Cedar Creek OU1 – Plant 2 Site

Cedarburg, Wisconsin
Ozaukee County

Record of Decision

United States
Environmental Protection Agency

Region 5

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFR	Code of Federal Regulations
CIP	Community Involvement Plan
COC	Chemical of concern
COPC	Chemical of potential concern
CSM	Conceptual Site Model
CTE	Central tendency exposure
DCL	Default closure level
DQO	Data quality objectives
DRO	Diesel range organics
ELCR	Excess lifetime cancer risk
EPA	United States Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk ass
ES	Enforcement stand
ESD	Explanation of Sig
FFS	Focused Feasibilit
GPS	Global Positioning
GRO	Gasoline range org
HHRA	Human health risk
HI	Hazard Index
HQ	Hazard quotient
HRS	Hazard Ranking System
LOQ	Limit of quantitation
MCL	Maximum contaminant levels
mg/kg	Milligrams per kilogram
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable unit
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	Polynuclear aromatic hydrocarbon
PAL	Preventative Action Level
PCB	Polychlorinated Biphenyl
ppm	Parts per million
PRG	Preliminary remediation goals
PRP	Potentially Responsible Party
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial action objective

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RBSL	Risk based screening level
RCL	Residual Contaminant Level
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial investigation
RI/FS	Remedial investigation/feasibility study
RME	Reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	Slope Factor
SVOC	Semivolatile organic compound
TAL	Target analyte list
TBC	To be considered
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TSCA	Toxic Substances Control Act
UCL	Upper confidence limit
UST	Underground storage tank
VOC	Volatile organic compound
WDNR	Wisconsin Department of Natural Resources

Cedarburg, Wisconsin

This Record of Decision (ROD) documents the remedy selected for the Cedar Creek OU1 - Plant 2 Site in the City of Cedarburg, Ozaukee County, Wisconsin. The ROD is organized in two sections: Part I contains the *Declaration* for the ROD and Part II contains the *Decision Summary*. The *Responsiveness Summary* is included as Appendix A.

PART I: DECLARATION

This section summarizes the information presented in the ROD and includes the authorizing signature of the United States Environmental Protection Agency (EPA) Region 5 Superfund Division Director.

Site Name and Location

The Cedar Creek Site (CERCLIS # WID988590261) is located in Cedarburg, Ozaukee County Wisconsin. The Site is divided into two operable units. The first operable unit (OU1) is Mercury Marine's Plant 2 located at W66 N598 Madison Avenue in the City of Cedarburg, Wisconsin (See Figure 1-1). The building was approximately 66,000 square feet in size and is addressed in this ROD. The Cedar Creek operable unit (OU2) consists of Cedar Creek, its impoundments, raceways, free flowing reaches and floodplain soils starting after the Ruck Pond dam, then downstream 4.6 miles to its confluence with the Milwaukee River.

Statement of Basis and Purpose.

This decision document presents the selected remedy for the Cedar Creek OU1 - Plant 2 Site. The remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP). Information used to select the remedy is contained in the Administrative Record file for the Site. The Administrative Record file is available for review at the EPA Region 5 Records Center, 77 West Jackson Boulevard, Chicago, Illinois, the Cedarburg City Hall, W63 N645 Washington Avenue and the Cedarburg Public Library, W63 N583 Hanover Avenue, Cedarburg, Wisconsin.

Assessment of the Site

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 pollutants or contaminants from this Site which may present an imminent and substantial endangerment to public health or welfare.

Description of the Selected Remedy

The Cedar Creek Site is being addressed as two operable units under the framework set forth in CERCLA. The selected remedy specified in this ROD will serve as the final action for soil contamination for Operable Unit 1 (OU1) at the Site. The selected remedy specifies response actions through removal of contaminated soil, backfill with clean soil, capping and groundwater monitoring. In addition, the selected remedy would include institutional controls (restrictive covenants) to restrict future site use and prohibit the use of site groundwater for potable purposes. EPA believes the response actions outlined in this ROD, if properly implemented, will protect human health and the environment.

The selected remedy consists of excavating soil material from the Plant 2 property that has concentrations in the soil that exceed the site-specific clean up levels for polychlorinated biphenyls (PCBs). In addition, shallow soils (up to 4 feet in depth) where the highest volatile organic compound (VOC) concentrations were detected will be excavated. This remedy would include removal of affected soils around the perimeter and beneath the existing concrete building slab to prevent potential future exposure or releases. In addition, the remedy would include periodic groundwater monitoring, installation of new groundwater monitoring wells and institutional controls (restrictive covenants) to restrict future site use and prohibit the use of site groundwater for potable purposes. A final remedy for groundwater will be determined at a later date, based on the results of the periodic monitoring. Under this alternative, the following soils would be targeted for removal:

- Surface soils surrounding the concrete slab and up to the fence line to the north and south and up to the sidewalks adjacent to St. John and Madison Avenues to the east and west (respectively) would be excavated to a depth of approximately 2 feet below ground surface (bgs) to address the presence of PCB-affected surface and shallow subsurface soils. Removal would include shallow subsurface soils around the perimeter of the Site with PCB concentrations above 1 ppm.

- Soils beneath the concrete slab, to the extent necessary, to support installation of foundations and/or utilities associated with possible redevelopment of the Site.

- Soils with higher concentrations of PCBs would be removed to prevent potential future exposure or releases. These soils are in targeted areas where former operations evidenced elevated PCB impacts; more specifically, in areas limited to the footprint of some former sumps, pits, and/or trenches, where elevated PCB concentrations (> 50 ppm) were detected in subsurface soils. Excavation has been assumed to bedrock.

- Shallow soils (up to 4 feet in depth) beneath Sumps 3 and 5, as well as at sample location B2 (in the vicinity of a former drainage ditch, Figure 4-2), where the highest VOC concentrations were detected. (Elevated metals concentrations were also detected at location B2.)

There is one viable potentially responsible party (Mercury Marine) for OU1, which will be responsible for implementing the remedy.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to this remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies (or resource recovery) to the maximum extent practicable. This remedy does not satisfy the preference for treatment as a principle element of the remedy for the following reasons: (1) the treatment of contaminated PCB soils in place has not been demonstrated for long term permanence and effectiveness, (2) treatment technologies are less-cost effective than this remedy, (3) the chosen remedy is a permanent remedy that is widely accepted by the community, and (4) source materials consisting of principle threat wastes will be addressed within the scope of this action. Because this remedy will result in hazardous substances, pollutants, or contaminants in groundwater and soil under the concrete slab remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory five-year review will be required for this remedial action.

Data Certification Checklist

The following information is included in the Decision Summary section (Part II) of this ROD. Additional information can be found in the Administrative Record file for this Site.

- Contaminants of concern and their respective concentrations (Section 5);
- Baseline risk represented by the contaminants of concern (Section 7);
- Remedial action objectives established for the site (Section 8);
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and ROD (Sections 6 and 7);
- Potential land use that will be available at the Site as a result of the selected remedy (Section 12);
- Estimated total present worth costs and the number of years over which the remedy cost estimates are projected (Sections 9,10 and 12); and
- Key factors that led to selecting the remedy (Sections 10 and 12).

Support Agency Acceptance

The Wisconsin Department of Natural Resources (WDNR) concurs with the selection of Alternative 4 for the Cedar Creek OU1 - Plant 2 Site. The WDNR's concurrence letter is provided in Appendix B.

Authorizing Signature

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Richard C. Karl, Director Date
Superfund Division
United States Environmental Protection Agency, Region 5

PART II: DECISION SUMMARY

1.0 Site Name, Location, and Brief Description

The Plant 2 Site is located in Cedarburg, Ozaukee County Wisconsin (See Figure 1-1). The Plant 2 Site consists of soils contaminated by PCBs and VOCs. The Cedar Creek site is divided into two operable units. The first operable unit (OU1), the Plant 2 Site, is located at W66 N598 Madison Avenue. The Plant 2 Site was occupied by an approximately 66,000 square foot building between St. John and Madison Avenues, and is shown in Figure 2-1. Demolition of the Plant 2 above-grade building components (roof, ceiling, and wall) was completed in May 2005 under EPA's Toxic Substances Control Act (TSCA) program, and a temporary cover was constructed over the remaining concrete floor slab. The surrounding area consists primarily of residential properties, with several industries located within a 2,000-foot radius of the Site. The Cedar Creek operable unit (OU2) consists of Cedar Creek, its impoundments , raceways, free flowing reaches and floodplain soils starting after the Ruck Pond dam, then downstream 4.6 miles to its confluence with the Milwaukee River. This ROD addresses the remediation of OU1, which will be the first OU addressed at the site. EPA is the lead agency for this site, and the Wisconsin Department of Natural Resources (WDNR) is the support agency. This site is not listed on the National Priorities List (NPL) but is instead being addressed under the Superfund Alternatives Site Program. The EPA CERCLIS Number is WID988590261. Site remediation will be financed by the Potentially Responsible Party (PRP).

2.0 Site History and Enforcement Activities

2.1 Source of Contamination

The original building was approximately 13,000 square feet and was constructed by the Milwaukee Northern Railway Company (Milwaukee Northern) between 1906 and 1907. This structure served as a car barn and rail car repair shop for Milwaukee Northern's interurban transport operations.

In 1928, the train car repair shop housed in the car barn was closed, except for light running repairs. The car barn and property were sold in 1942 to Herbert A. Nieman & Company, who reportedly used the original building as a canning factory.

In 1950, Herbert A. Nieman & Company sold the property to Kiekhaefer Corporation, which, as Cedarburg Manufacturing, started building outboard motors. The Kiekhaefer Corporation was the precursor to the current Mercury Marine of Fond du Lac, Wisconsin, which now is a Division of the Brunswick Corporation. The facility was renamed Kiekhaefer Plant 2 and was converted to an aluminum die casting and machining facility. In 1983, the building was sold to Madison Avenue (a joint venture) and reportedly used as a dry goods warehouse. In September 1993, the building was purchased by Brunswick, Mercury Marine's parent company.

Mercury Marine, which began operations in the 1950s, likely utilized products in their operations that contained PCBs and VOCs. Most recently, the deteriorating condition of the Plant 2 building necessitated that the building be demolished. Since PCBs were detected within the Plant 2 building, EPA requested that Mercury Marine proceed with an above-grade demolition under the EPA TSCA self-implementing rule. Under this rule, the party is allowed to cleanup PCBs at a moderately-sized site where there should be low residual impact from remedial activities. Demolition of the plant and installation of a temporary cover over the Site was completed in May 2005.

2.2 Previous Investigations

Investigation activities were performed between 1987 and 2002 to characterize Plant 2 Site conditions and included collection and laboratory analysis of samples from materials within the plant, as well as soils and groundwater.

2.2.1 Soil

Overall, over 100 soil samples were collected and analyzed from numerous locations at the Plant 2 Site. Soil borings were installed to depths of up to approximately 15 feet bgs. Samples collected from the borings were analyzed for Target Compound List/Target Analyte List (TCL/TAL) parameters, diesel range organics (DRO), and gasoline range organics (GRO). Total PCB concentrations reported for the soil samples ranged from non-detect to 7,854 milligrams per kilogram (mg/kg), with the highest PCB concentrations detected in samples collected up to depths of 11 feet from borings taken from three areas where former die casting operations were conducted in Plant 2. PCBs were detected in surface soils (top 1 foot of soil) surrounding the Plant 2 building, ranging in concentrations from non-detect to 146 mg/kg. The highest surface soil concentration (146 mg/kg) was detected in a soil sample collected from a location near the southeast corner of the plant. PCB concentrations in the remaining samples ranged from non-detect to 27.1 mg/kg. (See Figure 3-10A)

Other constituents were detected in the soil samples collected at the plant, including a few VOCs, semi volatile organic compounds (SVOCs) (primarily polynuclear aromatic hydrocarbons [PAHs]), pesticides (only a couple locations at low levels), and inorganics. A few chlorinated VOCs – primarily tetrachloroethene (PCE) and/or trichloroethene (TCE) – were detected in soil samples collected at the Site (all shallow). PAHs were primarily detected in the soil samples collected from the northern portion of the Plant 2 Site, mostly around the perimeter of the building, and the southeast corner of the Site. A few metals – primarily lead, copper, and arsenic – were detected at elevated concentrations at some locations.

2.2.2 Groundwater

Since 1997, Mercury Marine installed and sampled 18 monitoring wells, including one replacement well installed to replace a damaged well, at 16 locations around the Plant 2 Site. Shallow groundwater flows beneath the property and surrounding areas from the north-northwest to the south-southeast toward Cedar Creek. Analytes included TCL/TAL parameters as well as GRO and DRO. PCB concentrations ranging from 0.00025 to 0.00090 mg/L were detected in groundwater sampled from two well locations (in the northwest and southeast corners of the Site). PCBs were not detected in groundwater sampled from the other well locations, including the downgradient off-site wells.

One to six VOCs were detected at low concentrations in some of the wells and form a plume migrating offsite to the southeast. 1,1,1-Trichloroethane, 1,1-Dichloroethene, Tetrachloroethene (PCE) and Trichloroethene (TCE) were detected above Maximum Contaminant Levels (MCLs) and/or Wisconsin NR 140 Preventative Action Levels (PAL) (See Figures 3-16 – 3-17).

A number of inorganic constituents were also detected in the groundwater samples at low concentrations. SVOCs, herbicides, GRO, and DRO were not reported above the limit of quantitation (LOQ).

2.2.3 Building Floor Slab

The plant's concrete floor slab was sampled to delineate the extent of PCBs within the facility. PCBs were reported at concentrations ranging from non-detect to 877 mg/kg.

2.3 Previous Response Actions

Mercury Marine performed a number of cleaning and improvement activities, described in more detail below, at the Site since 1994, including cleaning the plant, demolition, and removal of two underground storage tanks (USTs) in 1998 (a third UST, which stored waste oil, was removed from outside the plant in 1987).

2.3.1– Storm Sewer Cleaning, Rerouting/Repairing Roof Leaders, and Sealing

During the summer of 1994, various measures were undertaken at Plant 2 and on the storm sewer system servicing Plant 2. An investigation at the facility was initially undertaken by Mercury Marine. The recommendations that were implemented included:

- Cleaning of the storm sewer located between the Plant 2 Site and the storm sewer outfall discharging to Ruck Pond.
- Sealing of two laterals which connected the storm sewer to the plant.
- Rerouting and repairing internal roof leaders at the plant.
- Repairing and sealing the plant's roof and repairing masonry walls.

2.3.2 – Plant Demolition and Capping

The Plant 2 was demolished to the concrete floor slab in May 2005. A temporary cover consists of the following components (from top to bottom):

- 4 to 6 inch layer of washed stone/gravel ballast
- 12-mil reinforced polyethylene flexible membrane liner
- 12-oz non-woven geotextile cushion layer
- Brick and masonry rubble
- Former building concrete floor slab (average approximately 6 to 8 inches thick)

In areas where the rubble was not placed, the non-woven geotextile cushion layer, the flexible membrane liner, and gravel were placed directly over the top of the floor slab.

2.4 Enforcement Activities

The Site was a State (WDNR) lead for a number of years before EPA became the lead in 2002. Two PRPs were identified by the State. An Administrative Order of Consent (AOC) was signed between EPA and Mercury Marine to conduct a Remedial Investigation/Feasibility Study (RI/FS) for the Cedar Creek Site, which includes Plant 2, in 2002.

3.0 Community Participation

The Proposed Plan for the Cedar Creek OU1 - Plant 2 Site was made available to the public for comment from October 8, to November 9, 2007. Copies of the Proposed Plan and the final RI and FS (as well as other supporting documents) were in the local Information Repository at the Cedarburg Public Library. Documents are also available at the EPA Region 5 Records Center in Chicago, Illinois. Copies of the Proposed Plan were sent to about 300 people on site mailing list. A note and link to the Proposed Plan on the site's web page was emailed to about 80 people.

A public notice announcing the comment period, public meeting and availability of the Proposed Plan was published in the Cedarburg News-Graphic on October 1st. A news release was also sent to Cedarburg and Milwaukee media on October 3, 2007. EPA held a public meeting on October 10th at the Cedarburg City Hall to present the Proposed Plan. About 30 people attended. Representatives from EPA, WDNR and Wisconsin Department of Health and Family Services gave a short presentation, answered questions and accepted comments on the Proposed Plan. Representatives from the City of Cedarburg, Cedarburg Public Library and Congressman Herb Kohl's office were in the audience in addition to a few residents. Responses to comments received during the public comment period (including those submitted at the public meeting) are included in the Responsiveness Summary attached to this ROD. These comments were considered prior to selection of the final cleanup plan for Plant 2.

In addition to the Proposed Plan mailing and public meeting, EPA held a kick off meeting for the RI in 2003 to explain the Cedar Creek site. A public notice was placed in the News-Graphic and a news release was sent to local media about a week prior to the meeting. EPA also spoke with many local residents during the community interviews when the Community Involvement Plan (CIP) was being developed in 2003. The CIP, Proposed Plan, news releases, technical and legal documents have been posted on the Region 5 Web page at http://www.epa.gov/region5/sites/cedarcreek.

4.0 Scope and Role of Response Action and Operable Units

The EPA has organized the Cedar Creek Site into two operable units (OUs).

Operable Unit 1: The first operable unit (OU1) is Mercury Marine's Plant 2 located at W66 N598 Madison Avenue in the City of Cedarburg, Wisconsin. The building was approximately 66,000 square feet in size and is addressed in this ROD. OU1 consists of excavating soil material from the Plant 2 property that has concentrations in the soil that exceed the site-specific clean up levels for polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs). In addition, OU1 would include groundwater monitoring and institutional controls (restrictive covenants) to restrict future site use and prohibit the use of site groundwater for potable purposes. OU1 will be the first operable unit addressed at the Site, and remediation activities at OU1 will be financed by the PRP.

Operable Unit 2: The second operable unit (OU2) is the creek portion of the Site. OU2 consists of Cedar Creek, its impoundments, raceways, free flowing reaches and floodplain soils starting after the Ruck Pond dam, then downstream 4.6 miles to its confluence with the Milwaukee River (See Figure 1). Remediation of OU2 will begin after a ROD for OU2 is completed, and will be the final response action for the Cedar Creek site. Remediation activities at OU2 will be financed by the PRP.

EPA addressed OU1 in the RI and Focused Feasibility Study (FFS) Report dated October 2007. The site was divided into operable units for two reasons: to address the soils with the highest levels of PCBs and VOCs in a timely manner and to address the need for two separate strategies for the OUs. The different strategies are necessary because of the large difference in sizes of the two operable units, which will affect the logistics, including time and money, of implementing the remedy at each OU. A ROD for OU2 is schedule to be completed in 2009, and will be the final response action for this Site. The implementation of a remedy at OU2 will likely take a considerable amount of time and resources as compared to OU1.

5.0 Site Characteristics

5.1 Conceptual Site Model for Cedar Creek OU1 - Plant 2 Site

The conceptual site model (CSM) provides an understanding of the site based on the sources of contaminants of concern (primarily PCBs), potential transport pathways, and environmental receptors. Based on the nature and extent of contamination and the fate and transport mechanisms described in the RI and FFS reports, the CSM includes the following components:

- Groundwater flows across the Plant 2 Site from the north-northwest toward the south-southeast.

- The highest concentrations of PCBs in soils were found within the footprint of Plant 2 beneath areas of the former die casting operations (within the Former Die Casting Room, Southeast Die Casting Room, and southern portion of the Furnace Area). PCBs in these areas likely were historically transported downward from trenches and/or sumps in the plant’s floors, in areas where their integrity was compromised. The highest surface soil concentrations were detected in soil samples collected from a location near the southeast corner of the plant. Surface soil contamination is limited to locations close to the building foundation and has not been found off-site.

- PCBs were detected in groundwater in two areas of the Plant 2 Site. The PCB levels detected were at very low concentrations. PCBs exhibit hydrophobic behavior and the available data indicate that PCBs are likely to remain within close proximity to the property.

- Off-site PCB transport could occur via storm water, but this is unlikely due to the presence of the former building floor slab and temporary cap.

- Other constituents detected at the Plant 2 Site include PAHs, VOCs, and inorganics:
    - PAHs were primarily detected in soil samples collected from the northern portion of the Plant 2 Site and the southeast corner of the Site (Southeast Die Cast Room/Shipping Room area) and are not migrating (not reported above reporting limits in groundwater).
    - Generally, low levels of chlorinated VOCs were detected in the groundwater beneath the eastern portion of the Plant 2 Site, however, 1,1,1-Trichloroethane, 1,1-Dichloroethene, Tetrachloroethene (PCE) and Trichloroethene (TCE) were detected above Maximum Contaminant Levels (MCLs) and/or Wisconsin NR 140 Preventative Action Levels (PAL). There were detections of chlorinated VOCs in site soils. Where chlorinated VOCs were detected in soils, detections were generally limited to the shallower depths.
    - While inorganics/metals are naturally occurring, lead, copper, and arsenic were detected in a limited number of soil samples at higher levels. However, these constituents were not reported above their respective laboratory reporting limits in groundwater. The highest soil lead and copper levels were generally in the southern portion of the Plant 2 Site, with some elevated concentrations also detected in the northern portion of the Plant 2 Site. While the reason for this is unknown, these higher levels may be associated with use of the original plant building as a canning factory, or prior use of the southern portion of the Plant 2 Site for parking/unloading. Elevated arsenic levels do not appear to be related to any portion of the Plant 2 Site.

- No ecological chemicals of concern are associated with the Plant 2 Site.

5.2 Site Overview

The Cedar Creek OU1 - Plant 2 Site is located in Cedarburg, Wisconsin. The Plant 2 Site is roughly bounded by Madison Avenue to the west, St. John Avenue to the east, residential properties to the south and Norstar (industry) located north of the Plant 2 Site. OU1, the area addressed in this ROD, contains elevated levels of PCBs and VOCs in soils found at the Plant 2 Site. Surficial soils contaminated with PCBs present an exposure risk to children and adults within the Plant 2 Site boundary. Sampling found PCB concentrations above cleanup levels at depths of two feet or less. There is one surface water body near the Plant 2 Site, Cedar Creek, which is approximately 1/4 mile from OU1. The Plant 2 Site does not lie within a floodplain. The Plant 2 Site is located in the Wisconsin-Lake Michigan basin. Based on the visual characterization of subsurface soil and bedrock samples collected during the investigations, three primary geologic units have been identified beneath the property, as described below:

- Fill: Man-placed fill materials and various man-made structures, including those related to the former on-site facilities. The fill is composed of a mixture of silt, sand, gravel, and debris (including slag, coal, concrete, bricks, and glass).
- Glacial Deposits: Native unconsolidated sediments consisting of glacial deposits of sand, gravel, silt, and clay. The unconsolidated Quaternary deposits encountered on-site consist of glacially-originated materials derived from end moraines and pitted outwash/ice-contact deposits.
- Bedrock in the vicinity of the Plant 2 Site is described as Cayugan/Niagaran/Alexandrian series dolomite of Silurian Age (Mudrey et al., 1982). Bedrock was encountered during the RI and previous investigations at depths ranging from 1.2 feet (at soil boring PTSBA1 located in the northwestern portion of the site) to 16 feet (at soil boring PTSBG1 located near the central portion of the Site).

The three main water-bearing units in Ozaukee County consist of the unconsolidated sand and gravel aquifer, the Niagara aquifer found in the dolomite bedrock, and the Sandstone aquifer found below the Maquoketa Shale. The sand and gravel aquifer generally is absent in the Cedarburg area, where the thickness of the unconsolidated deposits typically is about 50 feet or less, and the water table is located below the top of the Niagara aquifer. The unconsolidated deposits are reported to have a low to medium permeability and allow precipitation to infiltrate and recharge the Niagara aquifer. The infiltration rate for soils in the Cedarburg area is estimated to be about 0.2 to 0.8 inch per hour. Groundwater movement in the Niagara aquifer under static conditions at the Plant 2 Site is to the southeast, toward Cedar Creek, based on the direction of groundwater flow determined for water table wells installed by the City of Cedarburg. The water supply for the City of Cedarburg is provided by six wells that draw groundwater from both the Niagara and Sandstone aquifers (See Figure 3-8).

Two of the Municipal Wells, Nos. 3 and 5, which are located approximately 1600 feet and 4000 feet, respectively from the Site, have documented detections of trichloroethene (TCE) and 1,2-dichloroethene (1,2-DCE). However, given that the groundwater flow direction for the deep bedrock zone underlying the Plant 2 Site is toward the east-northeast, and not to the south-southeast toward the location of Municipal Wells No. 3 and No. 5, there appears to be no connection between the Plant 2 Site and the municipal wells.

Ozaukee County has a continental climate characterized by a wide range of temperatures between summer and winter, and modified by the effects of Lake Michigan. The Great Lakes significantly influence the local climate. The effects of the lake are most pronounced in the spring and early summer due to the prevailing north-northeasterly wind off the lake.

Temperature extremes are modified by Lake Michigan and, to a lesser extent, the other Great Lakes. Average daily maximum temperatures range from 28.8 degrees Fahrenheit (°F) in January to 81.9°F in July, with average daily minimum temperatures of 11.3 and 58.5°F for the same respective months. Mean annual precipitation for the area is about 31 inches per year, typically with the months of May and June having the highest average monthly precipitation. Yearly average snowfall is about 37 inches, with January having the highest average monthly snowfall.

5.3 Sampling Strategy

Soil sampling has been performed as part of a number of investigations conducted at the Plant 2 Site since 1987. Overall, 180 samples were collected and analyzed from 72 locations. The primary soil sampling programs were undertaken by Mercury Marine and included the 1997 subsurface investigation boring program, surficial soil sampling from 1999 to 2002, the 2003 RI/FS soil sampling, and the 2006 and 2007 supplemental soil sampling. Soil borings were installed to depths of up to approximately 15 feet bgs and sampled to further assess the potential impact to soils from historical operations and potential source areas associated with the Plant 2 Site. Samples collected from the borings have been analyzed for TCL/TAL parameters, DRO, and GRO.

Sampling of monitoring well MW-1, installed at the Plant 2 Site in August 1989 as part of the city-wide study commissioned by the City of Cedarburg, indicated the presence of VOCs and PCBs. Since 1997, Mercury Marine installed and sampled 18 monitoring wells, including one replacement well installed to replace a damaged well, at 16 locations around the Plant 2 Site. Analytes have included TCL/TAL parameters as well as GRO and DRO.

In addition, the plant’s concrete floor slab was extensively sampled from 1994 to 2006, to delineate the extent of PCBs within the facility.

These investigation activities were documented in several reports, including the following:

- *Subsurface Investigations Documentation Report* (BBL, 2000) provided a description of the Plant 2 Site’s history, existing regional information, and then-available Plant 2 Site soil and groundwater data.
- *Building Investigations Documentation Report* (BBL, 2001), a companion volume to the above report, provided data collected from within the plant itself, a brief description of the analytical results (with a focus on PCBs), and a brief overview of cleaning and improvement activities performed at the plant. This document and the prior one were prepared at the request of the EPA to document data for facilitating discussions regarding potential options for addressing the presence of PCBs at the Plant 2 Site.
- *Cedar Creek Remedial Investigation/Feasibility Study Work Plan* (BBL, 2003) (RI/FS Work Plan) included a review of previous investigative activities and existing data for both Cedar Creek and Plant 2, and outlined planned RI/FS characterization efforts.
- *Cedar Creek Preliminary Site Characterization Summary* (BBL, 2005) documented the investigation activities and analytical results of sampling efforts performed at Plant 2 as part of the Cedar Creek Site RI/FS in accordance with the RI/FS Work Plan (BBL, 2003).

5.4 Source of Contamination

As discussed in Section 2.1 of this ROD, the PCBs and VOCs found at the Cedar Creek OU1 - Plant 2 Site most likely originated from Mercury Marine’s plant operations. In 1994, various measures were undertaken to control the source of contamination (PCBs) to Cedar Creek. The storm sewer system that serviced Plant 2 was cleaned and/or sealed. However, the other former property owners also may have contributed to the contamination. In addition, the still operating industry (Norstar) located just north of the Plant 2 site may be contributing to the contamination.

5.5 Types of Contaminants and Affected Media

At the Cedar Creek OU1 - Plant 2 Site, groundwater and soil were analyzed for TCL/TAL parameters, DRO, GRO. The results were evaluated in the Baseline Human Health Risk Assessment (HHRA) to determine the Contaminants of Potential Concern (COPCs), which revealed which of these chemicals and affected media were most important in driving potential risk at the Plant 2 Site. These findings are summarized in Section 7 of this ROD, but extensive evaluation is found in the RI Report. The HHRA was evaluated using the site data, and the main Contaminant of Concern (COC) at the site was determined to be PCBs in soils.

The Plant 2 site is currently a building slab and parking area with little or no unpaved surfaces. It has a liner and is fenced, and located in a residential/commercial/industrial area. The available habitat was not considered suitable for ecological receptors. Therefore, the potential for ecological exposure at the Plant 2 site is unlikely and was not further addressed in the baseline risk assessment.

5.6 Extent of Contamination

5.6.1 Soil

A total of seven borings were installed/sampled in October 2003, as part of the RI to collect subsurface soil samples for analysis from: 1) beneath and adjacent to the locations of former UST-1 and UST-2, as shown on Figure 3-10A; 2) beneath the floor of the Southeast Die Cast Room; and 3) beneath the floor of the Tool Room. Subsurface soil samples were collected and analyzed to generate data to assess the presence of PCBs in the soils in the vicinity of the former USTs and beneath the floor of the building. The data were also collected to assess whether soil below the Tool Room floor may be acting as a source of the VOCs previously detected in groundwater samples from MW-97-5. The boring locations and summarized analytical results are shown on Figure 3-10A.

The two borings installed in each former UST area were advanced in the approximate center of each former tank pit (SB-03-17 and SB-03-19) and at an adjacent location, downgradient of each former tank (SB-03-18 and SB-03-20). The borings in the Southeast Die Cast Room were advanced in the vicinity of former floor trenches (SB-03-22) and/or a sump (SB-03-21) associated with the room. The boring in the Tool Room (SB-03-23) was advanced in the vicinity of the sump associated with the room.

An eighth boring was planned to be installed off site, north of and upgradient of groundwater monitoring well MW-97-5, to assess whether upgradient soil may be acting as a source of the VOCs detected in that well. This boring was to be developed as a monitoring well. However, the current property owner, Norstar, requested and received permission from the EPA to install the boring/well approximately 25 feet north of the Norstar building’s south wall, inside the plant, instead of in the area between Plant 2 and the Norstar plant (as specified in the RI/FS Work Plan [BBL, 2003]). The boring/well was installed on January 6, 2004. The boring was reportedly terminated at approximately 6 feet bgs, where bedrock was encountered. According to Norstar, soil samples were not retained for analytical testing and groundwater was not encountered at that depth.

Recovered soil samples were visually characterized with respect to lithology, grain size, moisture content, staining, odors, and other observations. Representative samples from each 2-foot split-spoon were placed in resealable plastic bags for headspace screening with a PID and the remaining portion of the samples placed in jars for potential laboratory analysis. One sample was selected from each boring for laboratory analysis based on observed staining, high PID readings, and/or smell. The other samples were retained for subsequent analysis, if necessary. If there were no indications that constituents were present, then the soil sample collected from immediately below the floor slab was selected. If there were no indications that constituents of interest were present in the borings near the former USTs, the soil sample located immediately below the bottom elevation of the former tank was selected. Samples collected from borings SB-03-17 through SB-03-23 were submitted for PCB and chlorinated VOC analyses. Encore samplers were used for collection of soil samples to be analyzed for VOCs. Results are summarized as follows:

PCBs

- Total PCB concentrations reported for the soil samples ranged from non-detect (SB-03-19) to 5,300 mg/kg, detected in one of the samples collected from beneath the Southeast Die Cast Room at a depth of 8.6 to 10.1 feet bgs (SB-03-22).

VOCs

- The VOCs detected in soil collected at the 8.6- to 10.1-foot depth interval from boring SB-03-22 in the Southeast Die Cast Room were 1,2,4-trichlorobenzene, isopropylbenzene, and m- and p-xylenes with reported concentrations of 0.083, 0.97, and 0.98 mg/kg, respectively.
- SB-03-23 had non-PCB constituents (VOCs) detected at the 0- to 0.7-foot depth interval, where PCE was detected at a concentration of 0.43 mg/kg. VOC concentrations in the other five borings that were installed were non-detect.

<u>Site Perimeter Soil Sampling (2003)</u>

Soil sampling was performed in October 2003 as part of the RI along the western and eastern edges of the property to define the horizontal and vertical extent of constituents of interest. The selection of sample locations and sample-specific analytical parameters was based on the results of soil sampling performed at the Plant 2 Site since 1997. In 2003, a total of 10 locations (SS-13 through SS-22) were sampled in 6-inch increments to depths of up to 1 foot or refusal. Sample locations are shown on Figure 3-10A. Samples were submitted to the analytical laboratory for analysis of PCBs, polynuclear aromatic hydrocarbons (PAHs), lead, and/or chromium, based on prior adjacent sampling results. Samples were analyzed using a phased approach. Surficial soil samples (0- to 6-inch bgs) collected at each location were analyzed. Subsurface soil samples (6- to 12-inch bgs, or to less than 12 inches if refusal was encountered) were then analyzed as appropriate based on the analytical results of the associated surficial samples. PCB concentrations ranged from 0.064 to 13 mg/kg. Several PAH constituents were detected at the five locations sampled at concentrations ranging from 0.00065 mg/kg (estimated) for acenaphthylene to 49 mg/kg for fluoranthene. Total PAH concentrations ranged from 0.31 to 259.7 mg/kg. Lead was detected at the seven locations sampled at concentrations ranging from 7.7 to 49 mg/kg, and chromium was detected in the 0- to 6-inch depth interval at two locations at concentrations of 19 and 20 mg/kg.

Installation/Sampling of Soil Borings (2006)

A total of twenty borings were installed/sampled in October 2006, as a supplement to the previous RI sampling events to collect surface and subsurface soil samples. Those borings were located based upon a detailed review of historical figures and site features. Figures 3-10A through 3-10D shows soil boring locations and summarized analytical results. Results are summarized as follows:

PCBs

- Total PCB concentrations reported for the soil samples ranged from non-detect to 1,800 mg/kg, detected in one of the samples collected from beneath the Southeast Die Cast Room, near Sump 1, at a depth of 8 to 10 feet bgs (PTSBH3).
- The next highest PCB concentrations detected were 860 mg/kg, reported in the sample collected from beneath the Southeast Die Cast Room (PTSBH1), and 780 mg/kg in a sample collected from beneath the Furnace Area (PTSBC3), in an area of former die casting.

VOCs

- Trace VOCs, primarily methyl acetate, were detected in samples collected from 13 of the borings at the Plant 2 Site.
- A few chlorinated VOCs were detected in some of the soil samples. PCE was detected at five locations, while other compounds were only detected at one location each: TCE, 1,1,1-TCA, *cis*- and *trans*-1,2-DCE, and 1,2- and 1,3-dichlorobenzene. PCE was detected at concentrations ranging from 0.042 mg/kg to 0.65. TCE was detected at 0.2 mg/kg and 0.42 mg/kg in samples collected from the 0- to 2-foot and 2- to 4-foot depth intervals, respectively, at location PTSBC2. Chlorinated VOC detections were generally limited to the shallower depths.

PAHs

- Total PAH concentrations ranged from non-detect to 108.1 mg/kg (PTSBH3, 2 to 4 feet).
- The higher concentrations of total PAHs were generally reported for soil samples collected from the northern portion of the Site and the southeast corner of the Site (Southeast Die Cast Room/Shipping Room area).

Inorganics

- A few metals - primarily lead, copper, and arsenic - were detected at elevated concentrations at some locations.
- Lead and copper were detected at elevated levels (up to 5,600 mg/kg, lead, 24,000 mg/kg, copper) in the northern portion of the Site and in the southeast corner of the Site. Arsenic was detected at elevated levels (58 and 59 mg/kg) at two locations in the eastern portion of the Site.

Installation/Sampling of Soil Borings (2007)

Three borings were installed on March 8, 2007, to supplement the previous RI sampling. Those borings were located based upon a detailed review of sample results from the 2006 soil sampling. Figures 3-10A through 3-10D shows soil boring locations and summarized analytical results. Results are summarized as follows:

Room C

- Total PCB concentrations reported for boring location PTSBC6 ranged from 0.50 mg/kg (12 to 14 feet bgs) to 680 mg/kg (4 to 6 feet bgs). Total PCB concentrations at boring location PTSBC7 ranged from non-detect to 0.13 mg/kg (4 to 6 feet bgs).

Room H

- Total PCB concentrations reported for boring location PTSBH5 ranged from non-detect to 1.1 mg/kg (2 to 4 feet bgs).
- Total PAH concentrations at boring location PTSBH5 ranged from non-detect to 12.4 mg/kg (2 to 4 feet bgs).
- The four metals analyzed for (arsenic, chromium, copper, and lead) in the samples collected from location PTSBH5 were detected. Arsenic was detected at up to 8.60 mg/kg (4 to 6 feet bgs), chromium up to 19.0 mg/kg (4 to 6 feet bgs), copper up to 58.0 mg/kg (4 to 6 feet bgs), and lead up to 120 mg/kg (4 to 6 feet bgs).

5.6.2 Groundwater

Installation/Sampling of Monitoring Wells (2003-2004)

Four additional monitoring wells were installed at the Plant 2 Site during 2003 and 2004 (MW-03-4R, MW-04-1, MW-04-2, and MW-04-3), the locations of which are shown on Figure 3-13A. Monitoring well MW-03-4R was installed in 2003, on the east side of the building, to replace the damaged and abandoned monitoring well MW-97-4. In 2004, double-cased monitoring wells MW-04-1 and MW-04-2 were installed upgradient and downgradient, respectively, of the Site to further assess PCBs in groundwater. Monitoring well MW-04-3 was installed as a double-cased well adjacent to MW-97-3 to investigate the potential for drag-down of PCBs during well installation that may have lead to PCB detection in groundwater previously sampled from MW-97-3. To allow for fluctuation of the water table during wet and dry seasons, 5 feet of well screen was installed in or straddling the bedrock/weathered bedrock.

A boring was to be installed off site, north of and upgradient of groundwater monitoring well MW-97-5 and converted to a monitoring well for collection of groundwater samples. However, as previously noted, the current property owner, Norstar, instead requested and received permission to install the well inside its plant, further upgradient than planned. The well was installed on January 6, 2004. The boring was reportedly terminated at approximately 6 feet bgs, where bedrock was encountered. According to Norstar, groundwater was not encountered at that depth. At the time of well installation, Norstar indicated that it would check the monitoring well installed on its property at an unspecified date sometime in the spring of 2004 to see if groundwater was present for testing. To date, Mercury Marine has not been contacted by Norstar regarding the well. Mercury Marine also has received no notice from Norstar that a new well was installed.

Groundwater-Level Measurement

Prior to sampling groundwater at Plant 2, water-level measurements were taken in the monitoring wells to characterize the direction of groundwater flow at the Plant 2 Site. Based on the groundwater water-level measurements, shallow groundwater flows from the north-northwest to the south-southeast across the Site.

Groundwater Sampling

Groundwater sampling was performed to document the groundwater quality at the Site. Four groundwater sampling events were performed during 2003 and 2004, as follows:

- In October 2003, monitoring wells MW-97-1, MW-97-2, MW-97-3, MW-97-5, MW-99-6, and MW-03-04R were sampled for PCBs and VOCs using low-flow sampling techniques. PCB concentrations ranged from non-detect to 0.00053 mg/L, with PCBs being detected in samples from MW-97-1 and MW-97-3. Select (two to six) VOCs were detected at low concentrations in some wells sampled, including one of the upgradient wells (MW-97-5). VOCs detected included TCE (0.00077 mg/L), PCE (0.110 mg/L), 1,1-dichloroethene (1,1-DCE) (0.012 mg/L), 1,1-DCA (0.0031 mg/L), and 1,1,1-TCA (0.2 mg/L).
- In February 2004, ultra low-flow sampling was performed at MW-97-1 and MW-97-3 to collect and analyze samples for PCBs to assess whether PCBs detected in October 2003 were associated with particulates in the well. PCB concentrations ranged from 0.00025 mg/L at MW-97-1 to 0.00067 mg/L at MW-97-3.
- In April 2004, MW-03-4R and MW-97-5 were sampled for VOCs to evaluate for the presence of these compounds in the groundwater. PCE was detected at 0.015 mg/L (MW-03-04R) and 0.0077 mg/L (MW-97-5). Other compounds,

including 1,1-DCE (0.0043 mg/L), 1,1-DCA (0.0011 mg/L), and 1,1,1-TCA (0.090 mg/L), were detected in the sample collected from MW-03-4R.

- In July 2004, MW-04-1, MW-04-2, and MW-04-3 were sampled for PCBs using ultra low-flow techniques to assess off-site groundwater (MW-04-1 and MW-04-2) and to verify PCB levels detected in groundwater near the southeast corner of the Plant Site (MW-04-3). PCB concentrations were non-detect at MW-04-1 and MW-04-2 and 0.00090 mg/L at MW-04-3.

The results of the groundwater sampling are summarized on Figure 3-13A.

Installation/Sampling of Monitoring Wells (2006)

Eight additional double-cased PVC monitoring wells were installed at the Plant 2 Site during 2006 (MW-06-1, MW-06-2, MW-06-3, MW-06-4, MW-06-5, MW-06-6, MW-06-7, and MW-06-8), the locations of which are shown on Figures 3-13A and 3-13B. Monitoring wells MW-06-2 and MW-06-3 were installed at an upgradient location near the property boundary and at a downgradient location, respectively, along the eastern side of the Site to further assess VOCs in groundwater. Monitoring well MW-06-4 was installed off site across St. John Avenue to assess the extent of VOCs in groundwater. Monitoring wells MW-06-5, MW-06-6, MW-06-7, and MW-06-8 were installed as deep bedrock groundwater monitoring wells in the northwestern, northeastern, southeastern, and southwestern corners of the Site, respectively, to assess the potential migration of constituents to the deep groundwater below the Site. To allow for fluctuation of the water table during wet and dry seasons, 5 feet of well screen was installed in or straddling the water table for the shallow wells.

Groundwater-Level Measurement

Prior to sampling groundwater at Plant 2, water-level measurements were taken in the monitoring wells to characterize the direction of groundwater flow at the Site. Based on the groundwater water-level measurements, shallow groundwater flows from the northwest to the southeast across the Site and that deep (bedrock) groundwater flows from the west-southwest to the east-northeast across the Site.

Groundwater Sampling

One round of groundwater sampling was performed during 2006 to document the groundwater quality at the Site. In October 2006, the 16 existing monitoring wells at the Site were sampled for PCBs and VOCs using ultra low-flow sampling techniques to minimize sample turbidity. Monitoring wells MW-03-4R, MW-04-1, and MW-06-1 were additionally analyzed for PAHs and inorganics. PCB concentrations ranged from non-detect to 0.00069 mg/L, with PCBs being detected in samples from MW-97-3 and MW-04-3. Select (one to six) VOCs were detected at low concentrations in some wells sampled, including both of the wells located upgradient near the property boundary (MW-97-5 and MW-06-2). VOCs detected included TCE (0.00065 mg/L), PCE (0.087 mg/L), 1,1-

dichloroethene (1,1-DCE) (0.0046 mg/L), 1,1-DCA (0.0016 mg/L), 1,1,1-TCA (0.078 mg/L), *cis*-1,2-dichloroethene (*cis*-1,2-DCE) (0.0016 mg/L), and acetone (0.0053 mg/L). Only one PAH (i.e., phenanthrene at 0.000015 mg/kg was detected in one groundwater sample at the Site. All other PAH analyses were reported as non-detect. Select (three to seven) inorganics were detected at low levels in the wells sampled, though neither the Wisconsin Enforcement Standards (ESs) nor Preventive Action Limits (PALs) were exceeded in any of the wells.

The results of the groundwater sampling are summarized on Figures 3-13A and 3-13B.

Sampling of Monitoring Wells (2007)

Two rounds of quarterly groundwater sampling were performed during 2007 – one during March and the second during June, as described below.

Groundwater-Level Measurement

Prior to sampling groundwater at Plant 2, water-level measurements were taken in the monitoring wells to characterize the direction of groundwater flow at the Site. Based on the groundwater water-level measurements, shallow groundwater flows from the northwest to the southeast across the Site and that deep (bedrock) groundwater flows from the west-southwest to the east-northeast across the Site.

Groundwater Sampling

In March and June of 2007, the 16 existing monitoring wells at the Site were sampled for VOCs using low-flow sampling techniques to minimize sample turbidity. Select VOCs were detected at low concentrations in some wells sampled, including both of the wells located near the northern property boundary (MW-97-5 and MW-06-2). VOCs detected included TCE (0.00082 mg/L, J-flagged as estimated), PCE (0.098 mg/L), 1,1-DCE (0.0049 mg/L), 1,1-DCA (0.0013 mg/L), 1,1,1-TCA (0.063 mg/L), *cis*-1,2-DCE (0.0011 mg/L), and acetone (0.0067 mg/L).

The results of the groundwater sampling are summarized on Figures 3-13A and 3-13B.

5.6.3 Building Floor Slab

To better characterize the concrete plant floors at depth, concrete floor samples were collected that consisted of concrete cores from either the interval between 1 cm and the bottom of the concrete pad or the interval between 7.5 cm and the bottom of the concrete pad (depending on prior sampling results). Samples were analyzed for PCBs by Aroclor using EPA Method SW-846 8082.

A total of four 1 cm-to-bottom composite floor samples were taken concurrent with sample locations PTSBA1, PTSBE4, PTSBG2, and PTSBH3. Two 7.5 cm-to-bottom composite floor samples were taken concurrent with PTSBC1 and PTSBD1. Sample locations are shown on Figure 3-15.

Analytical results for the concrete floor samples collected indicate that PCBs were detected in all rooms except the Die Repair Room (Room A). PCB concentrations ranged from 0.042 to 11 mg/kg in the samples collected below 1 cm. For the concrete floor sampling below 7.5 cm, total PCB detections ranged from 0.036 to 13 mg/kg.

6.0 Current and Potential Future Land and Resource Uses

The human health risk assessment (HHRA) for this Plant 2 Site considered exposure scenarios associated with assumed future land uses. Future land use at the Plant 2 Site is assumed to be commercial, but as a conservative approach, residential land use is also evaluated (both scenarios are non-industrial use). The HHRA also considered potential exposure of future workers involved in site construction activities. It is assumed that the future land use at the Plant 2 Site addressed in this ROD will be non-industrial use.

7.0 Summary of Site Risks

Mercury Marine prepared a HHRA for the Cedar Creek OU1 - Plant 2 Site, in order to evaluate potential risks to human health if no action is taken. This process characterizes current and future threats or risks to human health and the environment posed by contaminants at the Plant 2 Site. The risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline HHRA. The HHRA determined that the COCs for the Plant 2 Site are PCBs and VOCs in soils and that cleanup to levels within EPA's risk range will be protective of human health and the environment at the Plant 2 Site for current and future use.

In accordance with EPA guidance on preparing RODs, the information presented here focuses on the information that is driving the need for the response action at the Cedar Creek OU1 - Plant 2 Site and does not necessarily summarize the entire HHRA. Further information is contained in the risk assessments within the RI report, included in the Administrative Record for the Plant 2 Site.

7.1 Summary of Human Health Evaluation

The HHRA was prepared in accordance with EPA's Risk Assessment Guidance for Superfund (EPA, 1989; 2002; 2004a). Current plans for this Plant 2 Site are to redevelop the property, and as such future land use is assumed to be commercial. However, because there is currently no deed or other restrictions to preclude residential land use in the future, hypothetical future residential land use is also conservatively evaluated. It should be noted that this HHRA includes both reasonable- and worst-case exposure scenarios that assume either no removal or removal of the entire slab, respectively.

Media of potential concern for Plant 2 are soils and groundwater. Future commercial or residential receptors may be exposed to constituents in surface soil at the Plant 2 Site (i.e., generally a relatively small area of soil around the perimeter of the Plant 2 Site). Should the slab be removed for redevelopment purposes, these receptors may also be exposed to soils immediately beneath the slab. Receptors engaged in intrusive soil activities (e.g., construction workers) may also be exposed to constituents in perimeter surface and subsurface soils, as well as sub-slab soils if the slab is removed. Shallow groundwater at the Plant 2 Site is not used as a source of potable water, and as such, potential exposure to chemical constituents via potable use of groundwater is not quantitatively evaluated in the HHRA. Shallow site groundwater is not used, and is not likely to be used in the future, as a potable source largely because of the low yield of the shallow aquifer (i.e., five of nine site wells purged dry during low-flow sampling events). In addition, municipal drinking water is supplied to the Plant 2 Site and surrounding area by the Cedarburg Light & Water Utility (the Utility), and City Ordinance No. 2005-12 (City of Cedarburg, 2005) requires that all private supply wells be permitted for operation. City Ordinance No. 2005-12 also restricts the drilling of new private supply wells in the City; the Utility will only approve a new private well if the homeowner can justify its need in addition to water provided by the public water system. However, potential exposure via dermal contact with groundwater during intrusive activities is evaluated. While site-related constituents have been detected in the building's concrete floor slab, these constituents would be expected to be relatively immobile because of the nature of the concrete matrix. Thus, the constituents would not be readily available for exposure, and the concrete slab is not considered a medium of potential concern.

Constituents of Potential Concern (COPC) for soil are conservatively selected using WDNR Residual Contaminant Levels (RCLs) as outlined in WDNR Chapter NR 720 and WDNR (2002) Guidance. Groundwater COPCs are selected by comparing data to Enforcement Standards (ES) and Preventative Action Level (PAL) presented in WDNR Chapter NR 140. In instances where RCLs, ESs, or PALs are not available for certain detected constituents in soil or groundwater, alternative screening criteria such as the EPA (2004b) Region 9 Preliminary Remediation Goals (PRGs) for residential soil or drinking water are used to identify COPCs.

The HHRA process consists of the following four steps: 1) data evaluation, to identify site-related constituents of interest; 2) exposure assessment, to determine potential exposure pathways and quantify the magnitude of potential exposure; 3) toxicity assessment, to determine the types of effects associated with exposures; and 4) risk characterization, to quantify cancer risks and non-cancer hazards associated with specific exposures at the Plant 2 Site.

7.2 Identification of Contaminants of Concern

The COPC screening process was used to identify constituents for further evaluation in the HHRA. The process involves comparison of site data to conservative criteria which, if not exceeded, show that risks/hazards are insignificant.

Constituents in soil are compared to screening values derived according to WDNR Chapter NR 720 and WDNR (2002) guidance for developing generic RCLs. These screening values are based on the EPA (1996) soil screening levels (SSLs) for residential exposure but are further adjusted to account for a target cancer risk level of 1×10^{-7} and a hazard quotient of 0.2. These screening values are conservative and are used to satisfy requirements of the WDNR Voluntary

Party Liability Exemption (VPLE) program. When RCLs are not available, EPA (2004b) Region 9 PRGs for residential soil are used. Constituents in soil whose maximum concentrations exceed these screening values are considered COPC and are quantitatively evaluated in the HHRA. RCLs and PRGs are presented in Table 4-3 of Appendix D.

For groundwater, concentrations of chemical constituents are compared to WDNR Chapter NR 140 ES and PALs. ESs are generally the same as federal drinking water standards (i.e., maximum contaminant levels – MCLs), and the PALs are either 10% or 20% of the ES, depending on chemical classification (e.g., carcinogen, mutagen, teratogen). When ESs or PALs are not available, EPA (2004b) Region 9 PRGs for drinking water are used. Constituents in groundwater that exceed these drinking water standards and/or screening criteria are quantitatively evaluated in the HHRA using a construction worker dermal contact exposure scenario. Because site groundwater is not used as a potable water source, use of drinking water-based screening criteria provides a conservative evaluation. ESs, PALs, and PRGs are presented in Table 4-4 of Appendix D.

7.2.1 COPC Screening Results – Soil

Constituents in soil that exceeded the residential soil RCLs or PRGs are shown in Figures 3-10A – 3-10E. A comparison of maximum detected concentrations to residential RCLs and PRGs is shown in Table 4-3 of Appendix D. Several PAHs reported in surface soils around the perimeter of the Plant 2 building slab (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k) fluoranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) exceeded their respective residential RCLs. Maximum concentrations of these constituents ranged from 2.8 mg/kg (dibenz(a,h)anthracene) to 21 mg/kg (chrysene) and were reported in sample SS-21 (collected from the 0- to 0.5-foot and 0.5- to 1.0-foot depth intervals near the northwest corner of the building). Total PCB concentrations in most of the perimeter surface soil samples were above the residential RCL of 0.032 mg/kg. The highest total PCB concentration was 146 mg/kg (reported in SS-7, southeast corner of Plant 2, outside and adjacent to the Former Die Cast Room). A few inorganics also exceeded their respective RCLs, including lead and arsenic. The highest concentrations of arsenic and lead in surface soils are reported in sample SB-97-4 (69.1 mg/kg at 0 to 2 feet) and SS-9 (510 mg/kg at 0 to 1 foot), respectively.

TCE was detected in sub-slab soils in 3 of 57 samples (0.077 mg/kg at location SB-97-15 [0 to 2 feet below the slab floor]; 0.2 mg/kg at PTSBC2 [0 to 2 feet below the slab floor]; and 0.42 mg/kg at PTSBC2 [2 to 4 feet below the slab floor]), and was the only VOC detected above its respective residential RCL (of 0.0094 mg/kg). PCB concentrations reported in soils beneath the Plant 2 building slab are also above the residential RCL. Highest concentrations of TCE are reported below the Former Die Casting Room floor. There were also a few subsurface samples collected from the perimeter of the Plant 2 Site (about 3 to 5 feet bgs) that exceeded the residential PCB RCL. However, PCB concentrations reported in these outdoor subsurface samples are less than the concentrations reported in subsurface soils beneath the Plant 2 building slab (e.g., below the Former Die Casting Room floor). A few inorganics (i.e., antimony, arsenic, chromium, copper, lead, and thallium) also exceeded their respective residential RCLs. The highest concentration of arsenic (307 mg/kg) was reported outside of the former building foundation between the former Furnace Area and the sidewalk (SB-97-4 2- to 4-foot sample). The highest concentration of lead (5,600 mg/kg) was reported in sample PTSBB2 (2 to 4 feet) located beneath the floor slab of the Tool Room.

Based on this screening evaluation, TCE, PAHs, PCBs, and a few inorganic constituents (including arsenic and lead) have been identified as soil COPCs for further consideration in the HHRA.

7.2.2 COPC Screening Results – Groundwater

VOCs, pesticides, PCBs, and inorganics have been reported in groundwater associated with the Plant 2 Site; however, a few constituents have been detected above their respective ES, PAL, or PRG. No pesticides were present at concentrations above the ES, PAL, or PRG. Only two VOCs (PCE and 1,1-DCE) and total PCBs were reported at or above both the ES and PAL. Detected total PCB concentrations reported above the ES (0.00003 mg/L) and/or PAL (0.000003 mg/L) ranged from 0.00025 mg/L (MW-97-1) to 0.0009 mg/kg (MW-04-03). The only other monitoring well with detectable PCB concentrations was MW-97-3 (maximum detected concentration of 0.00069 mg/L in 2006). Arsenic was the only inorganic to exceed its respective PAL of 0.001 mg/L, but did not exceed the ES of 0.010 mg/L.

Based on this screening evaluation, a few VOCs, PCBs, and arsenic have been identified as groundwater COPCs for further consideration in the HHRA (Table 4-4).

7.2.3 Exposure Assessment

The exposure assessment identifies potential pathways by which receptors may be exposed to chemical constituents. This process involves consideration of constituent concentrations in site-related media (e.g., soils, groundwater) and potentially exposed receptor populations and their activity patterns.

Plant 2 was demolished to the concrete slab in May 2005. Although most of the data used in this assessment were collected prior to demolition of the building, the data are still considered representative of current conditions as the perimeter soils and subsurface soils beneath the slab were not disturbed. Additional data were collected from below the slab floor in 2006 and 2007 and are also used in the HHRA. The former plant's concrete slab floor is covered with a temporary cover and stone, and the Plant 2 Site is fenced. Residential properties are nearby, and there are also other industries located within a 2,000-foot radius of the Plant 2 Site. Under current conditions, there is little or no potential for exposure to constituents in soils or groundwater. As such, this HHRA considers exposure scenarios associated with assumed future land uses.

Future land use at the Plant 2 Site is assumed to be commercial, but as a conservative approach, residential land use is also evaluated. For purposes of this discussion, the following terms are used: surface soil, defined as the top 1 foot of soil; subsurface soil, defined as soils deeper than 1 foot.

Direct contact with soils (i.e., incidental ingestion and dermal contact) is likely to be the predominant exposure pathway for the Plant 2 Site. Inhalation of soil particulates is also considered as a potential exposure route. As requested by EPA (2007), the vapor intrusion to indoor air pathway is also evaluated due to the presence of VOCs in groundwater. Potential future receptors (commercial or residential) may be exposed to constituents in surface soils during routine activities (e.g., gardening, children playing). Exposure of commercial or residential receptors to subsurface soils is not likely under typical conditions, particularly to the extent that the slab can remain in place with additional development over it. If the slab is removed in the future, future commercial or residential receptors will still probably not be exposed to sub-slab soils as long as the slab is replaced by a new building foundation and/or backfill to bring the area back up to grade, thereby providing a barrier between the current sub-slab constituents and potential receptors. However, as a conservative approach, and consistent with EPA (2006) comments, should the slab be removed, future residential and commercial receptors are assumed to be exposed to sub-slab surface soils (i.e., top 1 foot of soil beneath the slab). There is also the potential for construction workers involved in intrusive activities to be exposed to perimeter surface and subsurface soils in addition to sub-slab soils should the slab be removed.

In summary, each receptor is evaluated using two different data sets; one that assumes that the slab will remain in place and the other that assumes the slab will be removed. For the commercial worker and resident, the first data set considers only surface soil samples collected from the perimeter area outside the slab and the latter data set considers exposure to these perimeter surface soil samples as well as sub-slab surface soils (i.e., soils immediately beneath the slab). Construction workers are also evaluated using two different data sets; one data set considers perimeter surface and subsurface soils, and the other considers all these perimeter soils plus all sub-slab soils.

As previously discussed, shallow groundwater at the Plant 2 Site is not used as a potable source and is not likely to be used as a potable source in the future. Potential exposure associated with dermal contact with groundwater by construction workers is, however, evaluated in this HHRA, because groundwater below the Plant 2 Site is somewhat shallow (approximately 10 feet bgs) and may be encountered during intrusive construction activities.

As previously mentioned, because the Plant 2 Site itself is a building slab and parking area with little or no unpaved surfaces, and because it is located in a residential/commercial/industrial area, available habitat is not considered suitable for ecological receptors. As such, the potential for ecological exposure is unlikely and is not further addressed in this baseline risk assessment.

7.2.4 Toxicity Assessment

The toxicity assessment identifies the potential effects that are generally associated with exposure to a given chemical. To quantify carcinogenic effects, EPA has derived slope factors (SFs) for those chemicals found to cause a dose-related, statistically significant increase in tumor incidence in an exposed population relative to the incidence of tumors observed in unexposed populations. SFs are typically developed based on oral toxicity studies and are reported as risk per unit dose in units of inverse milligrams per kilogram body weight per day [(mg/kg-day)$^{-1}$]. The SFs are used to quantify the potential risk of cancer associated with a given exposure (EPA, 1989).

To quantify non-carcinogenic hazards, EPA has derived reference doses (RfDs) that represent a threshold of toxicity in units of mg/kg-day. RfDs are intended to represent an exposure that the human population could be exposed to daily for an entire lifetime without appreciable risk of harmful effects (EPA, 1989).

Because most oral SFs and RfDs are based on an administered dose, the toxicity values are sometimes adjusted (expressed as an absorbed dose) when evaluating the dermal exposure scenarios. In accordance with EPA (2004b) Dermal Risk Assessment Guidance, the oral SF is adjusted only when the gastrointestinal absorption of the compound is less than 50%.

DROs and GROs are present in soil at the Plant 2 Site, but risks/hazards are not quantified due to the lack of toxicity data. Toxicity data are also not available for lead. However, potential effects of lead exposure are assessed using EPA-recommended models [Adult Lead Model (ALM) and Integrated Exposure Uptake Biokinetic (IEUBK) Model]. These models are briefly discussed below.

The EPA (2003) ALM is used to assess risks/hazards associated with non-residential adult exposures to lead in soil. It is intended to predict hypothetical blood lead concentrations in fetuses carried by women exposed to lead in soils (EPA, 2003). EPA (2003) guidance established a threshold of concern (fetal blood lead level of 10 ug/dL), and associated cleanup goals which limit the risk of exceeding the blood lead level of concern (10 µg/dL) to 5%.

The IEUBK model (Windows version 1, Build 263) is used to assess risks to hypothetical future child residents. The IEUBK model estimates the distribution of blood lead levels in children exposed to lead-containing media, which in turn is used to estimate the risk that a child will exceed the target level of concern (10 µg/dL). According to the model, the soil concentration that corresponds to the target blood lead level of concern of 10 µg/dL is 340 mg/kg.

7.2.5 Risk Characterization

The Risk Characterization integrates the results of the data evaluation, toxicity assessment, and exposure assessment to evaluate potential risks/hazards. Consistent with EPA guidance, carcinogenic risks and non-carcinogenic hazards are evaluated separately.

Carcinogenic Risk

Carcinogenic risk is expressed as a probability of developing cancer over the course of a lifetime as a result of a given level of exposure. For a given chemical and route of exposure, carcinogenic risk is calculated as follows:

Risk = E x SF

where:

E = Exposure Intake (mg/kg-day)
SF = Slope Factor $(\text{mg/kg-day})^{-1}$

The equations used to quantify risk for each exposure scenario are presented in Tables 4-5 and 4-6 in Appendix F.

Regulatory agencies have policies and guidelines to determine the significance of these calculated risk levels. EPA uses 1×10^{-6} to 1×10^{-4} as a "target range within which the Agency strives to manage risks as part of a Superfund cleanup" (EPA, 1991).

Soil

Future residents, commercial workers, and construction workers were each evaluated using two different exposure scenarios that assumed: 1) the current slab remains in place, and 2) the current slab is removed prior to redevelopment. Currently, the slab prevents direct contact and inhalation exposures to constituents beneath it. Cancer risk estimates for each receptor group and scenario are presented below.

Future Commercial

The total cancer risk associated with future commercial workers exposed to COPCs in perimeter surface soils (e.g., PAHs, total PCBs, and arsenic) is 8×10^{-5} (Table 4-9). This is based on the assumption that the slab remains in place and prevents exposure to constituents beneath it. COPCs with the highest individual cancer risks are arsenic (3×10^{-5}), followed by total PCBs (2×10^{-5}) and benzo(a)pyrene (2×10^{-5}). These risk levels are within the EPA target risk range of 1×10^{-6} to 1×10^{-4}. It should be noted that the cancer risk level for arsenic is driven by a single isolated elevated arsenic concentration of 69.1 mg/kg in sample SB-97-4, which is located just outside the furnace area. The maximum detected PCB concentration (146 mg/kg) was observed in sample SS-7, which was collected from the area of the Southeast Die Cast Room.

If the slab is removed, future commercial workers may be exposed to COPCs in soils immediately below the slab in addition to COPCs in the perimeter soils. For this commercial worker scenario, the total cancer risk is 1×10^{-4}, with the greatest risks being attributed to total PCBs (1×10^{-4}) (Table 4-10). The maximum detected PCB concentration (7,854 mg/kg) was observed in sample SB-97-7 from beneath the Former Die Casting Room area. Cancer risks attributed to arsenic are 1×10^{-5}, and are again attributed to a single isolated elevated arsenic concentration. The cancer risks for all other carcinogenic COPCs are on the order of 10^{-6} to 10^{-9}.

Future Residential

The total cancer risk associated with potential exposure of future residents (children and adults) to PAHs, total PCBs, and arsenic in perimeter surface soils is 4 x 10^{-4} (Table 4-11). This cancer risk level assumes that the slab remains in place and exposure occurs to COPCs in perimeter surface soil samples only. The highest individual COPC cancer risk (for combined child and adult) of 2 x 10^{-4} is attributed to arsenic, followed by benzo(a)pyrene (1 x 10^{-4}), and total PCBs (9 x 10^{-5}). The maximum detected arsenic concentration in surface soil (69.1 mg/kg) was observed in sample SB-97-4, which was collected adjacent to the furnace area. The maximum detected benzo(a)pyrene concentration (17 mg/kg) was observed in sample SS-21, which was collected from outside the Die Repair Room area. The cumulative cancer risk of 4 x 10^{-4} is greater than 1 x 10^{-4}.

Similar to the commercial worker scenario, if the slab is removed, future residents may also be exposed to soils immediately beneath the slab, in addition to perimeter soils. For this residential scenario, the total cancer risk is 6 x 10^{-4}, with the greatest risks being attributed to total PCBs (4 x 10^{-4}), followed by arsenic (7 x 10^{-5}) and benzo(a)pyrene (3 x 10^{-5}) (Table 4-12). Once again, the arsenic risk estimate is driven by a single isolated elevated arsenic concentration.

Future Construction Workers

Assuming that the slab remains in place (which prevents exposure to constituents beneath it), the total cancer risk level for construction workers is 1 x 10^{-6} (Table 4-13). The highest individual COPC cancer risk is associated with arsenic (1 x 10^{-6}).

The total cancer risk for construction workers using a dataset that includes perimeter soils as well as all soils beneath the current slab (i.e., assumes that the slab has been removed) is 5 x 10^{-6} (Table 4-14). The highest individual COPC cancer risk of 5 x 10^{-6} is associated with total PCBs. All other cancer risk levels for individual COPCs (PAHs and arsenic) are on the order of 10^{-8} to 10^{-11}.

Summary of Carcinogenic Risk for Soil

Total cancer risk estimates for the commercial and construction worker exposure scenarios are within the EPA target risk range of 1 x 10^{-6} to 1 x 10^{-4}. The total risk estimates for hypothetical future residential receptors of 4 x 10^{-4} (with slab) and 6 x 10^{-4} (slab removed) are greater than 1 x 10^{-4}.

Groundwater

Four VOCs (1,1,1-TCA, 1,1-DCE, TCE, and PCE), total PCBs, and arsenic were detected in groundwater above the Wisconsin ES, PAL groundwater standards, and/or EPA (2004b) Region 9 PRGs for drinking water. Cancer risks associated with construction worker dermal contact exposure to constituents in groundwater are presented in Table 4-15. The cumulative cancer risk is 1 x 10^{-7} and is less than the EPA target risk range of 1 x 10^{-6} to 1 x 10^{-4}. The highest carcinogenic risk is associated with PCE (7 x 10^{-8}) and total PCBs (4 x 10^{-8}) (Table 4-15).

In addition, an evaluation of the vapor intrusion to indoor air pathway was conducted for both nearby offsite residences and hypothetical future onsite residences. PCE was the only constituent whose concentrations exceeded the EPA VI screening criteria. Using maximum detected groundwater COPC concentrations from onsite and offsite wells, potential risks were estimated for this pathway using the Johnson-Ettinger (JE) model. Results indicated that onsite risk (8 x 10^{-5}) and offsite risk (7 x 10^{-5}) are within the EPA target risk range.

Non-Carcinogenic Health Hazards

The hazard index (HI) approach is used to characterize the overall potential for non-carcinogenic health hazards associated with exposure to multiple chemicals. This approach assumes that subthreshold chronic exposures to multiple chemicals are additive. The hazard index is calculated as follows:

$$HI = E1/RfD1 + E2/RfD2 + ... + Ei/RfDi$$

where:

HI = Hazard Index (HI)
E/RfD = Hazard Quotient (HQ)
Ei = exposure intake for the i^{th} chemical (mg/kg-day)
RfDi = RfD for the i^{th} chemical

Equations used to derive non-carcinogenic HQs for each exposure scenario are presented in Table 4-5 (soil) and Table 4-6 (groundwater). A HQ value greater than 1 indicates that a calculated exposure is greater than the RfD for a given constituent, and that there may be some potential for health concerns. Similarly, a HI greater than 1 indicates that overall exposure to all chemicals of interest may present concern for potential human health effects (USEPA, 1989).

Soil

Future Commercial

The non-cancer HI associated with future commercial workers exposed to COPCs in perimeter surface soils is 1 (Table 4-9), which is equal to the EPA target. This is based on the assumption that the slab remains in place and prevents exposure to constituents beneath it. This HI of 1 is attributed to total PCBs (HQ = 1). HQs for other COPCs are less than 0.2.

If the slab is removed, future commercial workers may be exposed to COPCs in soils immediately below the slab in addition to COPCs in the perimeter soils. For this worker scenario, the total non-cancer HI is 7, which exceeds the EPA target of 1 (Table 4-10). Total PCBs contribute most to the HI (HQ = 7). The maximum detected PCB concentration (7,854 mg/kg) was observed in sample SB-97-7 from beneath the Former Die Casting Room area. HQs for other non-carcinogenic COPCs are less than 0.1.

Future Residential

Non-cancer HIs associated with future residential exposure to constituents in surface soil (total PCBs and inorganics) for children and adults are 21 and 2, respectively, with total PCBs contributing HQs of 16 (child) and 2 (adult). For children, arsenic and thallium also contributed to the HI of 21, with HQs of 3 and 2, respectively (Table 4-11). For adults, the HQs for all other COPCs are less than 1. The maximum detected PCB concentration in shallow surface soil (146 mg/kg) was observed in sample SS-7, which was collected near the Southeast Die Cast Room area.

Non-cancer HIs were also derived for future residents assumed to be exposed to both perimeter soils and soils immediately beneath the slab (under the assumption that the slab is removed). For this residential scenario, non-cancer HIs for children and adults are 93 and 11, respectively (Table 4-12). Total PCBs are the main contributor to the HIs, with HQs of 88 and 11 respectively. For children, other COPCs with HQs greater than 1 are arsenic (1) and thallium (3). For adults, the HQs for other COPCs are less than 1.

Future Construction Worker

The non-cancer HIs associated with exposure of construction workers to combined surface and subsurface soils (but exclusive of soil beneath the slab) are less than 1 (0.6). The HQ for total PCBs is 0.4 and 0.1 for arsenic (Table 4-13). However, under the assumption that construction workers are exposed to constituents beneath the slab (assuming slab is removed for redevelopment purposes), the HI is greater than 1 (8) (Table 4-14). This HI is largely attributed to total PCBs (HQ of 8), and is greater that the EPA target of 1.

Summary of Non-Carcinogenic Hazards

The non-cancer HIs associated with exposure to constituents in site soils are less than 1 for future construction workers (assuming the slab remains in place). The non-cancer HI for the future commercial worker exposed to site soils with the slab in-place is equal to 1. For all other scenarios evaluated, the HI is greater than 1 and is generally driven by total PCBs.

Groundwater

For the construction worker dermal contact exposure scenario, the total non-cancer HI is less than 1 (HI of 0.3) (Table 4-15).

Lead

Because there are no standard toxicity values for lead that would allow for a typical risk/hazard calculation, potential risks associated with exposure to lead in soils are evaluated using the EPA (2002b) IEUBK Model and the EPA (2003) ALM.

Hypothetical Future Child Resident

Figure 4-2 shows the relationship between soil lead concentration and P10 statistic (probability of a blood lead level greater than or equal to 10 ug/dL) for child resident populations ages 1-84 months using EPA's IEUBK Model (EPA, 1994; Windows version 1, Build 263) with default input parameters. According to the model, the target risk of P10 equal to 5% is exceeded when the soil lead concentration is greater than 340 mg/kg. Consistent with EPA (2002b) guidance, arithmetic mean soil lead concentrations were used in the IEUBK model. The soil lead concentration for the slab-in-place scenario is 110 mg/kg which yields a P10 of 0%. The soil lead concentration for the slab-removed scenario is 103 mg/kg, which also yields a P10 of 0%. As such, the soil lead concentration, for both the slab-in-place and slab-removed scenarios yields a P10 value less than 5%, which indicates that soil lead levels will not pose a concern for hypothetical future child residents.

Future Construction Worker

Figure 4-3 shows the relationship between soil lead concentration (PbS, mg/kg) and P10 statistic for construction workers using the EPA (2003) ALM Model. The target risk of P10 of 5% is exceeded when the soil lead concentration is greater than 632 mg/kg. Consistent with EPA (2003) guidance, arithmetic mean soil lead concentrations were used in the ALM model. Specifically, the soil lead concentration used for the slab-in-place scenario was 81 mg/kg, and the concentration used for the slab-removed scenario was 173 mg/kg. The soil lead concentrations for the two scenarios are less than 632 mg/kg, and therefore lead levels in soil are below a level of concern for the construction worker.

Vapor Intrusion

An evaluation of the vapor intrusion to indoor air pathway was conducted for the Plant 2 Site. Specifically, the potential for VOCs to affect the indoor air quality of nearby offsite residences and hypothetical future onsite residences was evaluated. This evaluation relies on relevant guidance on vapor intrusion (VI) evaluations, specifically the Wisconsin Department of Health and Family Services (WDHFS) (2003) *Chemical Vapor Intrusion and Residential Indoor Air*, and EPA (2002c) *Draft Guidance for Evaluating Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*. The Wisconsin guidance generally refers to the EPA (2002c) guidance which consists of the three-tiered approach: tier 1 primary screening to simply determine whether the potential for vapor intrusion exists; tier 2 comparison of observed VOC concentrations (groundwater and/or soil vapor) to generic screening values; and tier 3, a site-specific assessment that may involve modeling or collection of additional data.

Tier 2 Evaluation

Based on VOCs detected onsite and in offsite well MW-06-4, EPA (2007b) determined that the potential for VI into offsite residences and hypothetical onsite residences exists. Consistent with the USEPA (2002c) tier 2 approach, VOC concentrations in onsite wells and offsite well MW-06-4 were compared to generic EPA (2002c) groundwater screening criteria. While EPA (2002c) provides three sets of screening values based on target cancer risk levels of 1 x 10^{-4}, 1 x 10^{-5} and 1 x 10^{-6}, the most conservative values (1 x 10^{-6}) were used consistent with Wisconsin guidance (see Tables below). Results show that all VOC concentrations in offsite well MW-06-4 were less than conservative screening criteria except PCE (100 ug/L in October 2006 and 51 ug/L in March 2007). Likewise, results show that all onsite VOC concentrations were less than screening criteria, except for PCE, which was detected above 5 µg/L in several wells (MW-97-4, MW-97-5, MW-03-4R, MW-06-1, MW-06-2, and MW-06-3). The maximum detected PCE concentration (110 µg/L) was observed in well MW-03-4R in 2003. Consistent with the EPA tier 2 approach, the maximum PCE concentrations were then compared to more site-specific screening criteria calculated using attenuation factors based on actual soil type. As shown in the tables below, the maximum PCE concentration was greater than the highest screening value listed (11 ug/L based on a 1 x 10^{-6} cancer risk level). As such, results of the Tier 2 screening indicate that additional site-specific evaluation is warranted. [Note that other available EPA (2002c) PCE screening criteria based on 1 x 10^{-5} and 1 x 10^{-4} target risk levels are 11 ug/L and 110 ug/L, respectively. The maximum detected PCE concentration in offsite well MW-06-4 (100 ug/L) is less than this latter value, and the maximum detected PCE concentration in onsite wells (110 ug/L) is equal to this value.]

Table 1 - Comparison of Offsite VOC Concentrations in Groundwater to EPA Groundwater Screening Values

Volatile Constituent	Maximum Detected at Concentration at Offsite Well MW-06-4	EPA Generic GW Screening Values – Table 2C)
	(ug/L)	(ug/L)
1,1,1-Trichloroethane	70	3100
1,1-Dichloroethane	1.1	2200
1,1-Dichloroethene	4.6	190
1,2,3-Tricholorobenzene	NA	3400
2-Butanone	ND(5)	440,000
cis-1,2-Dichloroethene	1.3	210
sec-Butylbenzene	NA	250
Tetrachloroethene (PCE)	**100**	5 [5 to 11]
Trichloroethene	0.57 J	5

Notes:

NA = Not analyzed.

ND = Non-detect. Value in parentheses is associated laboratory detection limit.

Values in square brackets present the range of attenuation factor-specific screening values listed in EPA Table 3c.

Table 2 - Comparison of Onsite VOC Concentrations in Groundwater to EPA Groundwater Screening Values

Volatile Constituent	Maximum Detected Onsite Concentration	EPA Generic GW Screening Values – Table 2C)
	(ug/L)	(ug/L)
1,1,1-Trichloroethane	200	3100
1,1-Dichloroethane	3.1	2200
1,1-Dichloroethene	12	190
1,2,3-Tricholorobenzene	4	3400
2-Butanone	1.6	440,000
cis-1,2-Dichloroethene	5.2	210
sec-Butylbenzene	1.55	250
Tetrachloroethene (PCE)	**110**	5 [5 to 11]
Trichloroethene	2	5

Notes:

Values in square brackets present the range of attenuation factor-specific screening values listed in EPA Table 3c.

Tier 3 Evaluation

The Johnson-Ettinger (JE) model (EPA, 2004c) was used to estimate the extent of PCE volatilization from groundwater to indoor air of offsite residences and hypothetical onsite residences. Potential cancer risks associated with exposure to PCE via inhalation of indoor air were also estimated using the JE model. The JE model is intended as a screening tool only and should not be the sole basis for remedial action. For this evaluation, the EPA (2004c) recommended default values for all model input parameters were used except: 1) groundwater temperature, 2) soil type, and 3) groundwater depth. The site-specific information is based on boring logs for offsite well MW-06-4 and onsite well MW-03-4R, and soil survey information for Ozaukee County.

Average Groundwater Temperature

The JE model allows site-specific groundwater temperature inputs to account for reduced volatility under colder temperatures. The groundwater temperature used in the model is 5.5°C, which is estimated based on the EPA (2004d) *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings* (the model default value is 10°C).

Soil Type

The soil type and the associated water-filled porosity are used to estimate the soil vapor permeability of the soil in contact with the hypothetical basement floor. The boring log for offsite well MW-06-4 identifies a mix of soil types including sand, silt and clay; the top 2 feet is generally sand, followed by clay from about 2.5 to 4 feet, followed by a mix of varying layers of sand, clay and silt to sand/gravel at 6 to 8 feet (which may simply be weathered bedrock encountered just above the water table). The boring log for onsite well MW-03-4R identifies a mix of soil types including sand, gravel, and silt; the top two feet is generally sand, followed by gravel/rock from 2 to 4 feet, followed by sand and silt from 5 to 6 feet and coarse material at deeper depths. Based on the soil types presented in the boring logs, as well as information presented in the USGS soil survey for Ozaukee county, silt loam was chosen as the vadose zone soil type for the JE model. Because coarse grade material (e.g., sand/gravel) is present at deeper depths in wells MW-06-4 and MW-03-4R, sand was conservatively chosen as the soil type immediately above the water table.

Depth to Groundwater

Groundwater depth at MW-06-4 was reported as 8.1 feet in October 2006 and 7.7 in March 2007. To be conservative, the shallower groundwater depth of 7.7 feet was used in the JE model. Groundwater depth at MW-03-4R ranged from 6.6 to 9.7 ft bgs from 2003 to 2007. The average of the 2007 groundwater depths (7.5 feet) was used in the JE model.

Results

Using conservative default assumptions and the site-specific parameters described above, JE model results show an estimated PCE inhalation cancer risk of 7×10^{-5} for potential offsite exposures and 8×10^{-5} for potential onsite exposures, both of which are within the EPA target risk range of 1×10^{-4} to 1×10^{-6}. These risks are based on the modeled indoor air concentration associated with the maximum detected PCE concentrations (100 ug/L for offsite well MW-06-4 and 110 ug/L for onsite well MW-03-4R).

7.3 Risk Assessment Conclusions

Results of the HHRA show that total cancer risks for all soil scenarios are within the EPA target risk range of 1×10^{-6} to 1×10^{-4}, with the exception of the total residential risks of 4×10^{-4} for the slab-in-place scenario and 6×10^{-4} for the slab-removed scenario. The highest carcinogenic risks are associated with total PCBs, arsenic, and benzo(a)pyrene. The non-cancer HIs associated with exposure to constituents in Site soils are less than 1 for future construction workers (assuming the slab remains in place). The HI for the future commercial worker scenario (slab-in-place) is 1. For all other scenarios evaluated, the HI is greater than 1 and is driven by total PCBs.

While non-cancer HIs greater than 1 have been identified for construction workers potentially exposed to constituents beneath the slab (HI = 8), these soils are not likely to pose a risk as long as the slab floor remains in place (non-cancer HIs for intrusive workers exposed only to surface and subsurface soils from around the perimeter of the former plant are less than 1 [HI of 0.6]). In addition, the current slab should limit rainwater infiltration and potential migration of constituents from soil into groundwater.

Potential risks/hazards associated with exposure to lead-containing soils were determined for both the hypothetical future child resident and the future construction worker. Results indicated that soil lead concentrations would not result in blood lead levels greater than the target level of 10 ug/dL for a hypothetical future child resident. Likewise, soil lead levels would not pose a concern to future construction workers. Arithmetic mean soil lead concentrations of 81 mg/kg (slab-in-place) and 173 mg/kg (slab-removed) are less than the model-predicted acceptable target concentration of 632 mg/kg.

PCB concentrations in groundwater are low and near the detection limit. Detected total PCB concentrations reported above the ES (0.00003 mg/L) and/or PAL (0.000003 mg/L) ranged from 0.00025 to 0.0009 mg/L in samples collected from three on-site monitoring wells at two locations. To put these concentrations into perspective, the reported PCB concentrations are less than or near the analytical detection limit of 0.00050 mg/L (detection limit used for previous groundwater data collected for the Site), and the PCB groundwater standards (ES and PAL) are actually less than this PCB detection limit. In addition, PCBs have not been detected in off-site monitoring wells. Arsenic was the only inorganic to exceed its respective PAL of 0.001 mg/L, but did not exceed the ES of 0.010 mg/L.

An evaluation of the vapor intrusion to indoor air pathway was conducted for both nearby offsite residences and hypothetical future onsite residences. PCE was the only constituent whose concentrations exceeded the EPA VI screening criteria. Using maximum detected groundwater COPC concentrations from onsite and offsite wells, potential risks were estimated for this pathway using the JE model. Results indicated that onsite risk (8×10^{-5}) and offsite risk (7×10^{-5}) are within the EPA target risk range.

In summary, certain constituents in Plant 2 Site soils may pose a concern to potential future residents, commercial workers, and/or construction workers. However, it is important to note that these estimates are based on reasonable maximum scenarios that consider: 1) maximum detected COPC concentrations (for some constituents, e.g., arsenic), 2) soil exposure frequencies that do not reflect seasonal factors (e.g., the lack of exposure to soils during the winter months), and 3) the fact that accessible surface soils are currently limited to a relatively small area around the perimeter of the Plant 2 Site.

As previously mentioned, because the Plant 2 Site itself is a building slab and parking area with little or no unpaved surfaces, and because it is located in a residential/commercial/industrial area, available habitat is not considered suitable for ecological receptors. Therefore, an ecological risk assessment was not conducted.

8.0 Remedial Action Objectives and ARARS

8.1 Remedial Action Objectives (RAOs)

RAOs are remedial goals for protecting human health and the environment. These objectives are used in the development of specific alternatives (i.e., alternatives are developed in consideration of site objectives), and later as a criterion in the evaluation of the various alternatives (i.e., evaluation of the extent to which each alternative would achieve the RAOs). The specific RAOs developed for the Plant 2 Site are:

- Protect human health by reducing or eliminating exposure of future site users to soils containing PCBs or other site-related COCs representing an excess cancer risk greater than 10^{-6}, a hazard index (HI) greater than 1, and State of Wisconsin standards per NR 720.

- Protect human health by preventing exposure to site groundwater with COCs in excess of regulatory or risk-based standards.

- Monitor contaminant levels in groundwater in order to assess compliance with Maximum Contaminant Levels (MCLs), State of Wisconsin NR 140 groundwater standards, and the need for further actions.

Thus, the focus of the remedial effort will be to minimize exposure to site soils and groundwater potentially posing a risk to human health and to assess the groundwater for further action.

8.2 Applicable or Relevant and Appropriate Requirements (ARARs)

CERCLA, as amended by SARA, specifies that Superfund Remedial actions must comply with the substantive requirements of federal and state environmental laws. Such requirements may be ARARs. In addition to ARARs, federal and state advisories and guidance documents exist that, although not binding regulations, contain information “to be considered” (TBC). ARARs and TBCs are important in developing remedial objectives that comply with regulatory requirements or guidance (as appropriate). The identification of site-specific ARARs is based on specific constituents at a site, the various response actions proposed, and the general site characteristics. As such, ARARs are classified into three general categories:

Chemical-specific ARARs – specific to the type(s) of constituents, pollutants, or hazardous substances at a site; include state and federal requirements that regulate contaminant levels in various media;

Action-specific ARARs – specific to the cleanup activities being considered; usually technology- or activity-based; regulatory requirements that define acceptable excavation, treatment, and disposal procedures; and

Location-specific ARARs – specific to actions at the geographic location; requirements for contaminant concentrations or remedial activities resulting from a site’s physical location (e.g., wetlands or floodplains).

Potentially applicable federal, state and local ARARs and TBCs are summarized in Appendix C.

9.0 Description of Alternatives

Following development of the RAOs, a screening and evaluation of potential remedial alternatives was conducted in accordance with CERCLA and the NCP in the FFS Report.

The technologies were assembled into remedial alternatives that meet RAOs and satisfy ARARs. The specific details of the remedial components discussed for each alternative are intended to serve as representative examples.

A number of potential remedial scenarios were developed to address soil and groundwater at the Site considering available and applicable remedial technologies. The alternatives were developed in cooperation with WDNR. When developing the alternatives, emphasis was placed on reducing the potential for human exposure to site-related constituents. The alternatives were developed considering overall effectiveness, implementability, and relative cost.

9.1 Description of Remedy Components

Each of the alternatives is briefly described below. More detailed information about each of the alternatives can be found in the FFS report, which is included in the Administrative Record for the Site.

Alternative 1 – No Action

Under Alternative 1, no active remediation would occur at the Plant 2 Site. Required under the NCP, this alternative serves as a baseline against which the alternatives with active remedial components are compared. This alternative considers only ongoing natural recovery processes at the Plant 2 Site, and does not incorporate institutional controls or monitoring. The existing fencing and cap would remain at the Plant 2 Site; however, their condition would not be monitored or maintained, potentially allowing for exposure to COCs in Plant 2 Site soils in the future. In addition, no restrictive covenants would be implemented to control future use of the Plant 2 Site.

Alternative 2 – Capping with Groundwater Monitoring

Alternative 2 requires that the site fence, concrete slab, and cap currently covering the Plant 2 Site would continue to be monitored and maintained as a direct contact barrier and to prevent surface water infiltration. Periodic monitoring of site groundwater would be performed to help determine the extent of groundwater contamination at and adjacent to the Plant 2 Site. Additional groundwater monitoring wells would be installed and developed. Institutional controls (restrictive covenants) would be implemented to control groundwater use at the Plant 2 Site. In addition, restrictive covenants would be implemented to control future use of the Plant 2 Site. Municipal drinking water is supplied to the Site and surrounding area by the Cedarburg Light & Water Utility, and City Ordinance No. 2005-12 (City of Cedarburg, 2005) requires all private supply wells be permitted for operation. City Ordinance No. 2005-12 also restricts the drilling of new private supply wells in the City; the Utility will only approve a new private well if the homeowner can justify its need in addition to water provided by the public water system. In addition, use of groundwater at the Plant 2 Site, as well as offsite, would be restricted through continued implementation of this City ordinance.

Alternative 3 – Removal of Surface Soil with Groundwater Monitoring

Alternative 3 assumes the Plant 2 Site will be redeveloped and a majority of the concrete slab will remain in place. In order to ensure continuity and adherence to institutional and engineering controls, deed restrictions, may be appropriate, and would be employed. All surface soils from approximately 0 to 2 feet depth around the perimeter of the existing concrete slab would be removed to reduce risk associated with potential direct contact. Removal would include shallow subsurface soils around the perimeter of the Site with PCB concentrations above 1 ppm. Removal areas would be backfilled with clean soil. Soils would be removed using readily available earthmoving equipment, such as backhoes, and properly disposed at an off-site disposal facility.

To reduce the risk to construction workers and others, the concrete slab would be removed only to the extent needed to accommodate the possible redevelopment of the Plant 2 Site and soils would be excavated only to the depth necessary for construction. Clean soil would be backfilled into the excavation areas to reduce the risk to future construction workers. The rest of the slab would remain across the Plant 2 Site to eliminate direct contact and minimize surface water infiltration, and would be incorporated into the design of any future site structure. Periodic monitoring of site groundwater would be performed to help determine the extent of groundwater contamination at and adjacent to the Plant 2 Site. Additional groundwater monitoring wells would be installed and developed.

In addition, institutional controls (restrictive covenants) would be implemented to control future use of the Plant 2 Site, limiting the use and providing for appropriate cap maintenance. Use of groundwater at the Plant 2 Site, as well as offsite, would also be restricted using restrictive covenants and/or through continued implementation of City Ordinance No. 2005-12.

Alternative 4 - Removal of Surface Soils and Subsurface Soils, with Groundwater Monitoring

Alternative 4 assumes the Plant 2 Site will be redeveloped and removal of the concrete slab will be required in order to excavate higher contaminated areas. All surface soils from approximately 0 to 2 feet around the perimeter of the existing concrete slab would be removed as necessary to reduce risk associated with potential direct contact. Removal would include shallow subsurface soils around the perimeter of the Site with PCB concentrations above 1 ppm. Removal areas would be backfilled with clean soil. Soils would be removed using readily available earthmoving equipment, such as backhoes, and properly disposed at an off-site disposal facility.

Excavation would be conducted (i) where needed to accommodate the possible redevelopment of the Plant 2 Site and (ii) in targeted areas where former operations evidenced elevated constituent impacts. More specifically, the targeted areas were defined based on the detection of elevated PCB (> 50 ppm) or VOC concentrations in soils and the locations of the likely sources within the former building (e.g., sumps, pits, trenches). Additional sampling would be performed in areas slated for removal as a result of PCB detections prior to remediation to further verify the limits of the excavation. A plan would be developed and approved by EPA describing the sampling approach, and would show proposed sample locations. The excavation of subsurface soil with elevated concentrations reduces potential future risk.

The concrete slab would be removed to the extent necessary for targeted excavations or as needed to accommodate the possible redevelopment. Excavations for possible footings would be conducted at such limited locations as necessary across the Plant 2 Site and soils would be excavated to the depth necessary for construction. Clean soil would be backfilled around the concrete footings. In the areas of elevated concentrations, targeted excavations would be conducted. The rest of the slab would remain across the Plant 2 Site to eliminate direct contact and minimize surface water infiltration. Periodic monitoring of site groundwater would be performed to help determine the extent of groundwater contamination at and adjacent to the Plant 2 Site. Additional groundwater monitoring wells would be installed and developed.

In addition, institutional controls (restrictive covenants) would be implemented to control future use of the Site, limiting the use and providing for appropriate cap maintenance. Use of groundwater at the Site, as well as offsite, would also be restricted using restrictive covenants and/or through continued implementation of City Ordinance No. 2005-12.

9.2 Common Elements and Distinguishing Features of Each Alternative

With the exception of Alternative 1 – No Action, each of the remedial alternatives address the primary exposure route of direct contact with affected site media. Alternatives 2 through 4 each meet the RAOs of reducing or eliminating exposure of future site users to soils (RAO No. 1) and groundwater (RAO No. 2). The potential exposure to site soils is generally related to anticipated future use of the Plant 2 Site. Alternative 2 assumes that the Plant 2 Site would not be developed in the future and the existing liner and stone cap would remain and be maintained. Alternatives 3 and 4 assume a future use of the Plant 2 Site (non-industrial) and incorporate additional measures (i.e., soil removal beneath the existing building slab) to reduce potential exposure to affected soil during potential onsite excavation. The alternatives incorporate more aggressive removal of materials relative to the future-use scenario.

Alternatives 2 through 4 each incorporate groundwater monitoring as a means of helping to determine the extent of groundwater contamination at and adjacent to the Plant 2 Site. Alternatives 2 through 4 would include installing new groundwater monitoring wells.

The estimated time for completion of remedial action for Alternatives 3 and 4 is 6 to 9 months. The implementation of Alternative 2 would require 2 to 3 months and Alternative 1 would not require any time. The estimated total costs for Alternative 1 are $0, for Alternative 2 are $370,000, for Alternative 3 are $840,000, and for Alternative 4 are $2.7 million.

9.3 Expected Outcomes of Each Alternative

If Alternative 1 is implemented, the COCs in environmental media at the Plant 2 Site would continue to pose unacceptable risk to adults and children. If Alternatives 2 or 3 are implemented, the risks will be within acceptable levels, however, it will likely be more difficult to redevelop the property. If Alternative 4 is implemented, the risks will be within acceptable risk levels and the reuse of the property will be more feasible.

Groundwater usage, which does not occur in OU1, will not change regardless of the alternative that is implemented.

If Alternative 1 or 2 is implemented, the area in and around OU1 will likely not change from its current condition and will continue to have a negative association of PCB contamination. If Alternative 3 is implemented, there may be a negative association attached to the area because the higher contamination will remain in the subsurface soils. If Alternative 4 is implemented, the contaminated areas in excess of the cleanup levels will be remediated and this may facilitate the area being redeveloped and revitalized. Currently, the City of Cedarburg is interested in neighborhood revitalization, with the remediation of OU1 being a step in that process.

9.4 Preferred Alternative

The preferred alternative described in the Proposed Plan for the Cedar Creek OU1 - Plant 2 Site is Alternative 4. The estimated cost of the preferred alternative is $2.7 million.

10.0 Summary of Comparative Analysis of Alternatives

This section explains the EPA's rationale for selecting the preferred alternative. The EPA has developed nine criteria to evaluate remedial alternatives to ensure that important considerations are factored into remedy selection decisions. These criteria are derived from the statutory requirements of Section 121 of CERCLA, the NCP, as well as other technical and policy considerations that have proven to be important when selecting remedial alternatives. When selecting a remedy for a site, EPA conducts a detailed analysis of the remedial alternatives consisting of an assessment of the individual alternatives against each of the nine evaluation criteria and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The nine evaluation criteria are described in more detail below.

Threshold Criteria

Threshold criteria are standards that all alternatives must meet in order to be selected as a remedy for the site. There is little flexibility in meeting the threshold criteria. If ARARs cannot be met, a waiver may be obtained where one or more site exceptions occur as defined in the NCP.

Overall Protection of Human Health and the Environment. Protectiveness is the main requirement that remedial actions must meet under CERCLA. It is an assessment of whether each alternative achieves and maintains adequate protection of human health and the environment. A remedy is protective if it eliminates, reduces, or controls all current and potential risks posed by the site through each exposure pathway. Adequate engineering controls, land use controls, or some combination of the two can be implemented to control exposure and thereby ensure reliable protection of human health and the environment over time. In addition, implementation of a remedy cannot result in unacceptable short-term risks or cross-media impacts on human health and the environment.

Compliance with ARARs. Compliance with ARARs is a statutory requirement of remedy selection. This criterion is used to determine whether the selected alternative would meet the federal, state, and local ARARs identified in Appendix C. A discussion of the compliance of each alternative with chemical-, location-, and action-specific ARARs is included.

Primary Balancing Criteria

Balancing criteria are used to weigh tradeoffs between alternatives. These represent the standards upon which the detailed evaluation and comparative analysis of alternatives are based. A high rating for one criterion can generally compensate for a low rating on another of the balancing criteria.

Long-Term Reliability and Effectiveness. Long-term reliability and effectiveness reflects CERCLA's emphasis on implementing remedies that will protect human health and the environment in the long term. Under this criterion, results of a remedial alternative are evaluated in terms of the risk remaining at the site after response objectives are met. The primary focus of the evaluation is the extent and effectiveness of the actions or controls that may be required to manage the risk posed by treatment residuals or untreated wastes.

Factors to be considered and addressed are magnitude of residual risk, adequacy of controls, and reliability of controls. Magnitude of residual risk is the assessment of the risk remaining from untreated waste or treatment residuals after remediation. Adequacy and reliability of controls is the evaluation of the controls that can be used to manage treatment residuals or untreated wastes that remain onsite.

Reduction of Toxicity, Mobility, or Volume through Treatment. This criterion addresses the statutory preference for remedies that employ treatment to significantly reduce the toxicity, mobility, or volume of the hazardous substances. That preference is satisfied when treatment is used to reduce the principal threats at a site by destroying toxic chemicals or reducing the total mass or total volume of affected media. This criterion is specific to evaluating only how the treatment reduces toxicity, mobility, and volume. Specifically, the analysis will examine the magnitude, significance and irreversibility of reductions. It does not address containment actions, such as capping.

Short-Term Effectiveness. This criterion examines the short-term impacts associated with implementing the alternative. Implementation may affect workers, the neighboring community, or the surrounding environment. Short-term effectiveness also includes potential threats to human health and environment associated with excavation, treatment and transportation of hazardous substances; potential cross-media impacts of the remedy; and the time required to achieve protection of human health and the environment.

Implementability. Implementability considerations include technical and administrative feasibility of the alternatives, as well as the availability of goods and services (including treatment, storage or disposal capacity) associated with the alternative. Implementability considerations often affect the timing of remedial actions (for example, limitations on the season in which the remedy can be implemented, the number and complexity of material handling steps, and the need to secure technical services). Onsite activities must comply with the substantive parts of applicable permitting regulations.

Cost. The detailed cost analysis of alternatives includes capital and annual O&M costs incurred over a period of 50 years in accordance with EPA guidance *Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. The focus during the detailed analysis is on the net present worth of these costs. Costs are used to select the most cost-effective alternative that will achieve the remedial action objectives.

The cost estimates are prepared to have accuracy in the range of –30 to +50 percent. The exact accuracy of each cost estimate depends upon the assumptions made and the availability of costing information. Present worth will be calculated assuming the current discount rate established by the Office of Management and Budget.

Modifying Criteria

Modifying criteria are evaluated by addressing comments received after the regulatory agencies and the public have reviewed the FFS and Proposed Plan. This evaluation is presented in the Responsiveness Summary, found in Appendix A.

State Acceptance. This criterion evaluates the technical and administrative issues and concerns the state may have regarding the alternatives. This is addressed by receiving comments on the RI/FS Report and the Proposed Plan.

Community Acceptance. This criterion evaluates the issues and concerns the public may have regarding the alternatives. This is addressed by receiving comments documented during the public comment period.

The full text of the detailed analysis of the four remedial alternatives against the nine evaluation criteria (including both the individual analysis and the comparative analysis) is contained in the FFS Report for the Cedar Creek OU1 - Plant 2 Site, which is part of the Administrative Record for the Plant 2 Site. Because the two Modifying Criteria cannot be fully evaluated until the public comment is closed, they were not evaluated in the FFS. The Responsiveness Summary of this ROD contains a more detailed discussion of public comments received.

This section of the ROD presents a comparative analysis of the remedial alternatives presented for the Plant 2 Site. The purpose of the comparative analysis is to identify the relative advantages and/or disadvantages of each remedial action alternative. The NCP is the basis for the detailed comparative analysis.

10.1 Overall Protection of Human Health and the Environment

With the exception of Alternative 1 – No Action, each of the remedial alternatives addresses the primary exposure route of direct contact with affected site media. Alternatives 2 through 4 each meet the RAOs of reducing or eliminating exposure of future site users to soils (RAO No. 1) and groundwater (RAO No. 2). The potential exposure to site soils is generally related to anticipated future use of the Plant 2 Site. Alternative 2 assumes that the Plant 2 Site would not be developed in the future and the existing liner and stone cap would remain and be maintained. Alternatives 3 and 4 assume a future use of the Plant 2 Site (non-industrial) and incorporate additional measures (i.e., soil removal beneath the existing building slab) to reduce potential exposure to affected soil during potential onsite excavation. The alternatives incorporate more aggressive removal of materials relative to the future-use scenario.

Alternatives 2 through 4 each incorporate groundwater monitoring as a means of helping to determine the extent of groundwater contamination surrounding the Plant 2 Site. Alternatives 2 through 4 would include installing new groundwater monitoring wells.

10.2 Compliance with ARARs

Chemical Specific ARARs: The primary chemical-specific ARARs for this OU1 include soil and groundwater quality standards. Alternatives 1 and 2 do not include any soil removal or treatment and do not effectively address the chemical-specific soil ARARs (e.g., PCBs - 50 ppm for TSCA). Alternatives 3 and 4 incorporate soil removal as part of the remedial activities. Alternative 4 incorporates removal of a larger soil volume and will remove soil containing higher PCB concentrations. Alternatives 2 through 4 each incorporate continued groundwater monitoring. Based on current information, Alternatives 2 through 4 have a comparable potential for meeting the chemical-specific groundwater ARARs.

Action-Specific ARARs: Action-specific ARARs that apply to this alternative include remedial activity requirements (e.g., Resource Conservation and Recovery Act [RCRA] and TSCA requirements) and health and safety requirements. Compliance with action-specific ARARs would be accomplished by following an EPA-approved RD/RA Work Plan and a site-specific Health and Safety Plan (HASP). Based on current information, Alternatives 2 through 4 have a comparable potential for meeting the action-specific ARARs.

Location-Specific ARARs: Each alternative possesses equal potential for meeting the location-specific ARARs. Potentially applicable location-specific ARARs include historic preservation-related requirements, although no issues are anticipated with this Site.

All the ARARs are presented in Tables 2-1 and 2-2 in Appendix C.

10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness for Alternative 2 is primarily dependant upon maintaining the integrity of the existing surface cover, institutional controls, and deed restrictions. Alternatives 3 and 4 provide potentially more permanence due to less emphasis on maintenance and an increase in removal of affected media. Alternative 4 involves the most removal, and includes removal of VOC-containing soils. All three of these alternatives would be effective at reducing the primary exposure route of direct contact with affected site media.

10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives include treatment to reduce toxicity, mobility or volume of the COCs. The treatment of contaminated PCB soils in place has not been demonstrated for long term permanence and effectiveness.

10.5 Short-Term Effectiveness

Alternatives 1 and 2 do not involve any invasive activities to implement the remedies. Therefore there are no short-term impacts. Alternatives 3 and 4 include soil removal which could potentially present a complete exposure pathway between onsite workers or trespassers to affected site media. Alternative 4 includes removal of soils containing higher concentrations of COCs and thus may pose additional risks in the short term. Under both of these alternatives, the potential exposure would be addressed by utilizing engineering controls to reduce the possibility of releases, using appropriate PPE, adhering to a site-specific HASP, and restricting access to the Plant 2 Site via security fencing.

10.6 Implementability

Each of the remedial alternatives is implementable. The remedial technologies are well understood and present no unusual challenges for construction. Although readily implementable, Alternative 4 would be the more difficult to implement of the four alternatives, possibly requiring sheetpiling to prevent slope failure during removal, including the subslab, beneath the Former Die Casting Room. Common to Alternatives 3 and 4 is the need for coordination with the future redevelopment of the property. Alternatives 3 and 4 incorporate removal of subsurface material to facilitate installation of subsurface foundations and utilities associated with potential redevelopment of the property. These potential difficulties for both alternatives could be addressed by prior planning/coordination and frequent communication.

10.7 Cost

There are no costs associated with Alternative 1. Costs increase from lowest to highest from Alternatives 2 through 4 due to effort and volume of material removed (in Alternatives 3 and 4). The table below summarizes the estimated costs associated with each of the remedial alternatives presented above.

Remedial Alternative	Estimated Capital Cost	Estimated Annual O&M Cost	Estimated Total Cost
Alternative 1 – No Action	$0 M	$0 M	$0 M
Alternative 2 – Capping with Groundwater Monitoring	$0.09 M	$0.28 M	$0.37 M
Alternative 3 – Removal of Surface Soils with Groundwater Monitoring	$0.64 M	$0.20 M	$0.84 M
Alternative 4 – Removal of Surface Soils and Subsurface Soils, with Groundwater Monitoring	$2.5 M	$0.20 M	$2.7 M

10.8 State Acceptance

The State Agency, WDNR, has been involved with the Site prior to EPA taking the lead, and has continued to be involved in all steps of the RI/FS for the Plant 2 Site. The WDNR concurs with the selection of Alternative 4. A letter of concurrence from the State can be found in Appendix B.

10.9 Community Acceptance

During the public comment period on the Proposed Plan, the community expressed very few concerns with the proposed remedy for the Cedar Creek OU1 - Plant 2 Site. This ROD includes a responsiveness summary that summarizes the public comments and EPA's response to those comments. The responsiveness summary is included as Appendix A.

11.0 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threat posed by a site wherever practicable. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The PCB contamination found in the soils at the Cedar Creek OU1 - Plant 2 Site is considered to be highly toxic. Therefore, the principal threat waste definition applies to the contamination at this Plant 2 Site.

12.0 Selected Remedy

This section describes the selected remedy and provides EPA's reasoning behind its selection. Alternatives can change or be modified if new information is made available to EPA through further investigation or research. An appropriate range of alternatives was developed, based upon initial screening of technologies, potential for contaminants to impact the environment, and site-specific RAOs and goals.

12.1 Identification of the Selected Remedy and Summary of the Rationale for its Selection

Based on the analysis of the nine criteria as summarized in Section 10 of this ROD, the selected remedy for the Cedar Creek OU1 - Plant 2 Site is Alternative 4. This alternative represents the best balance of overall protectiveness, compliance with ARARs, long-term effectiveness and permanence, cost, and other criteria. It is also the alternative favored by the WDNR and the community.

12.2 Description of the Selected Remedy

Alternative 4 would include removal of affected soils around the perimeter and beneath the existing concrete building slab to prevent potential future exposure or releases. Under this alternative, the following soils would be targeted for removal:

- Surface soils surrounding the concrete slab and up to the fence line to the north and south and up to the sidewalks adjacent to St. John and Madison Avenues to the east and west (respectively) would be excavated to a depth of approximately 2 feet bgs to address the presence of PCB-affected surface and shallow subsurface soils. Removal would include shallow subsurface soils around the perimeter of the Plant 2 Site with concentrations above 1 ppm.

- Soils beneath the concrete slab, to the extent necessary, to support installation of foundations and/or utilities associated with possible redevelopment of the Plant 2 Site.

- Soils with higher concentrations of PCBs would be removed to prevent potential future exposure or releases. These soils are in targeted areas where former operations evidenced elevated PCB impacts; more specifically, in areas limited to the footprint of some former sumps, pits, and/or trenches, where PCB concentrations (> 50 ppm) in excess of TSCA were detected in subsurface soils. Excavation has been assumed to bedrock.

- Shallow soils (up to 4 feet in depth) beneath Sumps 3 and 5, as well as at sample location B2 (in the vicinity of a former drainage ditch, Figure 4-2), where the highest VOC concentrations were detected. (Elevated metals concentrations were also detected at location B2.)

This alternative would also include the removal, management, and disposal of any sections of the concrete building slab necessary to support sub-slab soil removal. The anticipated maximum limits of the soil (and the concrete slab) to be removed under this alternative are shown on Figure 4-2. The areas of removal, or removal zones, were purposely expanded around the sample locations containing elevated PCBs to provide a buffer coincident with and/or beyond the limits of the historic sumps/trenches, which based on the RI sampling results, represent the source of the underlying COCs in the soil. Excavation activities would be conducted using a backhoe, excavator and/or other appropriate earthmoving equipment. Sheetpiling may be necessary to allow for excavation of the higher concentration PCB soils at depth below the building slab.

Additional soil removal beneath the existing concrete building slab is included under this alternative due to the increased potential for intrusive activities (utility installation, general construction, installation of foundation).

Approximately 4,700 CY of soil and concrete would be removed and managed under this alternative to meet the above objectives. The excavated soil would be stockpiled onsite to facilitate characterization of the material prior to transportation and offsite disposal. Soil stabilization/dewatering are not part of this alternative as excavation activities would primarily take place above the water table. Based on results obtained for soil samples collected during the investigation activities conducted at the Plant 2 Site, approximately 3,000 CY of the soil/concrete waste contains PCBs at concentrations greater than 50 ppm. Excavated material containing PCBs at concentrations less than 50 ppm would be transported for off-site disposal at a non-hazardous waste disposal facility. Excavated material containing PCBs at concentrations greater than 50 ppm would be transported for disposal as TSCA-regulated material at a TSCA approved landfill. Following soil removal, the excavation would be backfilled with imported clean fill material.

As part of this alternative, the existing liner and stone layer would be removed from the concrete slab to prepare the Plant 2 Site for possible redevelopment. As part of any future construction at the Plant 2 Site, a vapor barrier and collection system would be installed beneath any building constructed as a precautionary measure against potential volatilization of VOCs.

This alternative also includes institutional controls (restrictive covenants) to restrict future site use and prohibit the use of site groundwater for potable purposes. In addition, use of groundwater at the Plant 2 Site, as well as offsite, would be restricted through continued implementation of City Ordinance No. 2005-12.

Periodic groundwater monitoring would also be conducted to document concentrations of remaining chemical constituents in groundwater. Additional monitoring wells at and adjacent to the Plant 2 Site would be installed and developed. The entire site well network would be sampled for VOC and PCB analysis on a regular basis. A final remedy for groundwater will be determined at a later date, based on the results of the periodic monitoring.

12.3 Summary of the Estimated Remedy Costs and Time Required for Implementation

The estimated cost of the selected remedy for the Cedar Creek OU1 - Plant 2 Site is $2,700,000. The remedial design is expected to take three months to complete, and the remedial action is expected to take at least three months to complete. Appendix E contains the cost breakdown for Alternative 4.

The information in the cost estimate summary table is based on the best available information regarding the scope of the remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedy. Changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference (ESD), or a ROD amendment. The cost estimate is expected to be within +50 to -30 percent of the actual project cost.

12.4 Expected Outcomes of the Selected Remedy

The selected remedy for the Cedar Creek OU1 - Plant 2 Site, Alternative 4, will achieve the RAOs for the Plant 2 Site. The selected remedy will be protective of human health and the environment and will comply with all ARARs. The following are expected to occur by implementing Alternative 4 for OU1:

- Possible non-industrial reuse at the remediated property.

- Soil at the Plant 2 Site will have PCB and VOC concentrations below the cleanup levels, which will reduce the potential human health risk at OU1 to acceptable levels.

- Groundwater use at the site will not be affected, as there are no private groundwater wells within OU1 and all drinking water in OU1 is provided by the City of Cedarburg.

- There are anticipated beneficial socio-economic and community impacts resulting from the remediation of OU1. The City of Cedarburg is currently interested in revitalization of the area. Any planned projects will not move forward until the Plant 2 area is remediated.

13.0 Statutory Determinations

Under CERCLA Section 121 and the NCP, remedies selected for Superfund Alternative Sites are required to be protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a waiver is justified) and be cost effective. The following sections discuss how the selected remedy for the Cedar Creek OU1 - Plant 2 Site meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The current and potential future risks at the Cedar Creek OU1 – Plant 2 Site are due to the presence of elevated concentrations of PCBs and VOCs in soils. Implementation of the selected remedy will be protective of human health and the environment, as described in the NCP, through the removal of subsurface soils with PCB concentrations above 50 ppm and surface and shallow subsurface soils around the perimeter of the Plant 2 Site with concentrations above 1 ppm. In addition, the shallow soils (up to 4 feet in depth) where the highest VOC concentrations were detected will be removed. The site specific RAOs were developed to protect current and future receptors that are potentially at risk from contaminants at the Plant 2 Site. The selected remedy will meet the RAOs. OU1 will be available for reuse at the completion of the remedial action and institutional controls will be required to ensure that the remedy remains protective.

13.2 Compliance with ARARs

Section 121(d) of CERCLA requires that Superfund remedial actions meet ARARs. Appendix C provides all ARARs identified for this site which will be met under this ROD. In addition to

ARARs, non-enforceable guidelines, criteria, and standards may be useful in designing the selected remedy. As described previously in Section 8.2 of this ROD, these guidelines, criteria, and standards are known as TBCs. The selected remedy will comply with the ARARs for the Plant 2 Site.

13.3 Cost Effectiveness

EPA has determined that the selected remedy for the Cedar Creek OU1 - Plant 2 Site is cost effective and represents value for the money to be spent. A cost effective remedy in the Superfund program is one whose costs are proportional to its overall effectiveness. The overall effectiveness of the potential remedial alternatives for the Plant 2 Site was evaluated in the FFS by considering the following three criteria: long-term effectiveness and permanence, reduction in toxicity, mobility and volume through treatment, and short-term effectiveness. The overall effectiveness was then compared to cost to determine whether an alternative is cost effective. Of the remedial alternatives evaluated for the Plant 2 Site, Alternative 4 provided the highest degree of cost effectiveness.

13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable (MEP)

The selected remedy represents the maximum extent to which permanent solutions and treatment are practicable at the Plant 2 Site. Although treatment technologies will not be utilized in this remedy, the selected remedy is the only remedy with proven long-term permanence, and is more cost-effective than treatment technologies available. The selected remedy also permanently removes the contamination from the Plant 2 Site, allowing for reuse of the property. The selected remedy is also favored by the state and local community.

13.5 Preference for Treatment as a Principle Element

This remedy does not satisfy the preference for treatment as a principle element of the remedy for the following reasons: (1) the treatment of contaminated PCB soils in place has not been demonstrated for long term permanence and effectiveness, (2) treatment technologies are less-cost effective than this remedy, (3) the chosen remedy is a permanent remedy that is widely accepted by the community, and (4) source materials consisting of principle threat wastes will be addressed within the scope of this action.

13.6 Five-Year Review Requirements

The NCP requires that the remedial action be reviewed no less often than every five years if the remedial action results in hazardous substances, pollutants, or contaminants remaining at the Plant 2 Site above levels that allow for unlimited use and unrestricted exposure. Because this remedy will result in hazardous substances, pollutants, or contaminants in groundwater and soil under the concrete slab remaining on-site above levels that allow for unlimited use and unrestricted exposure, including Wisconsin Preventative Action Limits (PAL), a five-year review will be required for this remedial action.

14.0 Documentation of Significant Changes

The Proposed Plan for Cedar Creek OU1 - Plant 2 Site was released for public comment on October 8, 2007, and the public comment period ran from October 8 through November 9, 2007. The Proposed Plan identified Alternative 4 (Removal of Surface Soils and Subsurface Soils, with Groundwater Monitoring) as the preferred alternative for the Plant 2 Site. EPA reviewed all written and verbal comments submitted during the comment period and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.