WWTP Zone, and for Alternative 3, the excavation in the WWTP Zone, is made complex due to the presence of WWTP infrastructure, labor intensiveness of operations, and disruptive nature of shallow soil excavation on the WWTP property. A modification to Alternative 3 will be made during the remedial design to limit shallow soil excavation and to focus on source removal at the deeper depths. Areas with industrial SL exceedances in the surface soil will be evaluated to see whether horizontal barriers can be placed,

For Alternative 3, another challenging component will be the construction of temporary shoring to the depth of excavation exceeding 10 feet bgs. A dewatering system will be required to reach the desired excavation depth, and dewatering support includes readily available mobile treatment processes followed by discharge to the local WWTP.

J.7. Cost

The estimated total costs for each alternative are FS-level cost estimates that have an expected accuracy of +50% to -30%. Costs for the alternatives range from zero to $7,630,000 as listed below.

Alternative 1 is expected to cost $50,000 for performing the Five-Year Review.

Alternative 2 is estimated to cost $6,870,000

Alternative 3 is estimated to cost $7,630,000.

Table 3: Cost of Alternatives

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Capital Costs	$0	$6.04M	$6.18M
Annual O&M Costs/LT Costs	$50K	$830K	$1.45M
Total Present Worth Costs	$50K	$6.87M	$7.63M
Construction/Implementation Timeframe	None	3 months	4 months
Time to Completion	N/A	5 years	10 years

*LT= Long-term (30-year analysis period) *M=Million dollars *K=Thousand dollars

The final cost estimate for the selected remedy will be developed and refined during the RD.

J.8. State Acceptance

Wisconsin DNR has indicated concurrence with the selection of Alternative 3. The state concurrence letter will be added to the AR upon receipt.

J.9. Community Acceptance

The community has not objected to the selected remedy, as evidenced by comments received during the public comment period, which ran from July 17 through August 16, 2017. Some commenters indicated support for the selected remedy, while others highlighted the challenges that may arise from the work at the WWTP (see Responsiveness Summary).

K. Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure.

The principal threat waste at the WPSC Marinette MGP Site is PAH- and NAPL- contaminated soil because the toxicity of the material poses a potential risk of 10^{-3} or greater and contributes to groundwater contamination, as defined in *A Guide to Principal Threat and Low Level Threat Wastes*, Office of Solid Waste and Emergency Response 9380.3-06FS, November 1991.

L. Selected Remedy

Based on consideration of the requirements of CERCLA, the detailed analysis of the remedial alternatives, and public comments, EPA has selected **Alternative 3**, with modifications (see J.2 Documentation of Significant Changes), as the Selected Remedy. The follow subsections provide EPA's rationale for the Selected Remedy and a description of its anticipated scope, how the remedy will be implemented, and its expected outcomes.

L.1. Summary of Rationale for the Selected Remedy

The Selected Remedy is protective of human health and the environment, complies with ARARs, and provides the best balance of tradeoffs among the balancing criteria, including addressing many of the community's concerns raised through public comments.

It reduces risks within a reasonable time frame, is practicable, and provides for long-term reliability of the remedy. It will achieve substantial risk reduction by excavating and capping areas with the most contaminated soils, reduce remaining risks to the extent practicable through in-situ groundwater treatment, and manage remaining risks to human health through institutional controls.

The Selected Remedy is more permanent in the long term because it addresses more contamination in all areas of the Site.

Although the Selected Remedy presents greater short-term impacts to the community and implementability challenges compared to Alternative 2, it achieves higher post-construction risk reduction for human receptors compared with current risks from contaminated media. The Selected Remedy ensures that the preference for treatment is achieved for all media.

L.2. Documentation of Significant Changes

Based on the comments received by the City of Marinette Water and Wastewater Commission, the City Mayor, and other City officials, as well as comments received by the PRP, and Wisconsin DNR, EPA made a modification to Alternative 3 that constitutes a significant change.

In lieu of excavating and replacing the top two feet of soil at the majority of the WWTP zone, EPA will consider utilizing horizontal engineered barriers and/or ICs for that area. The areas to be addressed through excavation, horizontal engineered barriers, and ICs will be defined during the Remedial Design phase. This significant change may alter the estimated cost of the remedy; however, the cost will probably remain in the -30% to +50% range. The other components of Alternative 3 as the selected remedy will remain the same and are described below.

L.3. Description of Selected Remedy

Alternative 3, now the Selected Remedy, includes excavation and off-site disposal of accessible source material located within the Boom Landing and WWTP zones, installation of horizontal engineered barriers over surficial soil that exceeds PRGs in the Boom Landing zone and in a portion of the WWTP zone, and institutional controls to manage remaining potential soil, groundwater, soil gas, and sediment risks.

L.4. Summary of Estimated Selected Remedy Costs

Total present value costs estimated for the Selected Remedy are $7,630,000. The total capital cost is $6,180,000 and the total periodic costs are $1,450,000. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the Selected Remedy. Major changes may be documented in the form of a memorandum in the Administrative Record file, an explanation of significant differences, or a ROD amendment. The cost estimate is an order-of magnitude engineering estimate that is expected to be within +50 to -30% of the actual project cost.

L.5. Expected Outcomes of Selected Remedy

The intent of the Selected Remedy is to be protective of human health and the environment by reducing risks from the following: direct contact with, and ingestion of, soil and groundwater. The Selected Remedy will actively address contaminated soil and groundwater within the Site, thereby reducing exposure to contaminant concentrations in those media, which will significantly reduce human health risks at the Site to acceptable levels.

M. Statutory Determinations

Under CERCLA §121 and the NCP §300.430(f)(5)(ii), the EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

M.1. Protection of Human Health and the Environment

Alternative 3 will protect human health and the environment by reducing the quantity of contamination through soil excavation and disposal, placement of horizontal soil barriers, and maintenance and construction of new soil barriers, and in-situ treatment and injection treatment of groundwater. Institutional controls will prevent disruption to soil barriers, prevent groundwater usage until PRGs are achieved, and prevent disruption to the sediment RCM.

M.2. Compliance with ARARs

The selected remedy will comply with all ARARs.

M.3. Cost-Effectiveness

Alternative 3 is cost effective because the remedy's costs are proportional to its overall effectiveness [see 40 Code of Federal Regulations (CFR) §300.430(f)(l)(ii)(D)]. This determination is made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment, and comply with all federal and state ARARs, or as appropriate, waive ARARs). Overall effectiveness is evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). The overall effectiveness of each alternative is then compared to each alternative's costs to determine cost effectiveness. The relationship of the overall effectiveness of the Selected Remedial Action was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

M.4. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that Alternative 3 represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Alternative 3 addresses Site risks while also considering the statutory preference for treatment as a principal element, bias against off-site treatment and disposal, and considering state and community acceptance.

Alternative 3 will reduce contaminants in the soil and groundwater at the Site. The Selected Remedy accomplishes this through excavation and disposal, placement of barriers, and groundwater treatment. Because no further contaminant source will exist, the remedy will be permanent.

M.5. Preference for Treatment as a Principal Element

By treating the contaminated soil and groundwater using in-situ chemical reduction and injection of reducing reagents, Alternative 3 satisfies the statutory preference for remedies that employ treatment as a principal element.

M.6. Five-Year Review Requirements

CERCLA §121(c) and the NCP §300.430(f)(5)(iii)(C) provide the statutory and legal bases for conducting Five-Year Reviews. Because this remedy is expected to take at least 5 years to achieve the RAOs, it will result in hazardous substances remaining on-site in the groundwater and possibly in the soils above levels that allow for unlimited use and unrestricted exposure. A statutory review will be conducted every 5 years after initiation of the remedial action until RAOs are achieved to ensure that the remedy is, or will be, protective of human health and the environment.

N. Documentation of Significant Changes

The Proposed Plan was released for public comment on July 17, 2017, identifying **Alternative 3,** as the Preferred Alternative for the Site. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined a significant change to the remedy, as originally identified in the Proposed Plan, was necessary or appropriate.

This significant change is minimizing the excavation area at the WWTP zone to preclude those areas where the top two feet of soil do not meet cleanup standards and where a horizontal barrier was proposed. Instead, those areas will have an IC placed on them to prevent exposure. The areas with source material on the WWTP zone will still be addressed and the remainder of the remedy will stay the same.

Part 3. Responsiveness Summary

In accordance with CERCLA Section 117, 42 U.S.C. Section 9617, EPA released the Proposed Plan and Administrative Record on July 17, 2017, and the public comment period ran through August 16, 2017, to allow interested parties to comment on the Proposed Plan.

EPA is not required to reprint the comments of the commenter verbatim and may paraphrase where appropriate. In this responsiveness summary, EPA has included large segments of the original comments. However, persons wishing to see the full text of the comment should refer to the commenter's submittal to EPA, which has been included in the Administrative Record. The comments EPA received are shown below in normal text and EPA's response is shown in italics.

A. Stakeholder Comments and Lead Agency Responses

EPA received several written and verbal public comments on the Proposed Plan. The comments are found below:

Comments in Support for the Remedy

Comment 1a: I feel the option that the EPA is suggesting is the proper way to solve the issue at hand.

Comment 1b: I think the best alternative is alternative #3 as it meets all criterion.

Response: Thank you for your support.

General Public Comments

Comment 2:

Question 1: Has vertical and lateral extent of contamination been identified?

Response: Although the Site has gone through thorough the remedial investigation and we have a lot of data on the vertical and horizontal extent of contamination, further delineation sampling will occur during the Remedial Design phase to refine the areas to be addressed.

Question 2: What is being done to mitigate sub-surface impacts?

Response: At present, contaminated soil and groundwater are in place in the former footprint of the manufactured gas plant and the former logrun/slough that served as the preferential pathway for conveyance of MGP contaminants to the Boom Landing zone. There are buildings, pavement, asphalt, and grass over the contaminated soil and groundwater that are acting as barriers to prevent exposure, contact, and ingestion of contaminants.

As part of the chosen remedy, where feasible, the contaminated soil will be excavated and disposed of in a landfill. While the excavation area is open, we will place a chemical reagent that will react, over time, with MGP-waste that is located in the soil and groundwater. Then a horizontal engineered barrier, will be placed in the excavated area, before clean fill and topsoil are added. In areas where pavement or asphalt are present, they will be replaced and/or maintained after the excavation is complete. Once MGP-contaminants are removed and barriers are in place, there will be no risk to exposure to contaminants. Over time, approximately five years, the reagents placed in the excavated pits will continue to neutralize the MGP-wastes in the subsurface soil and groundwater.

Health and Safety Comments

Comment 3a: Careful planning is necessary for the removal of contaminated material with safeguards to protect overall human health, as well as attention paid to compliance of State/Federal procedures and other long term requirements. I strongly recommend all safe guards to be adhered to in soil removal to protect the groundwater located near the water of the Menominee River.

Response: All safeguards to protect human health and the environment will be taken, and all applicable or relevant and appropriate State and Federal requirements will be applied.
As detailed in the FS Rev. 3 Report, and summarized here in this ROD, several general types of safeguards will be applied to this cleanup. These include dust suppression measures to prevent fugitive dust from migrating off-site and into the river; installing temporary shoring to support deeper excavations and prevent run-off; monitoring and maintaining existing surface barriers that currently mitigate potential exposure to surficial soil containing COCs above residential PRGs; and placing barriers in locations not currently limited by an existing barrier.

The highest-contaminated soils will be excavated and sent to a landfill, reagents placed in the excavated soil pits will address MGP-contaminants in deeper soil and in groundwater, and injection wells will be installed to inject chemicals to neutralize MGP-contamination in groundwater. All these efforts will reduce contaminants in soil and groundwater and prevent migration of contaminants back into the Menominee River.

Comment 3b: The City (of Marinette) Officials and Commission Members express concern regarding the potential structural and underground utilities risks associated with excavation within the WWTP, which could cause disruptions of service at the WWTP. They also are opposed to any injection of chemicals into the ground that could have an effect on underground utilities as well. Lastly, and most importantly, the proposed plan poses risks to employees as well as construction workers from all of the activities being done at the site.

Response: Prior to implementation of the remedy, WPS will conduct additional activities to inform the remedial design. During the Remedial Design Phase, WPS will use a utility locater contractor to delineate all sub-surface infrastructure at the WWTP Zone and at the Boom Landing Zone. In addition to the utility locator, WPS will collect addition samples to refine the areas that will be addressed. The project will be designed as such to prevent impacts to utilities and infrastructures. WPS will submit remedial design information for input (from EPA, DNR, The City, and respective property owners) before the design becomes finalized and implemented.

The remedy will be designed and implemented, as such, to minimize disruption of service at the WWTP and within the Boom Landing Zone, and to protect existing WWTP infrastructure. Restoration work following the remedial action will restore properties to an equal. EPA and WPS will work with the Commission and City officials to ensure the designed remedy meets the City's expectations and requirements in both cleanup zones.

EPA's mission and priority is to protect human health and the environment. The potential risks to human health for workers at the WWTP and construction workers in the WWTP zone was evaluated utilizing EPA's 9 Criteria prior to the selection of the remedy. The 9 Criteria are:

Threshold Criteria

1. Overall protection of human health and the environment
2. Compliance with ARARs (applicable or relevant and appropriate standards)

Primary Balancing Criteria

3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility or volume
5. Short-term effectiveness
6. Implementability
7. Cost

Modifying Criteria

8. State acceptance
9. Community acceptance

The most important criterion in evaluating a remedy is "overall protection of human health and the environment." *EPA considered the risks and benefits associated with each remedy presented in the FS and for the remedy that was selected. Considered were the risks to long-term workers in areas to be addressed (e.g. WWTP employees), short-term workers in areas that will be addressed (e.g. construction workers conducting the cleanup in the Boom Landing and WWTP Zones), community members that may be impacted by increased truck traffic, people that use Boom Landing for recreational purposes, and even property trespassers.*

There will be potential short-term risks associated with the selected remedy and there will be risk-mitigation to minimize those risks. Some of the risk-mitigation measures include developing and following a Health and Safety Plan *to minimize risks to all that may be potentially impacted by the cleanup; putting up barriers and clearly marking areas that are disturbed; limiting access to areas that are undergoing remedial action; etc.*

Comments from the Potentially Responsible Party

Comments from WPS are separated and paraphrased below:
General Comments:

Comment 4: "In general, WPS has significant concerns with USEPA's conclusion that invasive excavation, soil removal and oxidant injection activities are warranted on the City of Marinette wastewater treatment plant (WWTP) property in order to adequately protect human health and the environment. As noted in the approved Feasibility Study Report, Revision 3 (FS) and related correspondence, the significant short term risks to (1) ongoing plant operations, (2) the structural integrity of above ground structures, and (3) of damage to critical below ground infrastructure associated with such activity in no way justify the small reduction in hypothetical human health risk or threats to groundwater quality that might be achieved. USEPA's own assessment shows the human health risks represented by current baseline conditions for soils on the WWTP property fall well within the acceptable risk management range, particularly for a secure, limited access facility such as the WWTP for which the default "reasonable maximum" exposure assumptions inherent in the derivation of PRGs for soils under an "industrial" scenario do not apply. Finally, as documented in the approved FS, the use and implementation of institutional controls in the form of materials handling and cover maintenance plans will be fully adequate in attaining the health and environmental quality related remedial action objectives (RAO) for the WWTP property in a far more efficient and cost effective manner."

Response: EPA's selected remedy was informed by the Site RI and FS reports in conjunction with EPA Law and Guidance. Remedy implementation risks were reviewed and compared with the benefits of removing principal threat waste and the decreased amount of time in achieving groundwater cleanup standards. The risks listed above can be minimized with planning during the Remedial Design phase of the project.

Comments on Safety

Comment 5a: The USEPA-preferred alternative involves excavating a minimum 9-foot deep hole directly abutting the entire eastern side of the WWTP's Aeration Basin.

The load of the Aeration Basin will significantly complicate the excavation and necessitate design and construction of a very complicated and extensive shoring system. Installation of shoring near the Aeration Basin risks potential structural and foundational damage to this structure. Such potential for damage would be further exacerbated by the need for dewatering the excavation area to an elevation well below the design depth, thereby creating a cone of depression that would affect all surrounding structures. Any substantial damage to the Aeration Basin will compromise the operational viability of the City's WWTP and would likely result in the plant being off line for an extended period, realignment of infrastructure, sewage treatment bypasses and related astronomical repair costs. Likewise, the injection of corrosive reagents at the volumes needed to oxidize the residual adsorbed mass in specific locations on the WWTP may lead to significant damage to the existing underground infrastructure to the point where the WWTP may need to temporarily cease operations to allow for repair. If chemical oxidants were to infiltrate the WWTP process piping it could also have a detrimental effect on the operation of the plant.

Response 5a: Based on the information presented in the RI and FS reports for this Site, EPA will rely on design engineering to refine the areas to be excavated to maximize principal threat waste removal and minimize impact to surrounding structures. Also during the remedial design, it may be prudent to conduct a pilot test to determine which chemical oxidants to apply to the excavated areas, and design a method of placement/injection that would minimize the volume of corrosive reagents and minimize impact to nearby infrastructure.

Comment 5b: Secondary safety concerns with the USEPA-preferred alternative relate to excavation in or adjacent to gas, underground electric, storm water, and sanitary sewer utility lines. Excavation around, or temporary relocation of, these utilities represents significant risk to the construction workers and risks damage to the utility, causing service disruptions for the City of Marinette.

Comment 5c: Finally, we believe that the traffic safety issues, odor, noise and potential road damage associated with hauling well over 1,300 additional loads of material through downtown Marinette that would be required with the USEPA-preferred Alternative 3 (USEPA) should have been given more serious consideration in the remedial action decision.

Response to 5b and 5c: EPA's mission and priority is to protect human health and the environment. The potential risks to human health was evaluated utilizing EPA's 9 Criteria prior to the selection of the remedy. The 9 Criteria are:

Threshold Criteria

1. Overall protection of human health and the environment
2. Compliance with ARARs (applicable or relevant and appropriate standards)

Primary Balancing Criteria

3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility or volume
5. Short-term effectiveness

6. Implementability
7. Cost

Modifying Criteria
8. State acceptance
9. Community acceptance

The most important criterion in evaluating a remedy is "overall protection of human health and the environment." *EPA considered the risks and benefits associated with each remedy presented in the FS and for the remedy that was selected. Considered were the risks to long-term workers in areas to be addressed (e.g. WWTP employees), short-term workers in areas that will be addressed (e.g. construction workers conducting the cleanup in the Boom Landing and WWTP Zones), community members that may be impacted by increased truck traffic, people that use Boom Landing for recreational purposes, and even property trespassers.*

There will be potential short-term risks associated with the selected remedy and there will be risk-mitigation to minimize those risks. Some of the risk-mitigation measures include developing and following a Health and Safety Plan *to minimize risks to all that may be potentially impacted by the cleanup; putting up barriers and clearly marking areas that are disturbed; limiting access to areas that are undergoing remedial action; etc.*

Furthermore, EPA will expect WPS to hire a utility locater contractor to delineate the extent of utility infrastructure and to design the remedy to work around the utilities to prevent disruption of service.

A health and safety plan will be developed during the Remedial Design to maximize safety during construction. EPA will expect WPS to have a health and safety officer on-site to oversee implementation of the health and safety plan and to prevent unsafe activities.

Traffic safety issues, odor, noise and potential road damage associated with hauling out excavated material has been taken into consideration. WPS will have to work with the City of Marinette to determine the size of the trucks to be used for hauling excavated materials to prevent road wear and damage. WPS will use trucks with odor and spill reducing capabilities (trucks with covers), and come up with safe route options for traffic safety and as a means to reduce noise in the neighborhoods.

Comments on Costs
Comment 6: "Alternative 3 (USEPA) will cost an estimated $7.63 million, making it the most costly (sic) alternative evaluated in the FS Report. This alternative is $4.01 million more than Alternative 2 (FS). This increased cost is primarily related to deep excavation of source areas in the WWTP and horizontal barrier construction on the WWTP. "

Response: An extensive analysis was completed to evaluate each alternative presented in the FS. Alternative 3, as presented in the Proposed Plan and the selected remedy in the ROD, was selected based on the evaluation against the 9 Criteria, including cost considerations.

Threshold Criteria

1. Overall protection of human health and the environment
2. Compliance with ARARs (applicable or relevant and appropriate standards)

Primary Balancing Criteria

3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility or volume
5. Short-term effectiveness
6. Implementability
7. Cost

Modifying Criteria

8. State acceptance
9. Community acceptance

The selected remedy meets the threshold criteria, primary balancing criteria, and the modifying criteria. The remedy was selected because it removes and treats principal threat waste in the WWTP Zone, and will result in overall waste volume reduction at the Site.

General Comments

Comment 7: There are internal inconsistencies and differences between the Factsheet and approved FS and between the Proposed Plan and the approved FS. There are other errors in the Proposed Plan. Specific inconsistencies and errors can be found on pages 2-7 (out of 13) in the *Comments on USEPA Proposed Remedial Action Plan* submitted by WPS on August 15, 2017, available in the Administrative Record.

Response: EPA drafted the Factsheet and Proposed Plan utilizing the details presented in FS Revision 2. FS Revision 3 was not submitted to EPA until close of business on June 26, 2017.

EPA's ROD reflects the details as presented in the approved RI and FS Rev. 3, with the exception to Alternative 2 as presented in the FS Rev. 3. Alternative 2, as presented in FS Rev. 3 does not comply with State ARARs at 10^{-6} risk level and EPA HQs recommended exclusion of this alternative from the Proposed Plan, as presented in the August 3, 2017 letter from EPA to WPS on that subject.

Further, the listed errors have been reviewed and corrections to those errors have been made if those topics carried forth into the ROD.

Comments from Wisconsin Department of Natural Resources

Comment 8: DNR considers sediment, along with soil and groundwater, to be a media of concern.

Response: The majority of the MGP-impacted sediments were addressed during the 2012 Removal Action. EPA will evaluate the efficacy of the sediment cleanup as part of the first Five Year Review for the site.

Comment 9: If residual soil contamination, above remediation goals, remains post excavation at a depth of 0-4' below ground surface, the following will be required: cap(s), institutional controls, continuing obligations (COs), a soil cover monitoring and maintenance plan, and a soil management plan.

Response: Noted. EPA considers surface soil as the top two feet (0-2'). Post-remedial action sampling will inform the next steps needed to address soil contamination, including institutional controls, continuing obligations, soil cover monitoring and maintenance plan, and soil management plan.

Comment 10: "Alternatives 2 and 3 within the Proposed Plan specify the long-term monitoring program will include visual inspections of the reactive core mat (RCM) and sediment sampling. It is unclear whether additional sampling of the residual sand cover will be completed. The DNR, in prior correspondence, recommended continued monitoring of the residual sand cover as part of the 5-year review process. Please clarify whether or not monitoring of the residual sand cover will be included in the 5-year review process or as part of a separate long-term monitoring plan."

Response: Sediment sampling, including sampling the sand cover, is part of the selected remedy. Additional sediment sampling may be required to inform the five-year review report.

Comment 11: "Alternatives 2 and 3 within the Proposed Plan specify effectiveness monitoring of the sediment RCM and institutional controls to manage potential risks associated with soil, groundwater, soil gas and sediment.

The DNR supports future effectiveness monitoring of the sediment RCM. The DNR also considers the RCM to be an engineering control. Per Wis. Stats. § 292.01(3m), 'engineering control' means an object or action designed and implemented to contain contamination or to minimize the spread of contamination, including a cap, soil cover, or in-place stabilization, but not including a sediment cover.

Further clarification is needed with respect to sediment and what is meant by "institutional controls" and "specific restrictions to be included on the Wisconsin DNR GIS Registry" for this media. The agencies will need to categorize, per Wis. Stats. § 292.01 definitions, the residual sand cover as an engineering control, defined above, or a sediment cover.
Wis. Stats. §292.01 (17m), defines 'sediment cover' as a layer of uncontaminated sand or similar material that is deposited on top of contaminated sediment. This categorization will then be used by the agencies to determine the institutional controls, continuing obligations and specific restrictions to be included on the Wisconsin DNR GIS Registry for sediment."

Response: EPA defines ICs as non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for exposure to contamination and/or protect the integrity of a response action.

ICs typically are designed to work by limiting land and/or resource use or by providing information that helps modify or guide human behavior at a site. ICs are a subset of Land Use Controls (LUCs). LUCs include engineering and physical barriers, such as fences and security guards, as well as ICs. The intent is to use the DNR GIS Registry to document areas of sediment that are not to be disturbed without prior notification by the party and without approval by DNR. Specific restrictions will be enumerated during the Remedial Design.

Appendix A – Administrative Record Index

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMEDIAL ACTION

ADMINISTRATIVE RECORD
FOR THE
WPSC MARINETTE MGP SITE
MARINETTE, MARINETTE COUNTY, WISCONSIN

ORIGINAL
JULY 17, 2017
SEMS ID: 935139

NO.	SEMS ID	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	915367	6/21/13	Tlachac, E., and Mika, K., Natural Resource Technology, Inc.	Gielniewski, M., U.S. EPA	Final Report - Focused NAPL and Sediment Removal Action (W/Cover Letter)	1723
2	915370	6/27/14	Hennings, B., and Hagen, H., NRT, Inc.	Gielniewski, M., U.S. EPA	Remedial Investigation Report - Revision 0	4729
3	915368	2/2/15	Hennings, B., and Hagen, H., NRT, Inc.	Gielniewski, M., U.S. EPA	Remedial Investigation Report - Revision 2	10118
4	934765	5/20/16	Natural Resource Technology, Inc.	File	Feasibility Study Rev 2 W/Response to Comments	1157
5	935125	6/26/17	Natural Resource Technology, Inc.	Gielniewski, M., U.S. EPA	Feasibility Study Rev 3 (W/Response to Comments)	1156
6	935140	7/17/2017	U.S. EPA	Public	Proposed Plan for Cleanup - WPSC Marinette Former MGP	41

Appendix B – ARARs Tables

Chemical-Specific ARARs

Chemical-specific ARARs are generally health- or risk-based standards, defining concentration limits for environmental media or discharges. These requirements may be used to set cleanup levels for COC in environmental media.

MEDIA	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
FEDERAL					
Groundwater	Groundwater Quality Standards	Alternatives 1-3	40 CFR Part 141.11 to 141.13– Safe Drinking Water Act of 1974	Relevant and Appropriate	The National Primary Drinking Water Regulations establish health-based standards for public drinking water systems [maximum contaminant levels (MCLs)]. MCLs are legally enforceable federal drinking water standards and relevant and appropriate to groundwater.
WISCONSIN					
Soil	Soil Cleanup Standards	Alternatives 1-3	Wis. Admin. § NR 720.07 to § NR 720.13: Soil Cleanup Standards	Applicable	Soil Cleanup Standards are legally applicable to soil, preferred method for determining RCLs outlined based on EPA soil screening values and 10-6 for individual compounds and 10-5 for cumulative risk, alternate RCLs can be developed with input from WDNR.
Groundwater	Groundwater Quality Standards	Alternatives 1-3	Wis. Admin. § NR 140.01 and § NR 140.12: Groundwater Quality	Applicable	NR 140 Groundwater Quality Standards are legally applicable to all groundwater, regardless of groundwater use o Generally, NR 140 PALs are the groundwater cleanup goal for all sites, however, flexible closure requirements in NR 726 may be used to set ESs as the primary ROD goal, provided that an adequate source control action is conducted and groundwater monitoring shows a stable or receding plume everywhere groundwater is monitored, including source and NAPL areas.
			Wis. Admin. § NR 726.05(4), §NR 726.05(6), § NR 726.05(7), and § NR 726.05(8), Case Closure	Relevant and Appropriate	NR 726 Case Closure Cleanup requirements are relevant and appropriate
Sediment	Surface Water Quality Standards	Alternatives 1-3	Wis. Admin. § NR 105.04 to §NR 105.07, § NR 105.10: Surface Water Quality Criteria and Secondary Values for Toxic Substances	To Be Considered	Surface Water Quality Standards. Refer to WDNR Publication PUBL-RR-606 (see TBC, page 4)
Surface Water	Surface Water Quality Standards	Alternatives 1-3	Wis. Admin. § NR 105.04 to §NR 105.07, § NR 105.10: Surface Water Quality Criteria and Secondary Values for Toxic Substances	Applicable	Surface Water Quality Standards for the MGP-related COCs at the site are applicable to monitoring of surface water as part of evaluation of the existing cap.

Chemical-Specific ARARs (Continued)

MEDIA	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
Soil Gas/Indoor Air – Chemical Specific	Indoor Air Quality and Vapor Migration	Alternatives 1-3	Wis. Admin. § NR 720.12 Soil Cleanup Standards	Applicable	NR 720.12: Soil Cleanup Standards are legally applicable.
			Wis. Admin. § NR 726.05(4) and § NR 726.15 Case Closure	Relevant and Appropriate	NR 726 Cleanup for Closure is relevant and appropriate • Indoor Air Quality Standards are used to develop Vapor Action Levels for MGP COCs in indoor air and Vapor Risk Screening Levels for MGP COCs in sub slab and soil gas, and in groundwater. • Actions must be taken to ensure soil and groundwater are remediated such that indoor air from vapor intrusion is addressed; the rule also requires vapor mitigation systems for occupied building if needed to address an immediate threat. • Note: Guidance (which would be a TBC) is planned to allow avoiding vapor mitigation systems in vacant buildings with VI issues provided a continuing obligation (CO) is put in place to require the RP to notify WDNR if the building use changes and possibly install a system.

Location-Specific ARARs

Location-specific ARARs are based on the Site's characteristics or location, including natural Site features such as wetlands, floodplains, and endangered or threatened species and habitats. Location-specific ARARs may also apply to man-made features, such as cultural resource areas.

LOCATION	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
FEDERAL					
Reactive Core Mat and Residual Sand Cover Area	Clean Water Act (CWA) (Section 401 and 404)	Alternatives 2 and 3	40 CFR 121, 230; & 33 CFR 320, 323, 325 and 328	Potentially Applicable if future contingent sediment remedial action is required	Regulates the discharge of dredge and fill materials into waters of the United States. Potentially applicable, if future contingent sediment remedial action is required.
WISCONSIN					
Boom Landing Zone	Navigable Water Ways Requirements	Alternatives 2 and 3	Wis. Stat. § 30.12; Wis. Stat. § 30.195, § 30.20: Navigable Waters, Harbors and Navigation	Potentially Applicable	Should soil excavation or other remedial activities impact the bank of the Menominee River, Navigable Water Ways Requirements will apply.
		Alternatives 2 and 3	Wis. Stat. § 281.15, §281.16 § 281.17, § 281.31, 281.33, 281.34: Water and Sewage	Potentially Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 328.35 and § NR 328.38: Shore Erosion Control Structures in Navigable Waterways	Potentially Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 341.035; § NR 341.05; § NR 341.06 § NR 341.07§ NR 341.08: Grading on the Bank of Navigable Waterway	Potentially Applicable	

Action-Specific ARARs

Action-specific ARARs are technology-based or activity-based limits used to guide implementation of the remedial action or guide how remedial waste may be handled.

Soil Action-Specific ARARs

MEDIA	REQUIREMENT, CRITERIA, STANDARD,	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
FEDERAL					
NONE IDENTIFIED					
WISCONSIN					
Wastewater Discharges to Publically Owned Treatment Works (POTW)	Surface Water Effluent Standards, Criteria, and Limitations	Alternatives 2 and 3	Wis. Stat. § 281.15, § 281.16, § 281.17: Water and Sewage	Applicable	Surface water quality effluent standards, criteria and limitations are Applicable where dewatering during soil excavation may necessitate discharge to the Menomonee River. Discharge to POTW is an off-site action, and any pretreatment requirements would need to be met.
		Alternatives 2 and 3	Wis. Stat. § 283: Pollution Discharge Elimination, Subchapter III Standards: Effluent Limitations	Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 106.06, § NR 106 Subchapter V, § NR 106 Subchapter VI: Procedures for Calculating Water Quality Based Effluent Limitations for Point Source Discharges to Surface Waters	Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 200.22 - Application for Discharge Permits and Water Quality Standards Variances	Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 207.03 to § NR 207.05: Water Quality Antidegradation	Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 218.05 to § NR 218.11: Method and Manner for Sampling	Applicable	
		Alternatives 2 and 3	Wis. Admin. § NR 219.04: Analytical Test Methods and Procedures	Applicable	

Soil Action-Specific ARARs (Continued)

MEDIA	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
Site Disturbance	Storm Water Runoff Requirements	Alternatives 2 and 3	Wis. Stat. § NR 281.33: Water and Sewage	Applicable	All are Applicable. Storm water runoff requirements apply during excavation activities at sites equal to or greater than one acre that may result in discharge of storm water to the Manitowoc River.
			Wis. Admin. § NR 216.46 and § NR 216.47: Storm water Discharge Permits	Applicable	
			Wis. Admin. § NR 151.015 or § NR 151.01: Runoff Management	Applicable	
Site Disturbance In-Situ Treatment of Soil Soil that generates vapors	Air Emissions Requirements, Criteria, Limitations	Alternatives 2 and 3	Wis. Admin. § NR 415.04(1), § NR 415.04(2)(a), § NR 415.04(2) b - Control of Particulate Emissions	Applicable	Air emission requirements will be applicable during soil excavation and blending activities that generate fugitive dust and/or vapors Air emission requirements will be applicable to in-situ treatment alternatives that involve the generation of vapors.
			Wis. Admin. § NR 419.07 - Control of Organic Compound Emissions	Applicable	
			Wis. Admin. § NR 429.03 - Malodorous Emissions and Open Burning	Applicable	
			Wis. Admin. § NR 445.07, § NR 445.09 - Control of Hazardous Pollutants	Applicable	

Groundwater Action-Specific ARARs

MEDIA	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
FEDERAL					
NONE IDENTIFIED					
WISCONSIN					
All Groundwater Alternatives	Groundwater Monitor Well Requirements	Alternatives 2 and 3	Wis. Admin. § NR 141.055 to§ NR 141.31: Groundwater Monitor Well Requirements	Applicable	Groundwater monitoring is required to demonstrate the effectiveness of any groundwater remedy on reducing concentrations of MGP COCs.
			Wis. Stat.§ NR 285.27: Air Pollution	Applicable	
In-Situ Chemical or Thermal Treatment	Air Emissions Requirements, Criteria, Limitations	Alternatives 2 and 3	Wis. Admin. § NR 415.04(1), § NR 415.04(2)(a), § NR 415.04(2)(b)- Control of Particulate Emissions	Applicable	Air Emission requirements, criteria and limitations will be applicable during remediation activities that generate vapors during injection, vapor recovery, and/or treatment of pumped groundwater.
			Wis. Admin. § NR 419.05(2); NR 419.07 (2)(a) and NR 419.07 (2)(b) - Control of Organic Compound Emissions	Applicable	
			Wis. Admin. § NR 429.03 - Malodorous Emissions and Open Burning	Applicable	
			Wis. Admin. §NR 431.03 - Control of Visible Emissions	Applicable	
			Wis. Admin. §NR 445.07(1), §NR 445.09(1) to §NR	Applicable	
In-Situ Chemical Treatment In-Situ Enhanced Bioremediation	Injection Well Requirements	Alternatives 2 and 3	Wis. Admin. § NR 815.09 and § NR 815.10: Injection Wells	Applicable	Substantive requirements of the injection well regulation are applicable for in-situ chemical treatment via injection of fluids.
			Wis. Admin. § NR 140 Groundwater Quality, Subchapter III Evaluation and Response Procedures:	Applicable	

All Media Action-Specific ARARs

MEDIA	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	TYPE OF ARAR	RELATIONSHIP BETWEEN REQUIREMENT, CRITERIA, STANDARD AND/OR LIMIT AND ALTERNATIVE COMPONENT AND OTHER COMMENTS
FEDERAL					
NONE IDENTIFIED					
WISCONSIN					
All Media – Chemical Specific	Laboratory Certification Requirement	Alternatives 2 and 3	Wis. Admin. § NR 149: Laboratory Certification and Registration Wis. Admin. § NR 299.04: Water Quality Certification	Applicable	Applicable. Any sampling during design and implementation must meet these requirements
Remediation Standards, Requirements, and Initiatives	Remedy selection, design, implementation and operation and maintenance requirements	Alternatives 2 and 3	Wis. Admin. § NR 724.13 § NR 724.17; § NR 724.19, Remedial and Interim Action Design, Implementation, Operation, Maintenance and Monitoring Requirements	Applicable	Applicable. The remedial action documents provide standards and requirements for remediation of contamination sites in Wisconsin. NR 722 is very similar to the NCP for remedy evaluation and selection.

Full Compliance Required

Other Non-ARAR Requirements (Full Compliance is Required)

ALTERNATIVE COMPONENT	REQUIREMENT, CRITERIA, STANDARD, LIMIT	RELEVANT ALTERNATIVES	CITATION	Relationship between requirement, criteria, standard and/or limit and Alternative Component and other Comments
FEDERAL				
NONE IDENTIFIED				
WISCONSIN				
Institutional Controls – any media	Notification for Residual Contamination and Continuing Obligation (CO) Requirements	Alternatives 2 and 3	Wis. Admin. § NR 725.05, § NR 725.07, and § NR 726.06 to § NR 726.15	Should WI CO responsibilities be used as additional ICs, then the rule requirements are applicable. To be enforceable, WDNR must issue an approval of a remedial action type plan with enforceable requirements for the continuing obligations. Enforcing COs at properties not controlled by the RP could be an issue.

To Be Considered Standards, Guidance, and Initiatives

STANDARD, GUIDELINE, INITIATIVE	RELEVANT ALTERNATIVES	CITATION	Relationship between TBC and Alternative Component
FEDERAL			
NONE IDENTIFIED			
WISCONSIN			
Soil Cleanup Standards	Alternatives 2 and 3	WDNR Guidance Document: "Soil Residual Contaminant Level Determinations Using the U.S. EPA Regional Screening Level Web Calculator" (WDNR PUBL-WR-890, January 23, 2014) WDNR Guidance Document: "RR Program's RCL Spreadsheet Update"	These documents provide guidance on applying the U.S. EPA Screening Level Web Calculator to Wisconsin soils to calculate soil cleanup standards.
Air Management Guidelines Community Involvement	Alternatives 2 and 3	Wisconsin Bureau of Environmental and Occupational Health, Department of Health and Family Services: "Health-based Guidelines for Air Management and Community Involvement During Former Manufactured Gas Plant Clean-ups" (March 23, 2014)	This document provides guidance on developing Air Management Plans to protect human health during remedial activities at MGP sites in Wisconsin.
Soil Cover Guidance	Alternatives 2 and 3	WDNR Guidance Document: "Guidance for Cover Systems as Soil Performance Standard Remedies" (WDNR PUBL-RR-709, October 2013)	This document provides guidance on cover systems and soil performance standard remedies.
Remediation Standards, Requirements, and Initiatives	Alternatives 2 and 3	Wisconsin's Initiative for Sustainable Remediation and Redevelopment in the State of Wisconsin, A Practical Guide to Green and Sustainable Remediation in the State of Wisconsin. (WDNR Pub-RR-911, January 2012)	The Guide to Green and Sustainable Remediation provides guidance on implementing the US. EPA's Superfund Green Remediation Strategy (September 2010) at cleanup sites in Wisconsin.
Sediment Quality Guidelines	Alternatives 2 and 3	WDNR Guidance Document: "Wisconsin Consensus-Based Sediment Quality Guidelines (WDNR PUBL-WT-732, December 2003	This document provides guidelines on developing sediment cleanup levels that are protective of benthic macroinvertebrate species.
Vapor Intrusion Guidance	Alternatives 2 and 3	WDNR Guidance Document: "Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin" (WDNR PUBL-RR-800, December 2010). WDNR Guidance Document: "Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin" (WDNR PUBL-RR-800) Update (July 2012) WDNR Guidance Document: "Sub-slab Vapor Sampling Procedures" (WDNR PUBL-RR-986, July 2014).	These documents provide guidance on the investigation and remediation of the vapor intrusion pathway at contamination sites in Wisconsin and the basis for calculating Indoor Air Vapor Action Levels and Vapor Risk Screening Levels. Also provided is guidance on how vapor intrusion is addressed through continuing obligations applied at case closure at contaminated sites in Wisconsin.
Institutional Controls (Continuing Obligations) Requirements	Alternatives 2 and 3	WDNR Guidance Document: "Guidance on Case Closure and the Requirements for Managing Continuing Obligations" (WDNR PUBL-RR- 606, April 2014): WDNR Guidance Document: "DNR Case Closure Continuing Obligations: Vapor Intrusion" (WDNR PUBL-RR-042, Aug 2015)	These documents provide guidance on which vapor intrusion continuing obligations should be selected when preparing for case closure.

Acronyms
ARARs: Applicable or Relevant and Appropriate
Requirements CO: Continuing Obligation
WDNR: Wisconsin Department of Natural Resources
MGP COCs: Manufactured Gas Plant Compounds of Concern
Wis. Stat.: Wisconsin Statute
Wis. Admin: Wisconsin Administrative Code

Appendix C – Tables from the RI's Human Health Risk Assessment

Table 4. Human health risks: Surface soil–Boom Landing
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Analyte	Mean Detected Value (µg/kg)	Maximum Detected Value (µg/kg)	Criteria Values: Soil Screening Level: Residential (µg/kg)	Criteria Values: Soil Screening Level: Industrial (µg/kg)	Scaled Risks (using mean detected): Residential: Cancer	Scaled Risks (using mean detected): Residential: Noncancer	Scaled Risks (using mean detected): Industrial: Cancer	Scaled Risks (using mean detected): Industrial: Noncancer	Scaled Risks (using maximum): Residential: Cancer	Scaled Risks (using maximum): Residential: Noncancer	Scaled Risks (using maximum): Industrial: Cancer	Scaled Risks (using maximum): Industrial: Noncancer
Polynuclear Aromatic Hydrocarbons (PAHs)												
Benz[a]anthracene	1,120	2,290	150 *c*	2,900 *c*	7E-06	--	4E-07	--	2E-05	--	8E-07	--
Benzo[a]pyrene	1,940	4,380	15 *c*	290 *c*	1E-04	--	7E-06	--	3E-04	--	2E-05	--
Benzo[b]fluoranthene	1,330	2,990	150 *c*	2,900 *c*	9E-06	--	5E-07	--	2E-05	--	1E-06	--
Benzo[k]fluoranthene	1,410	3,050	1,500 *c*	29,000 *c*	9E-07	--	5E-08	--	2E-06	--	1E-07	--
Chrysene	1,210	2,480	15,000 *c*	290,000 *c*	8E-08	--	4E-09	--	2E-07	--	9E-09	--
Dibenz[a,h]anthracene	366	814	15 *c*	290 *c*	2E-05	--	1E-06	--	5E-05	--	3E-06	--
Indeno[1,2,3-cd]pyrene	1,100	2,490	150 *c*	2,900 *c*	7E-06	--	4E-07	--	2E-05	--	9E-07	--
Summed Cancer Risk Estimate or Noncancer Hazard Index					**2E-04**	--	**9E-06**	--	**4E-04**	--	**2E-05**	--
Maximum single-chemical risk or hazard					1E-04	--	7E-06	--	3E-04	--	2E-05	--
Chemical associated with maximum risk or hazard					BaP	--	BaP	--	BaP	--	BaP	--

Notes: Predicted cancer risk calculated as: (Mean Detected Value × 1E-6) / Criteria OR (Maximum Detected Value × 1E-6) / Criteria.
For chemicals with toxicity information available for both cancer and noncancer endpoints, both a cancer risk and a noncancer hazard quotient were calculated.
BaP – benzo[a]pyrene
c – cancer; value corresponds to a cancer risk level of 1 in 1,000,000

Table 6. Human health risks: Subsurface soil–Boom Landing
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Analyte	Mean Detected Value (µg/kg)	Maximum Detected Value (µg/kg)	Criteria Values: Soil Screening Level: Residential (µg/kg)	Criteria Values: Soil Screening Level: Industrial (µg/kg)	Scaled Risks (using mean detected): Residential: Cancer	Scaled Risks (using mean detected): Residential: Noncancer	Scaled Risks (using mean detected): Industrial: Cancer	Scaled Risks (using mean detected): Industrial: Noncancer	Scaled Risks (using maximum): Residential: Cancer	Scaled Risks (using maximum): Residential: Noncancer	Scaled Risks (using maximum): Industrial: Cancer	Scaled Risks (using maximum): Industrial: Noncancer
Polynuclear Aromatic Hydrocarbons (PAHs)												
Benz[a]anthracene	39,000	324,000	150 *c*	2,900 *c*	3E-04	--	1E-05	--	2E-03	--	1E-04	--
Benzo[a]pyrene	18,000	116,000	15 *c*	290 *c*	1E-03	--	6E-05	--	8E-03	--	4E-04	--
Benzo[b]fluoranthene	27,000	213,000	150 *c*	2,900 *c*	2E-04	--	9E-06	--	1E-03	--	7E-05	--
Benzo[k]fluoranthene	28,000	213,000	1,500 *c*	29,000 *c*	2E-05	--	1E-06	--	1E-04	--	7E-06	--
Chrysene	39,000	325,000	15,000 *c*	290,000 *c*	3E-06	--	1E-07	--	2E-05	--	1E-06	--
Dibenz[a,h]anthracene	2,210	6,530	15 *c*	290 *c*	1E-04	--	8E-06	--	4E-04	--	2E-05	--
Indeno[1,2,3-cd]pyrene	4,100	20,100	150 *c*	2,900 *c*	3E-05	--	1E-06	--	1E-04	--	7E-06	--
1-Methylnaphthalene (c)	88,000	358,000	17,000 *c*	73,000 *c*	5E-06	--	1E-06	--	2E-05	--	5E-06	--
1-Methylnaphthalene (n)	88,000	358,000	4,100,000 *n*[a]	53,000,000 *n*[a]	--	0.02	--	0.002	--	0.09	--	0.007
2-Methylnaphthalene	84,000	318,000	230,000 *n*	3,000,000 *n*	--	0.4	--	0.03	--	1	--	0.1
Naphthalene (c)	127,000	510,000	3,800 *c*	17,000 *c*	3E-05	--	7E-06	--	1E-04	--	3E-05	--
Naphthalene (n)	127,000	510,000	130,000 *n*[a]	590,000 *n*[a]	--	1	--	0.2	--	4	--	0.9
Volatile Organic Compound (VOCs)												
Benzene (c)	23,300	49,000	1,200 *c*	5,100 *c*	2E-05	--	5E-06	--	4E-05	--	1E-05	--
Benzene (n)	23,300	49,000	82,000 *n*[a]	420,000 *n*[a]	--	0.3	--	0.06	--	0.6	--	0.1
Ethylbenzene (c)	94,000	288,000	5,800 *c*	25,000 *c*	2E-05	--	4E-06	--	5E-05	--	1E-05	--
Ethylbenzene (n)	94,000	288,000	3,400,000 *n*[a]	20,000,000 *n*[a]	--	0.03	--	0.005	--	0.08	--	0.01
Xylenes, total	262,000	900,000	580,000 *n*	2,500,000 *n*	--	0.5	--	0.1	--	2	--	0.4
Summed Cancer Risk Estimate or Noncancer Hazard Index					**2E-03**	2	1E-04	0.4	1E-02	8	7E-04	1
Maximum single-chemical risk or hazard					1E-03	1	6E-05	0.2	8E-03	4	4E-04	0.9
Chemical associated with maximum risk or hazard					BaP	Naphtha-lene	BaP	Naphtha-lene	BaP	Naphtha-lene	BaP	Naphtha-lene

Notes: Predicted cancer risk calculated as: (Mean Detected Value × 1E-6) / Criteria OR (Maximum Detected Value × 1E-6) / Criteria.
Predicted noncancer hazard calculated as: (Mean Detected Value × 1) / Criteria OR (Maximum Detected Value × 1) / Criteria).
For chemicals with toxicity information available for both cancer and noncancer endpoints, both a cancer risk and a noncancer hazard quotient were calculated.
BaP – benzo[a]pyrene
c – cancer; value corresponds to a cancer risk level of 1 in 1,000,000
n – noncancer; value corresponds to a target hazard quotient of 1

[a] Value is the noncancer screening level, used to calculate the noncancer hazard quotient.

Table 8. Human health risks: Surface soil–WWTP
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Analyt	Mean Detected Value (µg/kg)	Maximum Detected Value (µg/kg)	Criteria Values: Soil Screening Level: Residential (µg/kg)	Criteria Values: Soil Screening Level: Industrial (µg/kg)	Scaled Risks (using mean detected): Residential: Cancer	Scaled Risks (using mean detected): Residential: Noncancer	Scaled Risks (using mean detected): Industrial: Cancer	Scaled Risks (using mean detected): Industrial: Noncancer	Scaled Risks (using maximum detected): Residential: Cancer	Scaled Risks (using maximum detected): Residential: Noncancer	Scaled Risks (using maximum detected): Industrial: Cancer	Scaled Risks (using maximum detected): Industrial: Noncancer
Polynuclear Aromatic Hydrocarbons (PAHs)												
Benz[a]anthracene	1,770	5,850	150 *c*	2,900 *c*	1E-05	--	6E-07	--	4E-05	--	2E-06	--
Benzo[a]pyrene	2,230	6,690	15 *c*	290 *c*	1E-04	--	8E-06	--	4E-04	--	2E-05	--
Benzo[b]fluoranthene	1,790	5,040	150 *c*	2,900 *c*	1E-05	--	6E-07	--	3E-05	--	2E-06	--
Benzo[k]fluoranthene	1,810	5,270	1,500 *c*	29,000 *c*	1E-06	--	6E-08	--	4E-06	--	2E-07	--
Chrysene	1,930	5,890	15,000 *c*	290,000 *c*	1E-07	--	7E-09	--	4E-07	--	2E-08	--
Dibenz[a,h]anthracene	440	1,340	15 *c*	290 *c*	3E-05	--	2E-06	--	9E-05	--	5E-06	--
Indeno[1,2,3-cd]pyrene	1,330	3,870	150 *c*	2,900 *c*	9E-06	--	5E-07	--	3E-05	--	1E-06	--
Naphthalene (c)	277	648	3,800 *c*	17,000 *c*	--	--	--	--	--	--	--	--
Naphthalene (n)	277	648	130,000 *n*[a]	590,000 *n*[a]	--	2E-03	--	5E-04	--	5E-03	--	1E-03
Volatile Organic Compound (VOCs)												
Benzene (c)	480	1,620	1,200 *c*	5,100 *c*	4E-07	--	--	--	1E-06	--	--	--
Benzene (n)	480	1,620	82,000 *n*[a]	420,000 *n*[a]	--	6E-03	--	1E-03	--	2E-02	--	4E-03
Summed Cancer Risk Estimate or Noncancer Hazard Index					**2E-04**	**0.008**	**1E-05**	**0.002**	**6E-04**	**0.02**	**3E-05**	**0.005**
Maximum single-chemical risk or hazard					1E-04	0.006	8E-06	0.001	4E-04	0.02	2E-05	0.004
Chemical associated with maximum risk or hazard					BaP	Benzene	BaP	Benzene	BaP	Benzene	BaP	Benzene

Notes: Predicted cancer risk calculated as: (Mean Detected Value × 1E-6) / Criteria OR (Maximum Detected Value × 1E-6) / Criteria.
Predicted noncancer hazard calculated as: (Mean Detected Value × 1) / Criteria OR (Maximum Detected Value × 1) / Criteria).
For chemicals with toxicity information available for both cancer and noncancer endpoints, both a cancer risk and a noncancer hazard quotient were calculated.
BaP – benzo[a]pyrene
c – cancer; value corresponds to a cancer risk level of 1 in 1,000,000
n – noncancer; value corresponds to a target hazard quotient of 1

[a] Value is the noncancer screening level, used to calculate the noncancer hazard quotient.

Table 10. Human health risks: Subsurface soil–WWTP
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Analyte	Mean Detected Value (µg/kg)	Maximum Detected Value (µg/kg)	Criteria Values: Soil Screening Level: Residential (µg/kg)	Criteria Values: Soil Screening Level: Industrial (µg/kg)	Scaled Risks (using mean detected): Residential: Cancer	Scaled Risks (using mean detected): Residential: Noncancer	Scaled Risks (using mean detected): Industrial: Cancer	Scaled Risks (using mean detected): Industrial: Noncancer	Scaled Risks (using maximum): Residential: Cancer	Scaled Risks (using maximum): Residential: Noncancer	Scaled Risks (using maximum): Industrial: Cancer	Scaled Risks (using maximum): Industrial: Noncancer
Polynuclear Aromatic Hydrocarbons (PAHs)												
Benz[a]anthracene	79,000	634,000	150 *c*	2,900 *c*	5E-04	--	3E-05	--	4E-03	--	2E-04	--
Benzo[a]pyrene	45,000	317,000	15 *c*	290 *c*	3E-03	--	2E-04	--	2E-02	--	1E-03	--
Benzo[b]fluoranthene	85,000	837,000	150 *c*	2,900 *c*	6E-04	--	3E-05	--	6E-03	--	3E-04	--
Benzo[k]fluoranthene	85,000	837,000	1,500 *c*	29,000 *c*	6E-05	--	3E-06	--	6E-04	--	3E-05	--
Chrysene	65,000	525,000	15,000 *c*	290,000 *c*	4E-06	--	2E-07	--	4E-05	--	2E-06	--
Dibenz[a,h]anthracene	4,800	23,500	15 *c*	290 *c*	3E-04	--	2E-05	--	2E-03	--	8E-05	--
Indeno[1,2,3-cd]pyrene	8,600	47,100	150 *c*	2,900 *c*	6E-05	--	3E-06	--	3E-04	--	2E-05	--
1-Methylnaphthalene (c)	49,000	410,000	17,000 *c*	73,000 *c*	3E-06	--	7E-07	--	2E-05	--	6E-06	--
1-Methylnaphthalene (n)	49,000	410,000	4,100,000 *n*[a]	53,000,000 *n*[a]	--	1E-02	--	9E-04	--	1E-01	--	8E-03
2-Methylnaphthalene	50,000	529,000	230,000 *n*	3,000,000 *n*	--	2E-01	--	2E-02	--	2E+00	--	2E-01
Naphthalene (c)	110,000	1,630,000	3,800 *c*	17,000 *c*	3E-05	--	6E-06	--	4E-04	--	1E-04	--
Naphthalene (n)	110,000	1,630,000	130,000 *n*[a]	590,000 *n*[a]	--	8E-01	--	2E-01	--	1E+01	--	3E+00
Volatile Organic Compound (VOCs)												
Benzene (c)	480	2,650	1,200 *c*	5,100 *c*	4E-07	--	--	--	2E-06	--	--	--
Benzene (n)	480	2,650	82,000 *n*[a]	420,000 *n*[a]	--	6E-03	--	1E-03	--	3E-02	--	6E-03
Ethylbenzene (c)	1,600	11,000	5,800 *c*	25,000 *c*	3E-07	--	--	--	2E-06	--	--	--
Ethylbenzene (n)	1,600	11,000	3,400,000 *n*[a]	20,000,000 *n*[a]	--	5E-04	--	8E-05	--	3E-03	--	6E-04
Summed Cancer Risk Estimate or Noncancer Hazard Index					**5E-03**	**1**	**2E-04**	**0.2**	**3E-02**	**15**	**2E-03**	**3**
Maximum single-chemical risk or hazard					3E-03	0.8	2E-04	0.2	2E-02	13	1E-03	3
Chemical associated with maximum risk or hazard					BaP	Naphtha-lene	BaP	Naphtha-lene	BaP	Naphtha-lene	BaP	Naphtha-lene

Notes: Predicted cancer risk calculated as: (Mean Detected Value × 1E-6) / Criteria OR (Maximum Detected Value × 1E-6) / Criteria.
Predicted noncancer hazard calculated as: (Mean Detected Value × 1) / Criteria OR (Maximum Detected Value × 1) / Criteria).
For chemicals with toxicity information available for both cancer and noncancer endpoints, both a cancer risk and a noncancer hazard quotient were calculated.
BaP – benzo[a]pyrene
c – cancer; value corresponds to a cancer risk level of 1 in 1,000,000
n – noncancer; value corresponds to a target hazard quotient of 1

[a] Value is the noncancer screening level, used to calculate the noncancer hazard quotient.

Table 12. Human health screening: Soil vapor–industrial scenario
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Location	Building or Area / Under Building or Exterior	Date	Depth	Naphthalene (µg/m³)	Benzene (µg/m³)	Ethylbenzene (µg/m³)	Toluene (µg/m³)	1,2,4-Trimethyl benzene (µg/m³)	Xylenes, total (µg/m³)
		Soil Gas VISL, Industrial:		**3.6**	**16**	**49**	**220,000**	**310**	**4,400**
WWTP									
SG03SS	Vehicle bldg / underneath	8/7/2012	sub-slab	2.1 *U*	1.2 *U*	1.9 *U*	64.0	2.1 *U*	5.4 *U*
SG03SS	Vehicle bldg / underneath	5/1/2013	sub-slab	1.9 *U*	1.2 *U*	1.7 *U*	1.6	1.9 *U*	5.0 *U*
SG03I	Vehicle bldg / underneath	8/7/2012	5.5–6 ft	1.8 *U*	1.1 *U*	1.6 *U*	38.0	1.8 *U*	5.6
SG03I	Vehicle bldg / underneath	5/1/2013	5.5–6 ft	1.9 *U*	1.2 *U*	1.7 *U*	2.7	1.9 *U*	5.4
SG03D	Vehicle bldg / underneath	8/7/2012	9.5–10 ft	2.1 *U*	1.3 *U*	1.9 *U*	26.0	2.1 *U*	5.5 *U*
SG03D	Vehicle bldg / underneath	5/1/2013	9.5–10 ft	1.9 *U*	1.1 *U*	1.7 *U*	1.5	1.9 *U*	5.0 *U*
SG04SS	Vehicle bldg / underneath	8/7/2012	sub-slab	1.9 *U*	1.1 *U*	1.7 *U*	3.2	1.9 *U*	6.2
SG04SS	Vehicle bldg / underneath	5/1/2013	sub-slab	2.0 *U*	1.2 *U*	9.60	7.5	3.5	51.0
SG04I	Vehicle bldg / underneath	8/7/2012	5.5–6 ft	1.8 *U*	1.2	1.7 *U*	4.6	1.8 *U*	4.8 *U*
SG04I	Vehicle bldg / underneath	5/1/2013	5.5–6 ft	1.8 *U*	1.1 *U*	1.7 *U*	3.3	1.8 *U*	4.8 *U*
SG04D	Vehicle bldg / underneath	8/7/2012	9.5–10 ft	3.1	1.3	2.1	11.0	2.7	11.0
SG04D	Vehicle bldg / underneath	5/1/2013	9.5–10 ft	1.9 *U*	1.1 *U*	4.3	4.3	1.9 *U*	24.0
SG01	Service bldg / exterior	8/6/2012	3.5–4 ft	2.1 *U*	1.3 *U*	1.9 *U*	2.3	2.1 *U*	5.8
SG01	Service bldg / exterior	5/1/2013	3.5–4 ft	1.9 *U*	1.1 *U*	1.7 *U*	1.5 *U*	1.9 *U*	5.0 *U*
SG01	Service bldg / exterior	4/3/2014	3.5–4 ft	0.62	1.0 *U*	1.5 *J*	9.0	19.0	8.8
SG01	Service bldg / exterior	8/5/2014	3.5–4 ft	0.47 *U*	1.1 *U*	1.6 *U*	1.4 *U*	1.8 *U*	4.7 *U*
SG02	Service bldg / exterior	8/6/2012	4–4.5 ft	10.0	17.0	2.0	3.8	2.0 *U*	8.0
SG02	Service bldg / exterior	4/30/2013	4–4.5 ft	2.4 *J*	1.2 *U*	1.8 *U*	2.0	4.6	5.9
SG02	Service bldg / exterior	4/3/2014	4–4.5 ft	0.44	1.0 *U*	1.6 *J*	7.1	20.0	8.5
SG02	Service bldg / exterior	8/4/2014	4–4.5 ft	0.45	1.1 *U*	1.5 *U*	1.4	1.7 *U*	8.5
SG02A	Service bldg / exterior	8/6/2012	3–3.5 ft	4.4	1.2 *U*	1.8 *U*	4.9	2.0 *U*	5.2 *U*
SG02A	Service bldg / exterior	4/30/2013	3–3.5 ft	2.0 *U*	1.2 *U*	1.8 *U*	2.0	3.4	5.3
SG02A	Service bldg / exterior	4/3/2014	3–3.5 ft	1.4	1.1 *U*	1.6 *U*	1.5 *U*	1.8 *U*	4.7 *U*
SG02A	Service bldg / exterior	8/5/2014	3–3.5 ft	0.53 *U*	1.3 *U*	1.8 *U*	2.6	2.0 *U*	5.3 *U*
SG17SS	Service bldg / underneath	4/3/2014	sub-slab	1.6	1.1 *U*	3.4 *J*	13.0	60.0	18.0
SG17SS	Service bldg / underneath	8/5/2014	sub-slab	1.3	1.2 *U*	3.8	21.0	7.0	21.0
SG17D	Service bldg / underneath	4/3/2014	2–2.5 ft	2.0	1.1 *U*	3.5 *J*	12.0	45.0	18.0
SG17D	Service bldg / underneath	8/5/2014	2–2.5 ft	2.3	1.2 *U*	2.7	7.3	6.8	14.0
SG18SS	Service bldg / underneath	4/3/2014	sub-slab	1.9	4.5	13.0 *J*	51.0	110	58.0
SG18SS	Service bldg / underneath	8/4/2014	sub-slab	2.0	1.5	7.4	38.0	9.8	39.0
SG18D	Service bldg / underneath	4/3/2014	2–2.5 ft	1.7	2.2	6.9 *J*	28.0	76.0	34.0
SG18D	Service bldg / underneath	8/4/2014	2–2.5 ft	1.8	1.1 *U*	3.9	22.0	7.2	22.0
SG19SS	Service bldg / underneath	4/3/2014	sub-slab	2.1	1.3	4.5 *J*	14.0	59.0	23.0
SG19SS	Service bldg / underneath	8/5/2014	sub-slab	1.6	1.2 *U*	3.1	14.0	7.1	18.0

Table 12. Human health screening: Soil vapor–industrial scenario
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Location	Building or Area / Under Building or Exterior	Date	Depth	Naphthalene (µg/m³)	Benzene (µg/m³)	Ethylbenzene (µg/m³)	Toluene (µg/m³)	1,2,4-Trimethyl benzene (µg/m³)	Xylenes, total (µg/m³)
		Soil Gas VISL, Industrial:		**3.6**	**16**	**49**	**220,000**	**310**	**4,400**
SG07	Headwork bldg / exterior	8/6/2012	5.5–6 ft	2.6	1.7	1.7 *U*	9.0	2.9	6.0
SG07	Headwork bldg / exterior	5/1/2013	5.5–6 ft	1.9 *U*	1.2 *U*	1.7 *U*	2.6	1.9 *U*	5.0 *U*
SG05	Former slough / exterior	8/7/2012	6.5–7 ft	2,900	14,000	3,100	1,500	2,200	6,800
SG05	Former slough / exterior	4/30/2013	6.5–7 ft	660 *J*	3,300	710	400	440	1,600
SG06	W. of former slough / exterior	8/6/2012	5–5.5 ft	1.8 *U*	1.2	1.6 *U*	2.5	1.8 *U*	4.7 *U*
SG06	W. of former slough / exterior	4/30/2013	5–5.5 ft	1.8 *U*	1.1 *U*	1.6 *U*	3.5	3.1	7.1
SG06D	W. of former slough / exterior	8/6/2012	10–10.5 ft	2.0 *U*	1.2 *U*	1.8 *U*	1.6 *U*	2.0 *U*	5.1 *U*
SG06D	W. of former slough / exterior	4/30/2013	10–10.5 ft	2.1 *U*	1.2 *U*	1.9 *U*	1.7 *U*	2.1 *U*	5.4 *U*
SG08	E. of former slough / exterior	8/6/2012	4.5–5 ft	2.0 *U*	1.6	1.8 *U*	7.5	2.0 *U*	5.3 *U*
SG08	E. of former slough / exterior	4/30/2013	4.5–5 ft	2.1 *U*	1.3 *U*	2.7	53.0	2.5	13.0
SG09	W. of Ludington / exterior	8/7/2012	5.5–6 ft	2.9	1.1 *U*	1.7 *U*	4.6	3.1	6.4
SG09	W. of Ludington / exterior	5/1/2013	5.5–6 ft	1.9 *U*	1.2 *U*	5.3	1.8	1.9 *U*	37.0
SG09D	W. of Ludington / exterior	8/7/2012	11–11.5 ft	1.8 *U*	1.1 *U*	1.6 *U*	22.0	1.8 *U*	6.7
SG09D	W. of Ludington / exterior	5/1/2013	11–11.5 ft	2.0 *U*	1.2 *U*	3.7	6.3	2.0 *U*	21.0
SG14	Utility corridor / exterior	8/7/2012	4–4.5 ft	2.0 *U*	1.2 *U*	7.1	38.0	2.0 *U*	33.0
SG14	Utility corridor / exterior	4/30/2013	4–4.5 ft	2.2 *J*	1.1 *U*	4.1	220	4.1	22.0
SG15	Utility corridor / exterior	8/7/2012	3.5–4 ft	7.2	1.1 *U*	1.6 *U*	1.6	1.8 *U*	4.7 *U*
SG15	Utility corridor / exterior	4/30/2013	3.5–4 ft	2.0 *U*	1.2 *U*	1.8 *U*	1.6 *U*	2.0 *U*	9.0
SG16	Utility corridor / exterior	8/7/2012	3.5–4 ft	1.9 *U*	1.1 *U*	5.2	5.1	1.9 *U*	31.0
SG16	Utility corridor / exterior	4/30/2013	3.5–4 ft	3.3 *J*	1.2 *U*	1.7 *U*	3.7	5.0	7.0
Boom Landing: Exterior Samples									
SG10	Near MW311 / exterior	8/7/2012	6–6.5 ft	18.0	88.0	190	5,900	11.0	92.0
SG10	Near MW311 / exterior	5/1/2013	6–6.5 ft	2.0 *U*	1.2 *U*	1.8 *U*	4.4	2.0 *U*	5.2 *U*
SG11	Former slough / exterior	8/8/2012	3–3.5 ft	5.8	15.0	20.0	16.0	3.4	38.0
SG11	Former slough / exterior	5/1/2013	3–3.5 ft	2.4 *J*	1.2 *U*	4.0 *J*	3.9 *J*	2.0 *U*	6.2 *J*
SG12	Former slough / exterior	8/8/2012	3–3.5 ft	4.9	28.0	6.6	100	9.60	120
SG12	Former slough / exterior	5/1/2013	3–3.5 ft	2.0 *U*	1.2 *U*	1.8 *U*	1.6 *U*	2.0 *U*	5.2 *U*
SG13	W. of MW306 / exterior	8/7/2012	4–4.5 ft	2.1	2.1	1.9	12.0	1.8 *U*	4.6 *U*
SG13	W. of MW306 / exterior	5/1/2013	4–4.5 ft	1.9 *U*	1.2 *U*	1.7 *U*	2.6	1.9 *U*	5.0 *U*

Notes: Detected values that exceeded the screening criteria are boxed.
J - estimated
U - not detected; value represents detection limit
VISL - vapor intrusion screening level

Table 13. Human health risks: Soil vapor–industrial scenario
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Location	Building or Area / Under Building or Exterior	Date	Depth	Summed Cancer Risk	Summed Noncancer Hazard	Naphthalene, Cancer	Benzene, Cancer	Ethylbenzene, Cancer	Naphthalene, Noncancer	Benzene, Noncancer	Ethylbenzene, Noncancer	Toluene, Noncancer	1,2,4-Trimethyl benzene, Noncancer	Xylenes, total, Noncancer
Soil Vapor VISL, Industrial (µg/m³)						3.6 *c*	16 *c*	49 *c*	130 *n*	1,300 *n*	44,000 *n*	220,000 *n*	310 *n*	4,400 *n*
WWTP														
SG03SS	Vehicle bldg / underneath	8/7/2012	sub-slab	--	3E-04	--	--	--	--	--	--	3E-04	--	--
SG03SS	Vehicle bldg / underneath	5/1/2013	sub-slab	--	7E-06	--	--	--	--	--	--	7E-06	--	--
SG03I	Vehicle bldg / underneath	8/7/2012	5.5–6 ft	--	1E-03	--	--	--	--	--	--	2E-04	--	1E-03
SG03I	Vehicle bldg / underneath	5/1/2013	5.5–6 ft	--	1E-03	--	--	--	--	--	--	1E-05	--	1E-03
SG03D	Vehicle bldg / underneath	8/7/2012	9.5–10 ft	--	1E-04	--	--	--	--	--	--	1E-04	--	--
SG03D	Vehicle bldg / underneath	5/1/2013	9.5–10 ft	--	7E-06	--	--	--	--	--	--	7E-06	--	--
SG04SS	Vehicle bldg / underneath	8/7/2012	sub-slab	--	1E-03	--	--	--	--	--	--	1E-05	--	1E-03
SG04SS	Vehicle bldg / underneath	5/1/2013	sub-slab	2E-07	2E-02	--	--	2E-07	--	--	2E-04	3E-05	1E-02	1E-02
SG04I	Vehicle bldg / underneath	8/7/2012	5.5–6 ft	8E-08	9E-04	--	8E-08	--	--	9E-04	--	2E-05	--	--
SG04I	Vehicle bldg / underneath	5/1/2013	5.5–6 ft	--	2E-05	--	--	--	--	--	--	2E-05	--	--
SG04D	Vehicle bldg / underneath	8/7/2012	9.5–10 ft	1E-06	4E-02	9E-07	8E-08	4E-08	2E-02	1E-03	5E-05	5E-05	9E-03	3E-03
SG04D	Vehicle bldg / underneath	5/1/2013	9.5–10 ft	9E-08	6E-03	--	--	9E-08	--	--	1E-04	2E-05	--	5E-03
SG01	Service bldg / exterior	8/6/2012	3.5–4 ft	--	1E-03	--	--	--	--	--	--	1E-05	--	1E-03
SG01	Service bldg / exterior	5/1/2013	3.5–4 ft	--	--	--	--	--	--	--	--	--	--	--
SG01	Service bldg / exterior	4/3/2014	3.5–4 ft	2E-07	7E-02	2E-07	--	3E-08	5E-03	--	3E-05	4E-05	6E-02	2E-03
SG01	Service bldg / exterior	8/5/2014	3.5–4 ft	--	--	--	--	--	--	--	--	--	--	--
SG02	Service bldg / exterior	8/6/2012	4–4.5 ft	4E-06	9E-02	3E-06	1E-06	4E-08	8E-02	1E-02	5E-05	2E-05	--	2E-03
SG02	Service bldg / exterior	4/30/2013	4–4.5 ft	7E-07	3E-02	7E-07	--	--	2E-02	--	--	9E-06	1E-02	1E-03
SG02	Service bldg / exterior	4/3/2014	4–4.5 ft	2E-07	7E-02	1E-07	--	3E-08	3E-03	--	4E-05	3E-05	6E-02	2E-03
SG02	Service bldg / exterior	8/4/2014	4–4.5 ft	1E-07	6E-03	1E-07	--	--	3E-03	--	--	6E-06	--	2E-03
SG02A	Service bldg / exterior	8/6/2012	3–3.5 ft	1E-06	3E-02	1E-06	--	--	3E-02	--	--	2E-05	--	--
SG02A	Service bldg / exterior	4/30/2013	3–3.5 ft	--	1E-02	--	--	--	--	--	--	9E-06	1E-02	1E-03
SG02A	Service bldg / exterior	4/3/2014	3–3.5 ft	4E-07	1E-02	4E-07	--	--	1E-02	--	--	--	--	--
SG02A	Service bldg / exterior	8/5/2014	3–3.5 ft	--	1E-05	--	--	--	--	--	--	1E-05	--	--
SG17SS	Service bldg / underneath	4/3/2014	sub-slab	5E-07	2E-01	4E-07	--	7E-08	1E-02	--	8E-05	6E-05	2E-01	4E-03
SG17SS	Service bldg / underneath	8/5/2014	sub-slab	4E-07	4E-02	4E-07	--	8E-08	1E-02	--	9E-05	1E-04	2E-02	5E-03
SG17D	Service bldg / underneath	4/3/2014	2–2.5 ft	6E-07	2E-01	6E-07	--	7E-08	2E-02	--	8E-05	5E-05	1E-01	4E-03
SG17D	Service bldg / underneath	8/5/2014	2–2.5 ft	7E-07	4E-02	6E-07	--	6E-08	2E-02	--	6E-05	3E-05	2E-02	3E-03
SG18SS	Service bldg / underneath	4/3/2014	sub-slab	1E-06	4E-01	5E-07	3E-07	3E-07	1E-02	3E-03	3E-04	2E-04	4E-01	1E-02
SG18SS	Service bldg / underneath	8/4/2014	sub-slab	8E-07	6E-02	6E-07	9E-08	2E-07	2E-02	1E-03	2E-04	2E-04	3E-02	9E-03
SG18D	Service bldg / underneath	4/3/2014	2–2.5 ft	8E-07	3E-01	5E-07	1E-07	1E-07	1E-02	2E-03	2E-04	1E-04	2E-01	8E-03
SG18D	Service bldg / underneath	8/4/2014	2–2.5 ft	6E-07	4E-02	5E-07	--	6E-08	1E-02	--	9E-05	1E-04	2E-02	5E-03
SG19SS	Service bldg / underneath	4/3/2014	sub-slab	8E-07	2E-01	6E-07	8E-08	9E-08	2E-02	1E-03	1E-04	6E-05	2E-01	5E-03
SG19SS	Service bldg / underneath	8/5/2014	sub-slab	5E-07	4E-02	4E-07	--	6E-08	1E-02	--	7E-05	6E-05	2E-02	4E-03
SG07	Headwork bldg / exterior	8/6/2012	5.5–6 ft	8E-07	3E-02	7E-07	1E-07	--	2E-02	1E-03	--	4E-05	9E-03	1E-03
SG07	Headwork bldg / exterior	5/1/2013	5.5–6 ft	--	1E-05	--	--	--	--	--	--	1E-05	--	--
SG05	Former slough / exterior	8/7/2012	6.5–7 ft	2E-03	40	8E-04	9E-04	6E-05	2E+01	1E+01	7E-02	7E-03	7E+00	2E+00
SG05	Former slough / exterior	4/30/2013	6.5–7 ft	4E-04	9	2E-04	2E-04	1E-05	5E+00	3E+00	2E-02	2E-03	1E+00	4E-01
SG06	W. of former slough / exterior	8/6/2012	5–5.5 ft	8E-08	9E-04	--	8E-08	--	--	9E-04	--	1E-05	--	--
SG06	W. of former slough / exterior	4/30/2013	5–5.5 ft	--	1E-02	--	--	--	--	--	--	2E-05	1E-02	2E-03
SG06D	W. of former slough / exterior	8/6/2012	10–10.5 ft	--	--	--	--	--	--	--	--	--	--	--
SG06D	W. of former slough / exterior	4/30/2013	10–10.5 ft	--	--	--	--	--	--	--	--	--	--	--

Table 13. Human health risks: Soil vapor–industrial scenario
Marinette Former MGP Site
Marinette, Wisconsin
Baseline Risk Assessment (Revision 2)

Location	Building or Area / Under Building or Exterior	Date	Depth	Summed Cancer Risk	Summed Noncancer Hazard	Naphthalene, Cancer	Benzene, Cancer	Ethylbenzene, Cancer	Naphthalene, Noncancer	Benzene, Noncancer	Ethylbenzene, Noncancer	Toluene, Noncancer	1,2,4-Trimethyl benzene, Noncancer	Xylenes, total, Noncancer
SG08	E. of former slough / exterior	8/6/2012	4.5–5 ft	1E-07	1E-03	--	1E-07	--	--	1E-03	--	3E-05	--	--
SG08	E. of former slough / exterior	4/30/2013	4.5–5 ft	6E-08	1E-02	--	--	6E-08	--	--	6E-05	2E-04	8E-03	3E-03
SG09	W. of Ludington / exterior	8/7/2012	5.5–6 ft	8E-07	3E-02	8E-07	--	--	2E-02	--	--	2E-05	1E-02	1E-03
SG09	W. of Ludington / exterior	5/1/2013	5.5–6 ft	1E-07	9E-03	--	--	1E-07	--	--	1E-04	8E-06	--	8E-03
SG09D	W. of Ludington / exterior	8/7/2012	11–11.5 ft	--	2E-03	--	--	--	--	--	--	1E-04	--	2E-03
SG09D	W. of Ludington / exterior	5/1/2013	11–11.5 ft	8E-08	5E-03	--	--	8E-08	--	--	8E-05	3E-05	--	5E-03
SG14	Utility corridor / exterior	8/7/2012	4–4.5 ft	1E-07	8E-03	--	--	1E-07	--	--	2E-04	2E-04	--	8E-03
SG14	Utility corridor / exterior	4/30/2013	4–4.5 ft	7E-07	4E-02	6E-07	--	8E-08	2E-02	--	9E-05	1E-03	1E-02	5E-03
SG15	Utility corridor / exterior	8/7/2012	3.5–4 ft	2E-06	6E-02	2E-06	--	--	6E-02	--	--	7E-06	--	--
SG15	Utility corridor / exterior	4/30/2013	3.5–4 ft	--	2E-03	--	--	--	--	--	--	--	--	2E-03
SG16	Utility corridor / exterior	8/7/2012	3.5–4 ft	1E-07	7E-03	--	--	1E-07	--	--	1E-04	2E-05	--	7E-03
SG16	Utility corridor / exterior	4/30/2013	3.5–4 ft	9E-07	4E-02	9E-07	--	--	3E-02	--	--	2E-05	2E-02	2E-03
Boom Landing: Exterior Samples														
SG10	Near MW311 / exterior	8/7/2012	6–6.5 ft	1E-05	3E-01	5E-06	6E-06	4E-06	1E-01	7E-02	4E-03	3E-02	4E-02	2E-02
SG10	Near MW311 / exterior	5/1/2013	6–6.5 ft	--	2E-05	--	--	--	--	--	--	2E-05	--	--
SG11	Former slough / exterior	8/8/2012	3–3.5 ft	3E-06	8E-02	2E-06	9E-07	4E-07	4E-02	1E-02	5E-04	7E-05	1E-02	9E-03
SG11	Former slough / exterior	5/1/2013	3–3.5 ft	7E-07	2E-02	7E-07	--	8E-08	2E-02	--	9E-05	2E-05	--	1E-03
SG12	Former slough / exterior	8/8/2012	3–3.5 ft	3E-06	1E-01	1E-06	2E-06	1E-07	4E-02	2E-02	2E-04	5E-04	3E-02	3E-02
SG12	Former slough / exterior	5/1/2013	3–3.5 ft	--	--	--	--	--	--	--	--	--	--	--
SG13	W. of MW306 / exterior	8/7/2012	4–4.5 ft	8E-07	2E-02	6E-07	1E-07	4E-08	2E-02	2E-03	4E-05	5E-05	--	--
SG13	W. of MW306 / exterior	5/1/2013	4–4.5 ft	--	1E-05	--	--	--	--	--	--	1E-05	--	--

Notes:
Risks are calculated for all samples and all chemicals regardless of whether the observed concentration exceeded a screening level, and are rounded to one significant figure.
For any chemicals with both a carcinogenic and a noncarcinogenic effect, both cancer risks and noncancer hazards are calculated.
Predicted cancer risk calculated as: (Detected Value × 1E-6) / Criteria. Predicted noncancer hazard calculated as: (Detected Value × 1) / Criteria
Highlighted values exceed a summed cancer risk of 1×10^{-4} or a noncancer hazard index of 1.
-- – chemical was not detected
c – cancer; value corresponds to a cancer risk level of 1 in 1,000,000
n – noncancer; value corresponds to a target hazard quotient of 1
VISL – vapor intrusion screening level