Fifth Five-Year Review Report
for the

OCONOMOWOC ELECTROPLATING COMPANY, INC. SUPERFUND SITE

Town of Ashippun, Dodge County, Wisconsin

Prepared by:

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Region 5
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Date

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LIST OF ABBREVIATIONS & ACRONYMS

AROD	Record of Decision Amendment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
CFR	Code of Federal Regulations
COC	Contaminants of Concern
CVOC	Chlorinated Volatile Organic Compounds
DO	Dissolved Oxygen
ES	State of Wisconsin Groundwater Enforcement Standard
ESD	Explanation of Significant Difference
FYR	Five-Year Review
HHRA	Human Health Risk Assessment
ICs	Institutional Controls
ICIAP	Institutional Controls Implementation and Assurance Plan
ISSM	In Situ Soil Mixing
LTRA	Long-Term Remedial Action
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MNA	Monitored Natural Attenuation
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OECI	Oconomowoc Electroplating Company, Inc.
ORP	Oxidation-Reduction Potential
PAL	State of Wisconsin Groundwater Preventive Action Limit
PCB	Polychlorinated Biphenyl
RAO	Remedial Action Objective
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TBC	To Be Considered
TCE	Trichloroethylene
UU/UE	Unlimited Use and Unrestricted Exposure
VC	Vinyl Chloride
VI	Vapor Intrusion
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources
WWRD	Wisconsin Remediation and Redevelopment Database (WRRD)

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this FYR report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Oconomowoc Electroplating Company, Inc. Superfund Site (OECI site). The triggering action for this statutory review is the completion date of the previous FYR report. EPA performed the FYR because hazardous substances, pollutants, or contaminants at the site remain above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The OECI site comprises five Operable Units (OUs), all of which are assessed in this FYR. The 1990 Record of Decision (ROD) for the site identified four OUs:

- OU1: surface water, metal hydroxide sludge and contaminated soils associated with the two Resource Conservation and Recovery Act (RCRA) Subtitle C lagoons located behind the OECI facility.
- OU2: contaminated soil around the OECI facility not associated with the RCRA lagoons.
- OU3: contaminated groundwater associated with the OECI site.
- OU4: the most highly contaminated sediments in Davy Creek and the wetlands area.

EPA added a fifth OU in 1991 with an Explanation of Significant Differences (ESD):

- OU5: dismantle the abandoned facility and dispose of associated debris.

The remedial actions for OUs 1, 2, 4, and 5 have been completed. OU3 remains active, but the groundwater extraction and treatment system was shut down in 2004 after optimization studies concluded that metals had reached remedial standards and that it would take 290-620 years for extraction and treatment to achieve remedial standards for volatile organic compounds (VOCs). EPA signed a ROD Amendment (AROD) on May 16, 2011 to change the selected remedy for OU3 from groundwater extraction and treatment to source area removal or *in situ* treatment and Monitored Natural Attenuation (MNA) for groundwater.

EPA's Remedial Project Manager, William Ryan, led the OECI site FYR with support from Aristeo Pelayo, Hydrogeologist, Wisconsin Department of Natural Resources (WDNR). The review began on April 21, 2016, when EPA sent WDNR a letter announcing its commencement approximately fifteen months before the statutory due date.

Site Background

The 10-acre OECI site is located in the Town of Ashippun, Wisconsin, and comprises 4 acres formerly occupied by the OECI facility, which is bounded by Elm, Oak, and Eva Streets, and the Town's

municipal garage, and 6 acres of adjacent wetland. Davy Creek, a tributary to the Rock River, flows through the adjacent wetland about 100 meters south of Elm Street. Several small businesses line Oak Street to the north and back up to Chicago and North Western Railroad tracks. Residential areas lie west of Eva Street and south of Elm. East of the municipal garage is a baseball diamond and more residential property. A map depicting the site boundaries and each of the OUs is provided in Attachment 1.

The area immediately surrounding the OECI site is a mixture of light industrial, commercial, municipal, and residential parcels. There is no public water supply and the Town relies on groundwater drawn from individual private wells. Davy Creek is a warm-water sport fishery and there are two parks with facilities for baseball, skeet shooting, and picnicking within a quarter mile of the site. EPA and WDNR anticipate reuse of the four-acre parcel formerly occupied by the OECI facility. Appropriate restrictions preventing groundwater use, residential use, and excavation will be required by the institutional controls (ICs) placed on the site.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Oconomowoc Electroplating Company, Inc.		
EPA ID: WID0061002755		
Region: 5	**State:** WI	**City/County:** Ashippun/Dodge
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): William Ryan		
Author affiliation: EPA		
Review period: April 21, 2016 – April 1, 2017		
Date of site inspection: May 11, 2016		
Type of review: Statutory		
Review number: 5		
Triggering action date: July 11, 2012		
Due date ***(five years after triggering action date)***: July 11, 2017		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Hazardous substances have been released at the site. The contaminants of concern (COCs) found in each medium include the following:

Soil
Acetone
Arsenic
Cadmium
Chromium
Copper
Cyanide
1,1-Dichloroethane
1,2-Dichloroethene (total)
Lead
Methylene Chloride
Nickel
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
Trichloroethylene (TCE)
Xylene
Zinc

Lagoon Sludge/Liquid
Acetone
Arsenic
Cadmium
Chromium
Copper
Cyanide
1,1-Dichloroethane
Ethylbenzene
Lead
Methylene Chloride
Nickel
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
Trichloroethylene
Xylene
Zinc

Groundwater
Acetone
Cadmium
Cyanide
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethene (total)
Methylene Chloride
Nickel
1,1,1-Trichloroethane
Trichloroethylene
Vinyl Chloride

Wetland Sediment
Cadmium
Chromium
Copper
Cyanide
Lead
Nickel
Zinc

Exposure to soil and groundwater containing these COCs is associated with significant human health risks because they exceed EPA's risk management criteria. Contaminated groundwater at, or emanating from, the OECI site presented the highest carcinogenic risk from these COCs due to potential exposure by ingestion. Soil contaminated with cadmium and lead posed the greatest non-carcinogenic risk to human health through potential dermal contact and ingestion by children and people working at the site. Davy Creek and the wetlands area were contaminated with cadmium, chromium, nickel, copper, lead, zinc and cyanide, and toxicity tests confirmed that these contaminants exceeded levels known to be toxic to common aquatic species.

Response Actions

EPA performed a preliminary assessment of the OECI site in May 1983 and placed it on the National Priorities List (NPL) in September 1984. In 1985, the Wisconsin Geological and Natural History Survey installed three shallow groundwater monitoring wells. Samples from these wells revealed elevated concentrations of cadmium, nickel, and zinc, in addition to the VOCs 1,1-dichloroethane, 1,1,1 trichloroethane, and TCE.

In summer 1986, EPA conducted a limited sediment sampling survey in the wetlands and found high concentrations of metals and cyanide in the area immediately south of the OECI facility. In March and April 1987, EPA sampled approximately 300 acres of the wetlands along Davy Creek, the OECI sludge lagoons, and soil at the ballpark located southeast of OECI. The analytical results indicated that the sludge and several acres of the wetlands adjacent to OECI were contaminated with cadmium, chromium, nickel, copper, zinc, and cyanide - all associated with the facility's electroplating process.

EPA initiated a Remedial Investigation/Feasibility Study (RI/FS) in April 1987 and issued the final report in March 1990. A Proposed Plan, based on the RI/FS, outlining EPA's cleanup strategy was presented for public comment on July 23, 1990.

EPA signed a ROD for the OECI site on September 20, 1990. The Remedial Action Objectives (RAOs) in the ROD were developed from data collected during the RI, and the selected remedy employed multiple removal actions to eliminate the sources of contamination and restore contaminated groundwater. The RAOs required: (1) the elimination of principal threats by reducing the toxicity and mobility of the highly-contaminated materials, (2) reduction of potential exposure to VOCs and metals, and (3) restoring groundwater to applicable state standards.

The 1990 ROD identified four OUs, and the selected remedy required the following remedial actions:

- Excavation, treatment, and disposal at an off-site RCRA Subtitle C disposal facility of the impounded water, sludge, and contaminated soils associated with the two RCRA Subtitle C lagoons (OU1);
- Treatment and disposal at an off-site RCRA Subtitle C disposal facility for all other contaminated soil around the OECI facility not associated with the RCRA lagoons or beneath the OECI buildings, including the fill area, the lowlands area, the drainage ditches, and the parking lot (OU2);
- Construction and operation of a groundwater extraction and treatment system to achieve state groundwater quality standards for contaminated groundwater associated with the site, with treated water being discharged to Davy Creek in compliance with the substantive requirements of a Wisconsin Pollution Discharge Elimination System permit (OU3); and
- Excavation, treatment, and disposal at an off-site RCRA Subtitle C disposal facility for the most highly contaminated sediments in the Davy Creek wetlands area as an interim action because cleanup goals had not been established for contaminated sediment when the ROD was signed, and additional monitoring of Davy Creek and the wetlands performed after the remediation to determine the effectiveness of the remedy (OU4).

EPA issued a 1991 ESD to add a fifth OU to authorize dismantling the abandoned OECI facility and disposing of associated debris, and issued an ESD in 1994 to establish the final cleanup goals for the

adjacent wetlands.

EPA signed an AROD on May 16, 2011 to change the selected remedy for OU3 from groundwater extraction and treatment to either source area removal or *in situ* treatment, followed by MNA until the RAO for groundwater is attained.

EPA ruled out source area removal after a membrane interface probe study established that the depth and horizontal extent of the source area made this option impractical. *In situ* soil mixing (ISSM) was applied instead, using a proprietary source of zero valent iron to promote reductive dechlorination of the residual TCE in the source area. ISSM at the OECI Site treated a total of 2269 cubic yards of contaminated source material and was carried out in June and July of 2013.

Status of Implementation

The remedial actions for OUs 1, 2, 4, and 5 have been completed. Responsibility for implementing the MNA remedy in OU3 was transferred to WDNR in 2014 after completion of the ISSM project and the 10-year Long-Term Response Action (LTRA). The MNA component of the remedy relies on natural attenuation for remediation of the residual groundwater plume along with regular compliance monitoring to ensure that the residential wells already affected by low-level contamination remain below health-based standards.

Natural attenuation is the process by which contaminant concentrations are reduced by one or more inherent subsurface processes including volatilization, dispersion, adsorption, and biodegradation. The MNA remedy requires the ongoing analysis of natural attenuation parameters to ensure that the anaerobic conditions conducive to biological reductive dechlorination of the site VOCs remain present in the aquifer, and assesses the degree of natural attenuation that is occurring. The 2011 AROD predicted it would take approximately 15 years for natural attenuation to reduce the contaminant concentrations in affected groundwater to remedial standards.

Institutional Controls

ICs are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for exposure to contamination and protect the integrity of the remedy. Compliance with ICs is required to ensure long-term protectiveness for any areas that do not allow for UU/UE. Cleanup goals for soil, outlined in the decision documents, were based on commercial/ industrial use; cleanup goals for groundwater were based on (eventual) UU/UE; cleanup goals for the wetlands were based on commercial/ industrial use; and cleanup goals for the surface were set at water quality standards and therefore no restrictions are required. Table 1 summarizes the ICs required for the OECI Site.

The 2011 AROD states that "institutional controls will be designed for OECI in coordination with WDNR (e.g., deed restrictions such as easements and covenants, deed notices, land use restrictions such as zoning and local permitting, ground-water use restrictions, and public health advisories) to ensure the long-term protectiveness of the remedy."

Status of Access Restrictions and ICs: Title to the OECI site property is still in the name of the Oconomowoc Electroplating Company, Inc (OECI). The property has been in tax delinquency since 1994, and OECI no longer exists. Because deed restrictions are impossible without an owner accepting

their imposition, EPA and WDNR will use the state's Wisconsin Remediation and Redevelopment Database (WRRD) of Continuing Obligations to ensure protectiveness.

Continuing obligations are legal requirements designed to protect public health and the environment from contamination that remains on a property. Continuing obligations will apply after a property is sold or transferred, and each new owner is responsible for complying with the continuing obligations. The site is currently in the WRRD, but a continuing obligations letter has not been completed.[1]

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soil treated to industrial cleanup standards	Yes	Yes	Sitewide	Prohibit residential use	WRRD and Continuing Obligations (planned)
Groundwater	Yes	Yes	Sitewide	Restrict groundwater use until cleanup standards are achieved	WRRD and Continuing Obligations (planned)

A map showing the areas in which ICs are required by the ROD is included in Attachment 1.

Current Compliance: During the site inspection, EPA and WDNR inspectors did not observe any uses of the OECI site that are not protective based upon the industrial use cleanup assumptions. Furthermore, there is no evidence that anyone is being exposed to groundwater that has contaminants above health-based standards [i.e., the federal Maximum Contaminant Level (MCL) or the Wisconsin Enforcement Standard (ES)].

IC Follow up Actions Needed: An Institutional Control Implementation and Assurance Plan (ICIAP) should be developed for the OECI site. The ICIAP will document activities associated with ensuring long-term stewardship of ICs and specify the people and/or organizations that will be responsible for these activities. A continuing obligations letter will also be developed.

Systems Operations/Operation & Maintenance

Since the 2011 AROD changed the OU3 remedy for the OECI site from groundwater extraction and treatment to MNA, there are no longer any "systems" on-site requiring operation or maintenance. The site is regularly monitored to ensure protectiveness, and EPA has a cooperative agreement with WDNR to remove the treatment plant and its appurtenances. As of mid-April 2017, this work is nearing completion and EPA and WDNR plan to conduct a final inspection of the work in May 2017.

III. PROGRESS SINCE THE LAST REVIEW

This section presents the protectiveness determination and recommendations from the last FYR report, and the current status of those recommendations.

[1] A description of the continuing obligations process can be found at: http://dnr.wi.gov/topic/Brownfields/Residual.html, and a fact sheet published by WDNR is included in Attachment 3.

The 2012 FYR Report recommended collecting deep soil gas samples to ensure VI is not impacting residential properties near the site. EPA guidance for assessing the VI pathway, however, recommends collecting groundwater samples at the water table as the first step to determine whether a complete VI pathway exists. If contaminant concentrations in the shallow groundwater are below established VI screening levels, soil gas sampling is unnecessary. This was the case at the OECI site. The Wisconsin Department of Health Services concurred with the conclusions of the VI investigation, and its report is available at: http://dnr.wi.gov/botw/DownloadBlobFile.do?docSeqNo=59577. EPA's 2012 VI Risk Assessment report is included as Attachment 4.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement and Site Interviews

On May 27, 2016, EPA published a public notice in the *Watertown Daily Times* stating that EPA was conducting a FYR at the OECI site and inviting the public to submit any comments. The results of the FYR and the report will be made available at the OECI site information repository located at the Ashippun Town Hall, W1266 Highway O, Oconomowoc, WI. No community member or other interested individual has expressed an interest in conducting an interview related to the FYR since the notice appeared in the newspaper.

Data Review

Groundwater is sampled semi-annually to assess the effectiveness of the MNA remedy for the chlorinated volatile organic compounds (CVOCs) found in the groundwater and ensures that the remedy remains protective of the nearby private water supply wells. A secondary objective of the groundwater monitoring program is to determine the effects of the June 2013 *in situ* treatment of contaminated soil in the source area.

A typical groundwater monitoring event comprises the following activities:

- Measure the depth to groundwater in the 33 existing OECI site monitoring wells and note the condition of each well. Depth from the surface to groundwater is used to determine the direction of flow.
- Collect groundwater samples from a representative subset of the site monitoring wells for laboratory analyses of VOCs, methane, ethane, ethene, acetylene, total iron, dissolved iron, total manganese, dissolved manganese, alkalinity, chloride, sulfate, and total organic carbon. Field measurements of groundwater temperature, pH, specific conductance, oxidation-reduction potential (ORP), dissolved oxygen (DO) and turbidity are also taken at each sampling event.
- Collect groundwater samples from the residential wells affected by the plume.
- Notify the property owners (and residents if different than the property owner) of the analytical results within 10 days of receiving the reports from the laboratory subcontractor.

Groundwater Flow and Hydraulic Gradients: Depth to groundwater measurements collected from the OECI site monitoring wells are used to calculate water table contours, which are indicative of the general direction of groundwater flow. Groundwater flow at the water table and at mid-depth across the site is to the southwest, towards Davy Creek, while the general direction of groundwater flow in the bedrock is from east to west across the site.

Vertical gradients calculated for the nested OECI site monitoring wells show predominantly downward gradients in the monitoring well nests located north of Elm Street, and predominantly upward gradients in the monitoring well nests located south of Elm Street in the wetlands near Davy Creek, indicating groundwater is recharging north of Elm Street and discharging to the wetlands and Davy Creek.

Contaminant Concentrations in Monitoring Wells: A summary of CVOC concentrations relative to Wisconsin's Chapter NR140 ESs and PALs in groundwater samples collected from the OECI site monitoring wells during the November 2015 and May 2016 sampling events is presented in Table 4:

Table 4: A summary of CVOC concentrations from 28 monitoring wells compared to NR140 ESs and PALs

Compound	NR140 Enforcement Standard (ES) (µg/L)	NR140 Preventive Action Limit (PAL) (µg/L)	RL (µg/L)	LOQ (µg/L)	Number of Wells: ES or Greater	Number of Wells: PAL or Greater, but Less Than ES	Number of Wells with a J-flagged Result	Number of Wells with a Detection
1,1,1-Trichloroethane	200	40	0.060	0.21	0	1	1	6
1,1-Dichloroethane	850	85	0.060	0.19	0	1	5	12
1,1-Dichloroethene	7.0	0.7	0.070	0.23	1	6	7	9
1,2-Dichloroethane	5.0	0.5	0.040	0.14	0	4	6	6
cis-1,2-DCE	70	7.0	0.060	0.21	4	5	4	19
Methylene Chloride **	5.0	0.5	0.060	0.21	2	2	0	4
Tetrachloroethene	5.0	0.5	0.060	0.20	1	0	2	3
trans-1,2-DCE	100	20	0.060	0.20	1	2	4	11
TCE	5.0	0.5	0.030	0.10	7	1	6	18
Vinyl chloride (VC)	0.2	0.02	0.016	0.052	9	7	7	16

Notes:
RL = Undiluted Reporting Limit LOQ = Undiluted Limit of Quantitation
J flag = Reported concentration was between the RL and LOQ.
**The methylene chloride detections may be a laboratory or sample container contaminant as it is a common laboratory solvent and it was only detected in the May 2016 sampling event samples.
Dedicated sample tubing was used to collect the groundwater samples from the OECI site monitoring wells so no cross-contamination is expected.

Contaminant Concentrations in Private Wells: The most recent sampling results (November 2016) indicate only one private well has VC concentrations above the PAL (0.02 ug/l) and one private well has TCE concentrations above the PAL (0.5 ug/l). Monitoring data is uploaded to WDNR's Groundwater and Environmental Monitoring System (GEMS) and is available on the web at: http://dnr.wi.gov/wastemgmt/gotw/webpages (OECI's License Number: 4189).

Table 5: VC concentrations (µg/l) in private well from 2013-2016

Private Well	Nov-2013	Dec-2014	Nov-2015	Nov-2016
PW-03	0.033	<0.020	<0.020	<0.020
PW-04	NS	NS	<0.020	<0.020
PW-07	0.064	0.05	0.053	0.041
PW-08	0.04	0.045	0.043	<0.020
PW-09	0.057	0.056	0.055	<0.020
PW-10	<0.020	<0.020	0.021	<0.020
PW-11	0.029	0.039	0.04	<0.020

Notes: NS = not sampled Light blue indicates non-detects (< PAL of 0.02 µg/l)

Table 6: TCE concentrations (µg/l) in private well from 2013-2016

Private Well	Nov-2013	Dec-2014	Nov-2015	Nov-2016
PW-03	0.71	0.62	0.69	0.62
PW-04	NS	NS	0.086	0.089
PW-07	<0.02	<0.02	0.031	<0.05
PW-08	<0.02	0.083	0.069	0.11
PW-09	<0.02	0.06	0.068	0.066
PW-10	<0.02	<0.02	<0.03	<0.05
PW-11	<0.02	<0.02	<0.03	<0.05

NS = not sampled
Light blue indicates non-detects (< PAL of 0.5 µg/l)

Residual TCE and VC, which is produced by the sequential breakdown of TCE, are the contaminants of greatest concern in the groundwater at the OECI site. Nevertheless, bedrock at the OECI site (the source of drinking water in the Town of Ashippun) is relatively unaffected, and, where impacts are present, contaminant concentrations are below the NR140 ES.[2]

Analytical data indicate the center of mass of the TCE plume is south of Elm Street. TCE was detected in all but one of the mid-depth monitoring wells, and the TCE plume extends farther west in the zone monitored by the mid-depth monitoring wells compared to the zone monitored by the water table monitoring wells. Nevertheless, the analytical data from the bedrock monitoring wells and residential wells (which draw their water from the bedrock) indicate TCE impacts are limited in the bedrock, and where present do not exceed the NR140 ES of 5.0 µg/L.

Analytical data from the May 2016 sampling event also places the center of mass of the VC plume south of Elm Street. VC impacts exceeding its ES of 0.20 µg/L are most extensive in the zone monitored by the mid-depth unconsolidated deposits monitoring wells. Analytical results from mid-depth monitoring wells suggest VC impacts may be increasing near the western edge of the plume in the mid-depth zone, but analytical results from the bedrock monitoring wells and residential wells indicate VC impacts in the bedrock, where present, do not exceed the ES, and are less extensive compared to the extent of VC impacts in the unconsolidated deposits.

MNA Effectiveness: The presence of VC and cis-DCE in many of the monitoring wells samples indicate reductive dechlorination of TCE is occurring within the OECI site contaminant plume. The results from the May 2016 sampling event for the shallow-depth unconsolidated deposits monitoring wells, mid-depth unconsolidated deposits monitoring wells, and bedrock monitoring wells suggest the MNA parameters conducive to reductive dechlorination of TCE (DO less than 0.50 mg/L or ORP less than 50 mV) are present at a majority of the mid-depth monitoring wells. The DO and ORP data from the shallow-depth monitoring wells produced mixed results but suggest reducing conditions exist on the

[2] The 2007 FYR report noted that VC was detected at low concentrations in nearby private water supply wells. EPA conducted a human health risk assessment (HHRA) on the water well contamination in February 2010, looking at historical concentrations of methylene chloride, TCE, and VC in the private water supply wells. The HHRA concluded that the historical concentrations in the residential wells are significantly below non-cancer risk screening levels and the estimated lifetime cancer risk for these wells was either below or within EPA's target risk range. Therefore, based upon the historical data, the low levels of VOCs found in these private wells should not contribute to any detrimental health effects of those citizens using these wells for drinking or bathing purposes. This risk assessment was updated for the 2012 FYR report and a copy is included as Attachment 5.

north and southeast side of the former OECI facility, and the DO and ORP data from the bedrock monitoring wells suggest conditions are favorable for reductive dechlorination in the bedrock beneath most of the OECI site. In addition, trend analyses from the January 2009 through May 2016 sampling events indicate TCE concentrations are non-detect, stable, or decreasing in 23 of the 28 monitoring wells that are part of the current OECI site groundwater monitoring program, which suggests the OECI site plume is stable or decreasing.

Site Inspection

The FYR site inspection was conducted on May 11, 2016. In attendance were William Ryan, EPA Remedial Project Manager and Aristeo Pelayo, WDNR Project Manager. The purpose of the inspection was to assess the protectiveness of the remedy. The shut-down treatment plant building and idle process equipment were also inspected and found in good condition, the fencing was intact, and there was no evidence of vandalism or destructive mischief. The grounds are being properly maintained and no conditions that could impact current or future protectiveness were observed.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes - The review of documents, Applicable or Relevant and Appropriate Requirements, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the decision documents. Removing the lagoon sludge, contaminated soil, contaminated wetland sediment, the former facility and associated debris (OUs 1, 2, 4, and 5) has minimized the migration of contaminants to groundwater and surface water and prevented ingestion or direct contact with contaminated media. Implementation of the selected remedy for OU3 under the 2011 AROD indicates that natural attenuation is addressing the residual sources of contamination and regular monitoring is ensuring that the groundwater from private wells remains below risk-based standards while natural attenuation works to achieve cleanup goals in a reasonable period of time.

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

Yes - The exposure assumptions used to develop the baseline HHRA for the 1990 ROD included both current exposures and potential future exposures. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. There have been no changes in the toxicity factors for the contaminants of concern used in the baseline risk assessment that would affect the current site remediation goals. Nevertheless, there was a change in the toxicity value for TCE that would impact the soil gas screening level for VI (The value for TCE went from 30 µg/m3 to 10.7 µg/m3), and a VI investigation was performed in the off-site residential area in December 2012. Although site-related VOCs were detected in shallow groundwater, the concentrations were below applicable groundwater screening criteria. There have been no other changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

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

No - There have been no impacts from natural disasters, climate, unusual weather, or physical conditions that could adversely affect the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: Long-term stewardship procedures are needed to ensure that effective ICs are monitored, maintained and enforced.			
	Recommendation: Develop and implement an ICIAP to include procedures for monitoring and tracking compliance with existing ICs, communicating with EPA, and providing an annual certification to EPA that the ICs remain in place and are effective.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	4/30/2018

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: ICs are needed for areas not meeting UU/UE.			
	Recommendation: Implement ICs by issuing a Wisconsin Continuing Obligations letter.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	4/30/2018

VII. PROTECTIVENESS STATEMENT

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The remedy at the OECI Site currently protects human health and the environment. Remedy completion for OUs 1, 2, 4, and 5, comprising the removal of lagoon sludge, contaminated soil, contaminated sediment, former facility, and associated debris, has achieved the RAOs of

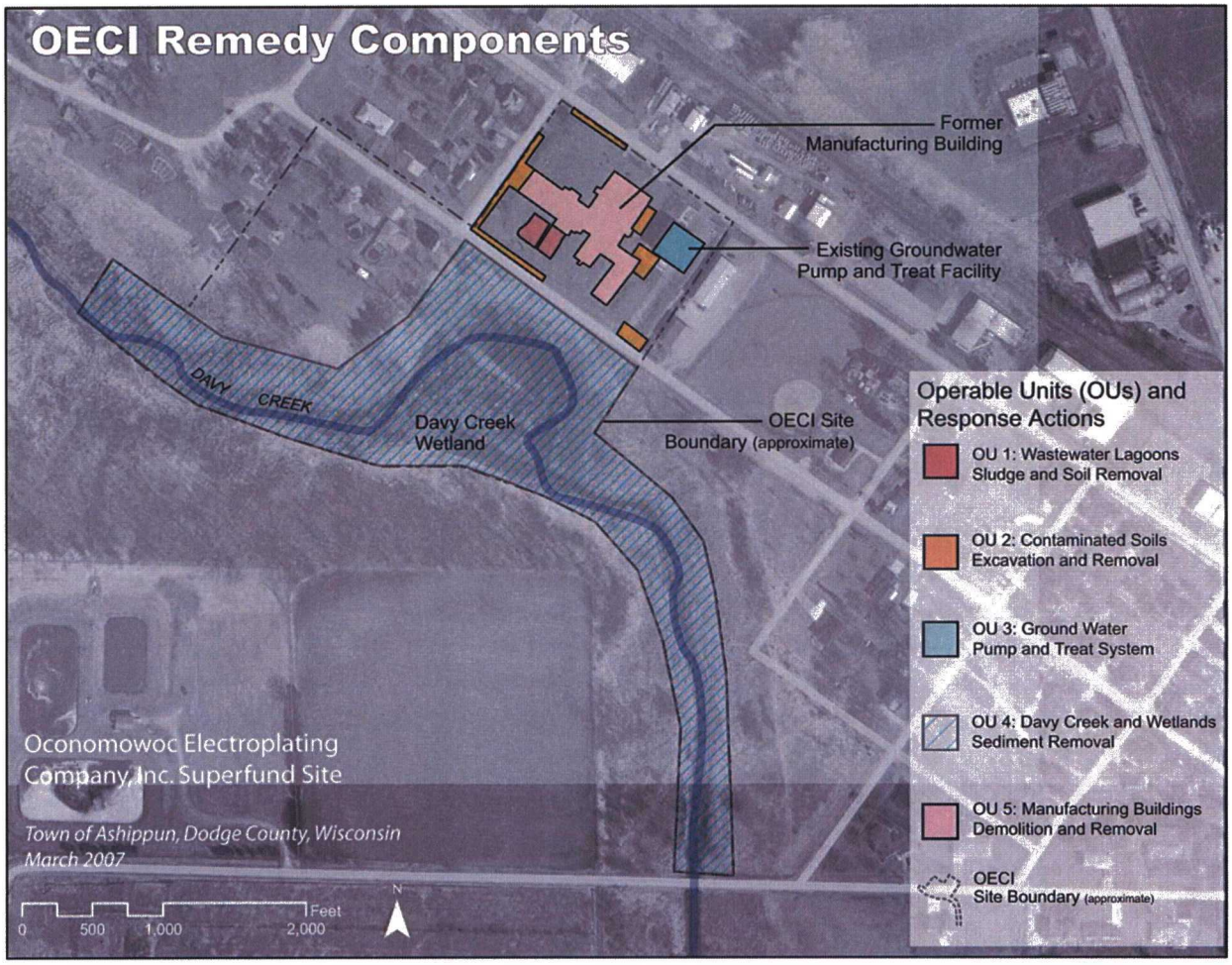
minimizing the migration of contaminants to groundwater and surface water and preventing ingestion or direct contact with contaminated media. Implementation of the selected remedy for OU3 under the 2011 AROD is addressing the residual sources of contamination and ensuring that the groundwater from private wells remains below risk-based standards while allowing natural attenuation to achieve cleanup goals in a reasonable period of time.

However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: development of an ICIAP and implementation of ICs. The remedy will achieve completion when groundwater cleanup standards are attained throughout the contaminant plume.

VIII. NEXT REVIEW

The next FYR report for the OECI Superfund site is required no less than five years from EPA's signature date of this review.

Attachment 1 - Site Map



Data Table: OECI Site - Operable Units

OU Name	Remedial Approach	Contaminants of Concern (COCs)	OU Status	Institutional Controls
OU 1	Wastewater Lagoons Sludge and Soil Removal	*Inorganics:* As, Cd, Cr, Cu, Pb, Ni, Zn, Cyanide; *Organics:* Acetone, Methylene Chloride, 1,1-Dichloroethane, 1,1,1 Trichloroethane, Trichloroethene, Tetrachloroethene, Toluene, Ethylbenzene, Xylene	Remedial work completed - 1996	Need is TBD
OU 2	Contaminated Soils Excavation and Removal	*Inorganics:* As, Cd, Cr, Cu, Pb, Ni, Zn, Cyanide; *Organics:* Dichloroethane, Trichloroethane, Trichloroethene, Toluene	Remedial work completed - 1996	Need is TBD
OU 3	Ground Water Pump and Treat System	*Inorganics:* Cd, Ni, Cyanide; *Organics:* 1,1-Dichloroethene, 1,1- Dichloroethane, 1,2-Dichloroethane, 1,1,1 Trichloroethane, Trichloroethene	Remedial work ongoing	Need is TBD
OU 4	Davy Creek and Wetlands Sediment Removal	*Inorganics:* Cyanide, NI, Cu	Remedial work completed - 1996	Need is TBD
OU 5	Manufacturing Buildings Demolition and Removal	Demolition debris	Remedial work completed - 1992	Need is TBD

Attachment 2 - List of Documents Reviewed

1990 ROD, U.S. EPA

1991 ESD, U.S. EPA

1994 ESD, U.S. EPA

2011 AROD, U.S. EPA

2012 FYR Report, U.S. EPA

WDNR's Annual Groundwater Monitoring Report,
November 2015 and May 2016 Sampling Events

2000 Remediation System Evaluation, U.S. EPA

2004 Groundwater Treatment Facility Shutdown Plan, CH2M Hill

2005 Soil Gas Survey Historical Results, CH2MHill

2009 Annual Groundwater Report, CH2M Hill

2010 Private Water Supply Contamination Risk Assessment, U.S. EPA

2010 Focused Feasibility Study, CH2M Hill

2011 Vapor Intrusion Risk Assessment, U.S. EPA

Attachment 3 – WDNR's Continuing Obligations Fact Sheet

Continuing Obligations for Environmental Protection

Responsibilities of Wisconsin Property Owners

PUB-RR-819 November 2013

This fact sheet is intended to help property owners understand their legal requirements under s. 292.12, Wis. Stats., regarding continuing obligations that arise due to the environmental condition of their property.

The term "continuing obligations" refers to certain actions for which property owners are responsible following a completed environmental cleanup. They are sometimes called environmental land use controls or institutional controls. These legal obligations, such as a requirement to maintain pavement over contaminated soil, are most often found in a cleanup approval letter from the state.

Less commonly, a continuing obligation may apply where a cleanup is not yet completed but a cleanup plan has been approved, or at a property owned by a local government that is exempt from certain cleanup requirements.

What Are Continuing Obligations?

Continuing obligations are legal requirements designed to protect public health and the environment in regard to contamination that remains on a property.

Continuing obligations still apply after a property is sold. Each new owner is responsible for complying with the continuing obligations.

Background

Wisconsin, like most states, allows some contamination to remain after cleanup of soil or groundwater contamination (residual contamination). This minimizes the transportation of contamination and reduces cleanup costs while still ensuring that public health and the environment are protected.

The Department of Natural Resources (DNR), through its Remediation and Redevelopment (RR) Program, places sites or properties with residual contamination on a public database in order to provide notice to interested parties about the residual contamination and any associated continuing obligations. Please see the "Public Information" section on page 3 to learn more about the database. (Prior to June 3, 2006, the state used deed restrictions recorded at county courthouses to establish continuing obligations, and those deed restrictions have also been added into the database.)

Wisconsin Department of Natural Resources
P.O. Box 7921, Madison, WI 53707
dnr.wi gov, search "brownfield"

Types of Continuing Obligations

1. **Manage Contaminated Soil that is Excavated**
   If the property owner intends to dig up an area with contaminated soil, the owner must ensure that proper soil sampling, followed by appropriate treatment or disposal, takes place. Managing contaminated soil must be done in compliance with state law and is usually done under the guidance of a private environmental professional.

2. **Manage Construction of Water Supply Wells**
   If there is soil or groundwater contamination and the property owner plans to construct or reconstruct a water supply well, the owner must obtain prior DNR approval to ensure that well construction is designed to protect the water supply from contamination.

Other Types of Continuing Obligations
Some continuing obligations are designed specifically for conditions on individual properties. Examples include:

- keeping clean soil and vegetation over contaminated soil;
- keeping an asphalt "cover" over contaminated soil or groundwater;
- maintaining a vapor venting system; and
- notifying the state if a structural impediment (e.g. building) that restricted the cleanup is removed. The owner may then need to conduct additional state-approved environmental work.

It is common for properties with approved cleanups to have continuing obligations because the DNR generally does not require removal of all contamination.

Property owners with the types of continuing obligations described above will find these requirements described in the state's cleanup approval letter or cleanup plan approval, and *must*:

- comply with these property-specific requirements; and
- obtain the state's permission before changing portions of the property where these requirements apply.

The requirements apply whether or not the person owned the property at the time that the continuing obligations were placed on the property.

Changing a Continuing Obligation

A property owner has the option to modify a continuing obligation if environmental conditions change. For example, petroleum contamination can degrade over time and property owners may collect new samples showing that residual contamination is gone. They may then request that DNR modify or remove a continuing obligation. Fees are required for DNR's review of this request and for processing the change to the database ($1050 review fee, $300/$350 database fee). Fees are subject to change; current fees are found in Chapter NR 749, Wis. Adm. Code, on the web at www.legis.state.wi.us/rsb/code/nr/nr749.pdf.

Public Information

The DNR provides public information about continuing obligations on the Internet. This information helps property owners, purchasers, lessees and lenders understand legal requirements that apply to a property. DNR has a comprehensive database of contaminated and cleaned up sites, *BRRTS on the Web*. This database shows all contamination activities known to DNR. Site specific documents are found under the *Documents* section. The information includes maps, deeds, contaminant data and the state's closure letter. The closure letter states that no additional environmental cleanup is needed for past contamination and includes information on property-specific continuing obligations. If a cleanup has not been completed, the state's approval of the remedial action plan will contain the information about continuing obligations.

Properties with continuing obligations can generally be located in DNR's *GIS Registry*, part of the *RR Sites Map*. RR Sites Map provides a map view of contaminated and cleaned up sites, and links to BRRTS on the Web.

If a completed cleanup is shown in *BRRTS on the Web* but the site documents cannot be found in the Documents section, DNR's closure letter can still be obtained from a regional office. For assistance, please contact a DNR Environmental Program Associate (see the RR Program's Staff Contact web page at dnr.wi.gov/topic/Brownfields/Contact.html).

BRRTS on the Web and
RR Sites Map are part of
CLEAN
(the Contaminated Lands
Environmental Action Network) at
dnr.wi.gov/topic/Brownfields/clean.html

Off-Site Contamination: When Continuing Obligations Cross the Property Line

An off-site property owner is someone who owns property that has been affected by contamination that moved through soil, sediment or groundwater from another property. Wisconsin law, s. 292.13, Wis. Stats., provides an exemption from environmental cleanup requirements for owners of "off-site" properties. The DNR will generally not ask off-site property owners to investigate or clean up contamination that came from a different property, as long as the property owner allows access to his or her property so that others who are responsible for the contamination may complete the cleanup.

However, off-site property owners are legally obligated to comply with continuing obligations on their property, even though they did not cause the contamination. For example, if the state approved a cleanup where the person responsible for the contamination placed clean soil over contamination on an off-site property, the owner of the off-site property must either keep that soil in place or obtain state approval before disturbing it.

Property owners and others should check the *Public Information* section above if they need to:

- determine whether and where continuing obligations exist on a property;
- review the inspection, maintenance and reporting requirements, and
- contact the DNR regarding changing that portion of the property. The person to contact is the person that approved the closure or remedial action plan.

Option for an Off-Site Liability Exemption Letter

In general, owners of off-site properties have a legal exemption from environmental cleanup requirements. This exemption does not require a state approval letter. Nonetheless, they may request a property-specific liability exemption letter from DNR if they have enough information to show that the source of the contamination is not on their property. This letter may be helpful in real estate transactions. The fee for this letter is $700 under Chapter NR 749, Wis. Adm. Code. For more information about this option, please see the RR Program's Liability web page at dnr.wi.gov/topic/Brownfields/Liability.html.

Legal Obligations of Off-Site Property Owners

- Allow access so the person cleaning up the contamination may work on the off-site property (unless the off-site owner completes the cleanup independently).
- Comply with any required continuing obligations on the off-site property.

Required Notifications to Off-Site Property Owners

1. The person responsible for cleaning up contamination must notify affected property owners of any proposed continuing obligations on their off-site property **before** asking the DNR to approve the cleanup. This is required by law and allows the off-site owners to provide the DNR with any technical information that may be relevant to the cleanup approval.

   When circumstances are appropriate, an off-site neighbor and the person responsible for the cleanup may enter into a "legally enforceable agreement" (i.e. a contract). Under this type of private agreement, the person responsible for the contamination may also take responsibility for maintaining a continuing obligation on an off-site property. This agreement would not automatically transfer to future owners of the off-site property. The state is not a party to the agreement and can not enforce it.

2. If a cleanup proposal that includes off-site continuing obligations is approved, DNR will send a letter to the off-site owners detailing the continuing obligations that are required for their property. Property owners should inform anyone interested in buying their property about maintaining these continuing obligations. For residential property, this would be part of the real estate disclosure obligation.

More Information

For more information, please visit the RR Program's Continuing Obligations web site at dnr.wi.gov/topic/Brownfields/Residual.html.

Attachment 4 – EPA's VI Risk Assessment

MEMORANDUM

SUBJECT: Review of Potential Vapor Intrusion Issue for Oconomowoc Electroplating.

FROM: Keith Fusinski, PhD Toxicologist U.S. EPA
Superfund Division, Remedial Response Branch #1, Remedial Response Section #1

TO: William Ryan, Remedial Project Manager, U.S. EPA
Superfund Division, Remedial Response Branch #2, Remedial Response Section #7

DATE: 4/2/2012

BACKGROUND

The Oconomowoc Electroplating Company Inc. remedial site (the Site), comprises 10 acres of land which includes the former 4 acre facility and 6 acres adjacent to the property. The site is located at 2573 Oak Street in Ashippun, WI.

Former operations at the site included metal cleaning and electroplating which used chlorinated solvents, cyanide and various metals. Operations ceased in 1990 and the buildings on site were demolished in 1992. Historical groundwater contamination was noted and remediated from 1994 through 2004 for various metals and chlorinated solvents.

STATEMENT OF THE ISSUES

Vapor intrusion is the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals in contaminated groundwater can emit vapors that may migrate through subsurface soils and into indoor air spaces of overlying buildings. In extreme cases, the vapors may accumulate in dwellings or occupied buildings to levels that may pose near-term safety hazards (e.g., explosion), acute health effects, or aesthetic problems (e.g., odors).

The vapor intrusion pathway is considered complete when the vapors move from the source (or groundwater contamination) through the deep soil and subsurface soil gas, and into a structure. Each of these components must exist in order for the pathway to be considered complete. It is possible for volatile compounds to impact deep and subsurface soil gas but still not impact indoor air. In this case the pathway would not be considered complete and no mitigation would be required.

RPM Bill Ryan was advised by the Wisconsin Department of Natural Resources (WDNR) of concerns for a possible vapor intrusion issue at the residential neighborhood to the west/southwest of the site. These concerns are based upon elevated trichloroethylene (TCE) in the shallow and deep monitoring wells which are proximal to the residential neighborhood. Mr. Ryan requested an analysis of historical groundwater data to determine if these concerns are valid.

CHEMICALS OF CONCERN

Trichloroethylene (TCE)

Trichloroethylene (TCE) is a nonflammable, colorless liquid (ATSDR-1997). It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical. TCE is known to be only slightly soluble in water, but there is ample evidence that dissolved TCE can remain in groundwater for a long time. When TCE is released into the air, it reacts relatively quickly in the presence of sunlight and oxygen, with about half of it breaking down to simpler compounds in about a week (ATSDR 1997).

Inhalation of small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Inhalation of large amounts of TCE may cause impaired heart function, unconsciousness, and death. Nerve, kidney, and liver damage may result from prolonged inhalation of TCE.

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

VAPOR INTRUSION AND GROUNDWATER ASSESSMENT

The US EPA determines probability of a non-cancer detrimental health effect to occur by calculating a hazard index (HI). The HI is a ratio of a single substance exposure level over a specified period of time to a reference dose of the same substance derived from a similar exposure period. It is recommended that the HI of an exposure to a chemical of concern be below or equal to 1, which is the level at which no adverse human health effects are expected to occur. For cancer risk, the US EPA recommends a screening level that would equate to a one in a million ($1x10^{-6}$) or greater lifetime risk of developing cancer from exposure to a contaminated site. US EPA Office of Solid Waste and Emergency Response (OSWER) recommends a removal action if exposure to contamination may result in a non-cancer risk (HI) greater than 3, or a lifetime cancer risk greater than 1 in 10,000. US EPA's residential indoor air screening levels are based upon an HI of 1 or an excess lifetime excess cancer risk of 1 in 1,000,000.

WDNR has expressed concerns regarding possible vapor intrusion issues based upon TCE exceedances of Wisconsin Preventative Action Limits (PALs). PALSs are determined by WDNR to be protective of human health (WDNR - 2010). US EPA Region 5 Vapor Intrusion Guidance recommends the vapor intrusion mitigation be based upon indoor air concentrations shown to be from a subsurface source, such as a contaminated groundwater plume (USEPA – 2010). A complete vapor intrusion pathway should be established prior to a remedial action taking place.

The Region 5 Vapor Intrusion Guidance describes a calculation to determine the attenuation factor (AF) between groundwater and indoor air (USEPA – 2010).

$AF = C_{indoor}/(C_{groundwater} \times H \times CF)$

Where;
AF = attenuation factor
C_{indoor} = Concentration indoor Air
$C_{groundwater}$ = Concentration groundwater
H = Henry's law constant (unitless)
CF = Conversion factor ($0.001 m^3/L$)

The Region 5 Vapor Intrusion Guidance states that the default AF from groundwater to indoor is 0.001. Therefore, the default AF from indoor air to groundwater is 1000. The above equation can be used to derive groundwater screening levels using the above default parameters. The regional screening level for indoor air based upon a 1 in 1,000,000 excess lifetime cancer risks is 0.43 $\mu g/m^3$. The Region 5 Vapor Intrusion Guidance suggest that because of temporal and seasonal variations, indoor air levels exceeding a 1 in 100,000 ($1x10^{-5}$) lifetime cancer risk level generally trigger actions to reduce indoor air levels under the Remedial Program. Therefore, an indoor air screening level of 4.3 $\mu g/m^3$ would be used to protect against a lifetime excess cancer risk of 1 in 100,000. However, the indoor air screening level of 2.1 $\mu g/m^3$ is protective against potential non-cancer health effects and should be used to calculate groundwater screening concentrations since it is a more protective number. The Henry's law constant of TCE is 0.4.

$C_{groundwater} = C_{indoor} / (CF \times H \times AF)$

Using the above factors;
$C_{groundwater} = 2.1\ \mu g/m^3 / (0.001 m^3/L \times 0.4 \times 1000)$

This results in a groundwater screening level of 5.25 µg/L

Ground water flow is to the southwest of the site with discharge to Davy Creek (CH2M Hill 2009). Historically there were four monitoring wells of interest to the southwest of the site MW-6, MW-15S, MW-15D, and MW-102D (Figure 1).

- MW- 6 was abandoned in 2003. However in 1989 it had TCE concentrations of 130 µg/L.
- MW-15S one detection of TCE in March 2006 of 25 µg/L.
- MW-15D thirteen detections of TCE during sampling events which took place between 2004 and 2009. TCE concentrations ranged from 10 µg/L to 41 µg/L. The most recent detection in 2009 was 18 µg/L.
- MW-102D eleven detections of TCE during sampling events which took place between 2004 and 2009. TCE concentrations ranged from 0.63 µg/L to 3.7 µg/L. The most recent detection was 1 µg/L.

The concentration of TCE from one sampling event of MW-6 and five from MW-15D were at or above the calculated protective vapor intrusion groundwater screening criteria of 5.25 µg/L.

CONCLUSIONS

As stated previously, exceedance of the groundwater screening level does not automatically trigger a vapor intrusion mediation. The vapor intrusion pathway requires multiple lines of evidence to determine

if volatilization of groundwater contamination leads to deep soil gas contamination. This in turn must impact subslab soil gas underneath buildings. The contaminated subslab soil gas then impacts indoor air through cracks in the foundation, and so forth. Each of these is required for a complete vapor intrusion pathway.

A number of monitoring wells located on the site property consistently show high levels of TCE in the groundwater (CH2M Hill 2009). Based upon this, and the above discussion of monitoring wells in the residential area, it can be concluded that there is a **potential** for the existence of a groundwater plume of volatile organic compounds under the residential structures southwest of the former Oconomowoc Electroplating facility.

RECOMMENDATIONS

It is the mission of US EPA to protect human health and the environment. The health effects of prolonged inhalation of TCE from vapor intrusion can be detrimental to human health. In order to ensure that vapor intrusion is not an issue at this site, it is recommended that deep soil gas samples be collected and analyzed for volatile organic compounds. If TCE is detected in soil gas at levels above 2.1 $\mu g/m^3$ then this should be followed by subslab soil gas and indoor air sampling. However, if TCE levels in soil gas are found to be below 2.1 $\mu g/m^3$ then the vapor intrusion pathway can be ruled out.

In addition to TCE, other volatile organic compounds may also play a role in the vapor intrusion pathway. The table below shows indoor air screening levels based upon a 1 in 100,000 excess lifetime cancer risk or a HI of 1 for other potential chemicals of concern at the Oconomowoc Electroplating site, along with calculated groundwater screening levels. Once again, an exceedance of the groundwater screening level does not necessarily equate to an exceedance in the indoor air through the vapor intrusion pathway.

Volatile Organic Compounds (VOCs)	Soil-gas Screening Level (ug/m3)	Groundwater Screening Level (ug/l)	Basis (nc=noncancer; ca=cancer)	
Trichloroethane, 1,1,1-	5,200	7,400	nc	(HI=1)
Dichloroethane, 1,1-	15	65	ca	(CR=1e-05)
Dichloroethylene, 1,1-	210	197	nc	(HI=1)
Dichloroethylene, 1,2-trans-	63	378	nc	(HI=1)
Trichloroethylene	2.1	5.2	nc	(HI=1)
Vinyl Chloride	1.6	1.4	ca	(CR=1e-05)

REFERENCES

ATSDR 1997. Toxicological Profile for Trichloroethylene. U.S. DHHS, Atlanta

CH2M Hill 2009. ANNUAL GROUNDWATER REPORT. Oconomowoc Electroplating Company, Inc. Site. Oconomowoc , Wisconsin. WA No. 003-LRLR-05M8/Contract No. EP-S5-06-01

US EPA 2010. United States Environmental Protection Agency. Region 5-Superfund Division. Vapor Intrusion Guidebook.

WDNR 2010. NR 140.05 Groundwater Criteria. http://legis.wisconsin.gov/rsb/code/nr/nr140.pdf

Figure 1. Area map showing the former Oconomowoc Electroplating facility and local residences. Groundwater flow is to the southwest. Shallow and deep groundwater monitoring wells are shown with maximum detected TCE concentrations. Green dots are active monitoring wells. Red dot is a decommissioned monitoring well. The location of wells is approximated.

Attachment 5 – EPA's Private Well Risk Assessment

MEMORANDUM

SUBJECT: Well water contamination from Oconomowoc Electroplating, Ashippun, WI

FROM: Keith Fusinski, PhD Toxicologist US EPA
Superfund Division, Remedial Response Branch #1, Remedial Response Section #1

TO: William Ryan, Remedial Project Manager, US EPA
Superfund Division, Remedial Response Branch #2, Remedial Response Section #7

DATE: 4/2/2012

BACKGROUND

The Oconomowoc Electroplating Company Inc. (OECI) remedial site (hereafter referred to as the Site), comprises 10 acres of land which includes the former 4 acre OECI facility and 6 acres adjacent to the property. The site is located at 2573 Oak Street in Ashippun, WI.

Former operations at the site included metal cleaning and electroplating which used chlorinated solvents, cyanide and various metals. Operations ceased in 1990 and the buildings on site were demolished in 1992. Historical groundwater contamination was noted and remediated from 1994 through 2004 for various metals and chlorinated solvents.

STATEMENT OF THE ISSUES

RPM William Ryan requested an evaluation of human health risks be performed on data collected from various private wells from the Site. These wells have shown historical exceedances of the Wisconsin Administrative Code (WAC) NR 140 Preventive Action Limit (PAL) of volatile organic compounds (VOC).

CHEMICALS OF CONCERN

Vinyl Chloride

Vinyl chloride is a colorless, manufactured gas which does not occur naturally (ATSDR 2006). It burns easily and it is not stable at high temperatures. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down.

Breathing high levels of vinyl chloride can cause dizziness and unconsciousness. Breathing extremely high levels can cause death. Structural changes of the liver have been associated with prolonged breathing of vinyl chloride for several years. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. The effects of drinking high levels of vinyl chloride are unknown.

Touching vinyl chloride may cause numbness, redness, and blisters. Animal studies have shown that long-term exposure to vinyl chloride can damage the sperm and testes.

The U.S. Department of Health and Human Services has determined that vinyl chloride is a known carcinogen. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain, lung cancer, and some cancers of the blood have also been observed.

Methylene Chloride

Methylene chloride is a colorless liquid which does not occur naturally in the environment (ATSDR-2000). It is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film.

Inhalation of small amounts of methylene chloride may effect attention and accuracy in tasks requiring hand-eye coordination. Inhalation of large amounts of methylene chloride may cause dizziness, nausea and a tingling or numbness of finger and toes. Skin contact with methylene chloride causes burning and redness of the skin.

It is not known if methylene chloride can cause cancer in humans. An increased cancer risk was seen in mice breathing large amounts of methylene chloride for a long time. The World Health Organization (WHO) has determined that methylene chloride may cause cancer in humans. The Department of Health and Human Services (DHHS) has determined that methylene chloride can be reasonably anticipated to be a cancer-causing chemical. The EPA has determined that methylene chloride is a probable cancer-causing agent in humans.

Trichloroethylene (TCE)

Trichloroethylene (TCE) is a nonflammable, colorless liquid (ATSDR-1997). It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical. TCE is known to be only slightly soluble in water, but there is ample evidence that dissolved TCE can remain in groundwater for a long time. The primary means of degradation of TCE in groundwater is by bacteria, but a breakdown product by this means is vinyl chloride, a known human carcinogen and likely more of a health concern than TCE. When TCE is released into the air, it reacts relatively quickly in the presence of sunlight and oxygen, with about half of it breaking down to simpler compounds in about a week. (ATSDR-1997.)

Inhalation of small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Inhalation of large amounts of TCE may cause impaired heart function, unconsciousness, and death. Nerve, kidney, and liver damage may result from prolonged inhalation of TCE.

Consumption of small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear. Drinking large amounts may cause nausea, liver damage, unconsciousness, impaired heart function, or death. Skin rashes may occur after short periods of contact with TCE.

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

EXPOSURE ASSESSMENT AND ASSUMPTIONS

To be conservative in this assessment, the highest historical concentration detected, of each individual VOC, in each well was used to determine both cancer and non-cancer risks. Ingestion of well water and inhalation of volatilized VOCs during daily showering of the residents were both evaluated in this assessment. It is assumed that the residents shower for 30 minutes every day.

CONCLUSIONS

The US EPA determines probability of a non-cancer detrimental health effect to occur by calculating a hazard index (HI). The HI is a ratio of a single substance exposure level over a specified period of time to a reference dose of the same substance derived from a similar exposure period. It is recommended that the HI of an exposure to a chemical of concern be below or equal to 1 which is the level at which no adverse human health effects are expected to occur. For cancer risk, the U.S. EPA recommends a screening level that would equate to a one in a million ($1x10^{-6}$) or greater lifetime risk of developing cancer from exposure to a contaminated site. However, rates up to 1 in 10,000 ($1x10^{-4}$) can be considered acceptable.

Of the ten private wells evaluated, only eight had exceedances of the Wisconsin Administrative Code (WAC) NR 140 Preventive Action Limit (PAL). Wells PW-04, PW-05, PW-07, PW-08, PW-09, PW-11 all had multiple historical exceedances of vinyl chloride. Well PW-03 had multiple historical exceedances of trichloroethylene. Well PW-01 had a single exceedance of methylene chloride in April of 2007.

As demonstrated in the chart below, all of the historical exceedances of the public wells are well below non-cancer risk screening levels. The lifetime cancer risk for these wells is either below or within the US EPA's acceptable cancer risk range. Therefore, based upon the historical data, the low levels VOCs found in these private wells should not contribute to any detrimental health effects of those citizens using these wells for drinking or bathing purposes.

Well ID	Chemical of Concern	Highest Historical Concentration	Non-Cancer Child (HI)	Non-Cancer Adult (HI)	Lifetime Cancer Risk
PW-01	Methylene Chloride	3.5 ug/L	3.7E-03	1.3E-03	3.9E-07
PW-02	No Exceedances				
PW-03	Trichloroethylene	0.65 ug/L	8.6E-02	3.1E-02	4.4E-07
PW-04	Vinyl Chloride	0.069 ug/L	1.5E-03	5.0E-04	1.5E-06
PW-05	Vinyl Chloride	0.042 ug/L	8.9E-04	3.1E-04	9.4E-07
PW-07	Vinyl Chloride	0.080 ug/L	1.7E-03	5.8E-04	1.8E-06

PW-08	Vinyl Chloride	0.070 ug/L	1.5E-03	5.1E-04	1.6E-06
PW-09	Vinyl Chloride	0.073 ug/L	1.6E-03	5.3E-04	1.6E-06
PW-10	No Exceedances				
PW-11	Vinyl Chloride	0.039 ug/L	8.3E-04	2.8E-04	8.7E-07

* No reference dose available

REFERENCES

ATSDR. 1997. Toxicological Profile for Trichloroethylene. U.S. DHHS, Atlanta

ATSDR. 2000. Toxicological Profile for Methylene Chloride. U.S. DHHS, Atlanta

ATSDR. 2006. Toxicological Profile for Vinyl Chloride. U.S. DHHS, Atlanta

Appendix A

The equations used to determine health risk for local residents drinking and bathing in water from private wells on the Oconomowoc Electroplating Site are described below along with examples as to how these equations were used.

AT = Averaging time
(cancer = 365 days/year x 70 years = 25550 days)
(non-cancer child = 365 days/year x 6 years = 2190 days)
(non-cancer adult = 365 days/year x 24 years = 8760 days)

AT_s = Averaging time in Shower scenario
(cancer = 24 hours/day x 365 days/year x 70 years = 613200 hours)
(non-cancer child = 24 hours/day 365 days/year x 6 years = 52560 hours)
(non-cancer adult = 24 hours/day x365 days/year x 24 years = 262800 hours)

BW_c = Body Weight for Child (15kg)

BW_a = Body Weight for Adult (70kg)

CF = Conversion factor ($1x10^3$ ug/1mg)

Conc = Measured Concentration (mg/kg)

ETs = Exposure Time in shower scenario (0.5 hours/day)

ED_c = Exposure Duration Child (6 years)

ED_a = Exposure Duration Adult (24 years for cancer; 30 years for non-cancer)

EF = Exposure Frequency (1 hour/day)

HI = Hazard Index (recommended to be less than 1)

HQ = Hazard Quotient (recommended to be less than 1)

Ing_c = Water Ingestion Rate for Child (1L/day)

Ing_a = Water Ingestion Rate for Adult (2L/day)

IUR = Inhalation Unit Risk ($\mu g/m^3$)

K = Volatilization factor (0.5 – RAGS B)

Rfd_o = Oral reference dose from IRIS or applicable tables (mg/kg-day)

RfC_i = Inhalation Reference Concentration from IRIS or applicable tables (mg/m^3)

Sf_o = Cancer Slope factor from IRIS or applicable tables $(mg/kg\text{-}day)^{-1}$

Ingestion of Soil

Daily Ingestion Rate for Child = Conc x Ing_c x EF x ED /(BWc x AT)

Daily Ingestion Rate for Adult= Conc x Ing_a x EF x ED /(BWa x AT)

HI = Daily Ingestion Rate /Rfd_o

Lifetime cancer risk = Daily Average Dose x Sf_o

Inhalation of volatiles in shower scenario

Daily Average Dose = Conc x K x ET x EF x ED / AT_s

HI = Daily Average Dose/(RfCi x CF)

Lifetime cancer risk = Daily Average Dose x IUR

Total Risk

HQ = ΣHI from each scenario

Total Lifetime Cancer Risk = ΣCancer Risk

Example

The maximum vinyl chloride concentration found in well PW-07 was 0.080 ug/L. Health risks from this concentration are demonstrated below.

Non-Cancer –child

Ingestion of well water from PW-09
(8.0 x10^{-5} mg/L x 1 L/day x 350 days/year x 6 years) / (15 kg x 2190 days)

This results in a daily dose of 5.1x10^{-6} mg vinyl chloride/kg-day for a child.

This value is then divided by Rfd_o to determine total non-cancer risk.

5.1x10^{-6} mg vinyl chloride/kg-day / 3x10^{-3} mg vinyl chloride/kg-day = a hazard index of **1.7x10^{-3} by well water ingestion**

Inhalation of volatile compounds during shower/bathing scenario
(8.0 x10^{-5} µg/m^3 x 0.5 x 0.5 hours/day x 350 days/year x 6 years) / (52560 days)

This results in a daily dose of 7.9x10^{-7} µg vinyl chloride per cubic meter of air through volatilization for a child.

This value is then divided by the inhalation reference concentration multiplied by the conversion factor to convert µg to mg. 7.9x10^{-7} µg vinyl chloride per cubic meter/
(1.0x10^{-1} mg/m^3 x1000 µg/mg). **This results in a hazard index of 7.9x10^{-9} by volatile inhalation.** When the HIs of both exposure pathways are added together, the result is a **total hazard index of 1.7x10^{-3} for a child**.

Non-Cancer –adult

The same equations can be used to calculate non-cancer risks for an adult exposed to.
0.080 ug/L of vinyl chloride with a consumption rate of 2 liters per day.

Ingestion

(8.0 x10^{-5} mg/L x 2 L/day x 350 days/year x 24 years) / (70 kg x 10950 days)

This results in a daily dose of 1.8x10^{-6} mg of vinyl chloride/kg-day for an adult through ingestion.

This value is then divided by Rfd_o to determine the HI. 1.8x10^{-6} mg of vinyl chloride /kg-day /3x10^{-3} mg vinyl chloride/kg-day = a **HI of 5.8x10^{-4} by ingestion**

Inhalation of volatile compounds during shower/bathing scenario
(8.0 x10^{-5} µg/m^3 x 0.5 x 0.5 hours/day x 350 days/year x 24 years) / (262800 hours)

This results in a daily dose of 6.4x10^{-7} µg vinyl chloride per cubic meter of air through volatilization for an adult.

This value is then divided by the inhalation reference concentration multiplied by the conversion factor to convert µg to mg. 6.4x10^{-7} µg vinyl chloride per cubic meter/
(1.0x10^{-1} mg/m^3 x1000 µg/mg). **This results in a hazard index of 6.4x10^{-9} by volatile inhalation.** When the HIs of both exposure pathways are added together, the result is a **total hazard index of 5.8x10^{-4} for an adult**.

Cancer -child

Cancer Risk is assessed by the same method except the averaging time of 25550 days is used to determine cancer risk over a lifetime.

Ingestion
(8.0×10^{-5} mg/L x 1 L/day x 350 days/year x 6 years) / (15 kg x 25550 days)
This results in an average daily dose of 4.4×10^{-7} mg vinyl chloride/kg-day for a child. This value multiplied by the Sf_o to determine cancer risk by ingestion.

4.4×10^{-7} mg vinyl chloride/kg-day for a child x 1.5×10^{0} $(mg/kg\text{-}day)^{-1}$ = **6.6×10^{-7} cancer risk** for a child due to ingestion.

Inhalation of volatile compounds during shower/bathing scenario
(8.0×10^{-5} $\mu g/m^3$ x 0.5 x 0.5 hours/day x 350 days/year x 6 years) / (613200 hours)

This results in a daily dose of 6.8×10^{-8} µg vinyl chloride per cubic meter of air through volatilization for a child.

This value is then multiplied by the inhalation unit risk. 6.8×10^{-8} µg vinyl chloride per cubic meter x 8.8×10^{-6} $\mu g/m^3$. **This results in a cancer risk of 6.0×10^{-13} by volatile inhalation.**

Cancer -adult

Ingestion
(8.0×10^{-5} mg/L x 2 L/day x 350 days/year x 24 years) / (70 kg x 25550 days)

This results in an average daily dose of 7.5×10^{-7} mg vinyl chloride/kg-day for an adult. This value multiplied by the Sf_o to determine cancer risk by ingestion.

7.5×10^{-7} mg vinyl chloride/kg-day x 1.5×10^{0} $(mg/kg\text{-}day)^{-1}$ = **1.1×10^{-6} cancer risk** for an adult due to ingestion.

Inhalation of volatile compounds during shower/bathing scenario
(8.0×10^{-5} $\mu g/m^3$ x 0.5 x 0.5 hours/day x 350 days/year x 24 years) / (613200 hours)

This results in a daily dose of 2.7×10^{-7} µg vinyl chloride per cubic meter of air through volatilization for an adult.

This value is then multiplied by the inhalation unit risk. 2.7×10^{-7} µg vinyl chloride per cubic meter x 8.8×10^{-6} $\mu g/m^3$. **This results in a cancer risk of 2.4×10^{-12} by volatile inhalation.**

Total lifetime cancer risk for vinyl chloride exposure can be determined by adding each cancer risk for each exposure pathway for both children and adults resulting in a **total lifetime cancer risk of 1.8×10^{-6}** from exposure to well water at the Oconomowoc Electroplating Site.

Attachment 6 - Applicable or Relevant and Appropriate Requirements (ARARs)

Evaluation of ARARs and requirements To Be Considered (TBC)
OECI Focused Feasibility Study Report

Regulation	Requirement	ARAR Status	Analysis
Chemical-Specific ARARs			
CERCLA Guidance on Land Use in the CERCLA Remedy Selection Process	Establishes appropriate considerations in defining future land use.	TBC	Provides guidance to USEPA in selecting land use for remedy selection purposes.
40 CFR 260 through 264, Subtitle C	Regulates the generation, transport, storage, treatment, and disposal of hazardous wastes generated in the course of a remedial action. Regulates the construction, design, monitoring, operation, and closure of hazardous waste facilities.	ARAR	Requirements under these regulations may be relevant and appropriate to storage of certain non-hazardous wastes or treatment system residuals if the risk they present are similar to those associated with hazardous wastes. The criteria and limitations used to identify wastes as being hazardous or non-hazardous are applicable to groundwater treatment residuals.
40 CFR 261–Identification and Listing of Hazardous Waste	Identifies those wastes subject to regulation as hazardous wastes.	ARAR	The criteria and limitations used to identify wastes as being hazardous or nonhazardous in 40 CFR 261 are relevant and appropriate to all proposed cleanup actions at the Oconomowoc Site. Determining whether wastes qualify as hazardous will often establish the applicability of other regulations.
40 CFR 264, Subpart G–Closure and Post-Closure	Provides technical and procedural closure requirements for hazardous waste facilities. Requires the facility be closed in a manner that controls, minimizes or eliminates to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface water or to the atmosphere.	Not an ARAR	No remedial alternative includes consolidation.
40 CFR 268 Subpart D–Treatment Standards	Materials containing RCRA hazardous waste subject to land disposal restrictions. Some hazardous wastes restricted from land disposal in Subpart C may be land-disposed providing they attain levels achievable by best demonstrated available technologies (BDAT) for each hazardous constituent for each listed waste.	ARAR	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is being placed No alternatives propose moving soil within the area of contamination
NR 720–Soil Cleanup Standards	Establishes the soil cleanup standards (residual contaminant levels, RCLs) for the remediation of soil contamination.	Not an ARAR	Applies to determining the effectiveness of soil remedial alternatives. Do not apply to remediation of groundwater.
Groundwater			
Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, Section 208(b)	The proposed action must be consistent with regional water quality management plans as developed under Section 208 of Clean Water Act.	ARAR	Substantive requirements adopted by the state pursuant to Section 208 of the Clean Water Act would be applicable to direct discharge of treatment system effluent or other discharges to surface water.

Regulation	Requirement	ARAR Status	Analysis
Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, Section 304	Establishes water quality criteria for specific pollutants for the protection of human health and for the protection of aquatic life. These federal water quality criteria are non-enforceable guidelines used by the state to set water quality standards for surface water.	TBC	Water quality criteria may be relevant and appropriate to groundwater or treatment system effluent or other discharges to surface water.
40 CFR 122 44(a)–Technology-Based Effluent Limitations and Standards	Requires the use of the Best Available Technology (BAT) for toxic and nonconventional wastewaters or the Best Conventional Technology (BCT) for conventional pollutants. The nature of the wastewater and the technology-based limitations will be determined by the state on a case-by-case basis	ARAR	Substantive requirement is used by WDNR in setting discharge limits for onsite groundwater treatment.
40 CFR 122 44(e)–Technology-Based Controls for Toxic Pollutants	Discharge limits must be established at concentrations exceeding levels achievable by the technology-based (BAT/BCT) standards. The discharge limitations would be evaluated on a case-by-case basis depending on the proposed treatment system and the receiving water.	ARAR	Substantive requirement is used by WDNR in setting discharge limits for onsite groundwater treatment
40 CFR 131–Water Quality Standards	States are granted enforcement jurisdiction over direct discharges and may adopt reasonable standards to protect or enhance the uses and qualities of surface water bodies in the state.	ARAR	Applicable to direct discharge of treatment system effluent or other process waters Such a discharge would activate the administrative requirements of this rule because it would affect offsite surface waters
40 CFR 141–National Primary Drinking Water Regulations	Establishes maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) for specific chemicals to protect drinking water quality	ARAR	MCLs and nonzero MCLGs are relevant and appropriate because groundwater is used as drinking water supply.
Safe Drinking Water Act (SDWA)—Maximum Contaminant Levels (MCLs) 40 CFR 141.61 (organic chemicals) 40 CFR 141 62 (inorganic chemicals)	CERCLA 121(d) states that a remedial action will attain a level under the SDWA. MCLs are enforceable maximum permissible level of a contaminant which is delivered to any user of a public water system.	ARAR	MCLs are relevant and appropriate for potential drinking water sources per the NCP. Remedies may not have to demonstrate compliance with an ARAR that is technically impracticable (see NCP), such as areas of DNAPL.
SDWA—Maximum Contaminant Level Goals (MCLGs) 40 CFR 141.50 (organic chemicals) 40 CFR 141.51 (inorganic chemicals)	CERCLA 121(d)(2)(A) states that a remedial action attain MCLGs where relevant and appropriate. MCLGs are non-enforceable health goals under the SDWA.	ARAR	Non-zero MCLGs may be relevant and appropriate MCLGs equal to zero are not appropriate for cleanup of groundwater or surface water at CERCLA sites by USEPA policy (see NCP).
40 CFR 143-SDWA—Secondary MCLs (SMCLs)	Non-enforceable limits intended as guidelines for use by states in regulating water supplies. Secondary MCLs are related to aesthetic concerns (e.g taste and odor) and are not health-related.	Not an ARAR	Chemicals with SMCLs have not been identified as chemicals of concern at this site
Office of Drinking Water Drinking water health advisories.	Guidance levels for drinking water issued by Office of Drinking Water.	TBC	May be used for chemicals without MCLs if groundwater is to meet drinking water quality.
NR 140–Groundwater Quality (Enforcement Standards)	Establishes the remediation goals for groundwater which are to achieve the Enforcement Standards (ESs) at the Site. Also specifies actions required should a	ARAR	Relevant to determine effectiveness of remedial alternatives considered.

Regulation	Requirement	ARAR Status	Analysis
	groundwater standard be exceeded at the point of standards application.		
NR 140–Groundwater Quality (Preventative Action Limits)	Establishes the Preventive Action Limits (PALs) at the Site. Also specifies actions required should a groundwater standard be exceeded at the point of standards application.	ARAR	Relevant to determine effectiveness of remedial alternatives considered.
NR 809–Safe Drinking Water	Establishes drinking water standards for water supplies, including federal MCLs Also specifies sampling and analysis requirements	ARAR	MCLs are relevant and appropriate for potential drinking water sources per the NCP. Remedies may not have to demonstrate compliance with an ARAR that is technically impracticable (see NCP), such as areas of DNAPL.
Surface Water			
Federal Water Pollution Control Act as amended by the Clean Water Act of 1977, Section 208(b)	Establishes water quality criteria for specific pollutants for the protection of human health and aquatic life. These federal water quality criteria are non-enforceable guidelines used by the state to set water quality standards for surface water	TBC	Water quality criteria are TBCs used in setting standards for discharges to surface water from a treatment system.
NR 102–Water Quality Standards for Wisconsin Surface Water	Describes the designated use categories and water quality criteria to support uses	ARAR	Surface water standards are applicable to Davy Creek. Also treated groundwater must meet water quality standards.
NR 103–Water Quality Standards for Wetlands	Establishes water quality standards for wetlands and implementation procedures for application of the wetland water quality standards.	ARAR	Relevant to treated discharge from groundwater source control. Also relevant for soil excavation and groundwater withdrawal activities that have the potential to impact wetlands.
NR 104–Uses and Designated Standards and Secondary Values	Establishes surface water classifications and specifies effluent limitations for intrastate waters.	ARAR	Actions involving treated discharge must meet water quality standards.
NR 105–Surface Water Quality Criteria for Toxic Substances	Establishes water quality criteria and methods for developing criteria and secondary values for toxic and organoleptic substances for the protection of human health and welfare, and propagation of fish, aquatic life and wildlife. Also requires that contaminated sediment be remediated to meet sediment quality criteria that are protective of surface water quality standards.	ARAR	Water quality criteria are used by WDNR in setting WPDES discharge limit for toxics and developing sediment quality criteria.
NR 106–Procedures for Calculating Water Quality Based Effluent Limitations for Toxic and Organoleptic Substances Discharged to Surface Waters	Specifies the procedures to calculate effluent limits for toxic and organoleptic substances and if and how these limits will be included in WPDES permits	ARAR	Water quality criteria are used by WDNR in setting WPDES discharge limit for toxics and developing sediment quality criteria Surface water standards are applicable to Davy Creek
Air			
Clean Air Act	Calls for development and implementation of regional air pollution control programs	ARAR	Section 101 of the Clean Air Act delegates primary responsibility for regional air quality management to the states. The rules for implementation of regional air quality plans are contained in 40 CFR 52. Regulations promulgated under the Clean Air Act may apply to possible actions at the

Regulation	Requirement	ARAR Status	Analysis
			Site that generate air emissions, but are most applicable to stationary sources.
40 CFR 50–National Primary and Secondary Ambient Air Quality Standards	Establishes Ambient Air Quality Standards	ARAR	Applicable to discharges of toxic substances to the atmosphere during waste handling or treatment. The existing groundwater treatment system did not require air emission controls so it is unlikely re-starting the treatment system with lower VOC concentrations will require air emission controls. The substantive requirements of an air permit will need to be re-evaluated.
40 CFR 61–National Emission Standards for Hazardous Waste Pollutants	Requires limits on the discharges of toxic substances to the atmosphere	ARAR	Applicable to discharges of toxic substances to the atmosphere during waste handling or treatment. The existing groundwater treatment system did not require air emission controls so it is unlikely re-starting the treatment system with lower VOC concentrations will require air emission controls The substantive requirements of an air permit will need to be re-evaluated
40 CFR 264 AA–Air Emission Standards for Process Vents	Requires total organic emissions from air strippers or steam strippers to be reduced below 1.4 kg/hr and 2.8 Mg/yr or that total organic emissions be reduced by 95 percent by weight.	ARAR	Applicable to discharges of toxic substances to the atmosphere during waste handling or treatment. The existing groundwater treatment system did not require air emission controls so it is unlikely re-starting the treatment system with lower VOC concentrations will require air emission controls. The substantive requirements of an air permit will need to be re-evaluated.
NR 404–Ambient Air Quality	Establishes ambient air quality standards for particulate matter and specifies measurement methods.	ARAR	Relevant to excavation of soil for remediation.
NR 405 - Protection of Significant Deterioration	Establishes the requirements and procedures for reviewing and issuing air pollution control construction permits to any new major stationary source.	ARAR	Relevant to air emissions associated with restarting the existing groundwater treatment system.
NR 407 - Operation Permits	Required for all direct stationary sources requiring a permit.	ARAR	Relevant if the size of the pump and treat air emission system falls within the size and type limits requiring an operation permit.
NR 415–Control of Particulate Emissions	Establishes standards for fugitive dust emissions and specifies that precautions should be taken to prevent particulate matter from becoming air borne.	ARAR	Relevant to excavation of soil for remediation.
NR 419–Control of Organic Compound Emissions	Describes the notification and approval requirements and emission limitations for remediation of soil or water contaminated organic compounds.	ARAR	Applicable to discharges of toxic substances to the atmosphere during waste handling or treatment The existing groundwater treatment system did not require air emission controls so it is unlikely re-starting the treatment system with lower VOC concentrations will require air emission controls. The substantive requirements of an air permit will need to be re-evaluated.
NR 431 - Control of Visible Emissions	This applies to all air contaminant sources and is used to categorize air contaminant sources and to establish visible emission limitations for these sources to protect air quality.	ARAR	No owner or operator of a direct or portable source may cause or allow emissions of shade or density great than number 2 of the Ringlemann chart or 40% opacity. This can affect operation of the groundwater treatment system emissions.

Regulation	Requirement	ARAR Status	Analysis
NR 439 - Reporting of Record Keeping, Testing, Inspection, and Determination of Compliance	This establishes general reporting, recordkeeping, testing, inspection and determination of compliance requirements for all air emission sources	ARAR	Substantive requirements apply to the groundwater pump and treat system air emission unit.
NR 440 - Standards of Performance for New Stationary Sources	This enables WDNR to implement and enforce standards of performance for new stationary sources promulgated by the USEPA under the Clean Air Act	ARAR	Applies to the groundwater treatment system emissions.
NR 445–Control of Hazardous Pollutants	Specifies emission limits and control requirements for air contaminant sources emitting hazardous pollutants.	ARAR	Emissions for actions that may emit air pollutants must meet NR 445 requirements.
NR 445.04–Emission Limits for New or Modified Sources	Specifies air concentrations not to be exceeded in terms of 24-hour and 1-hour averages. Requires lowest achievable emission rates and best available technology for air contaminants without acceptable ambient concentrations.	ARAR	Emissions for actions that may emit air pollutants must meet NR 445 requirements
NR 449 - Control of Vinyl Chloride Emissions	Establishes emission limitations and sampling and testing procedures for vinyl chloride air contaminant sources.	ARAR	Applies to the groundwater treatment system emissions.
Location-Specific ARARs			
50 CFR 402 - Interagency Cooperation - Endangered Species Act of 1973 16 USC §1531 et seq. 50 CFR 200	Requires that Federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	ARAR	Potential risks to threatened and endangered species were not identified previously at Site.
50 CFR 402–Interagency Cooperation—Endangered Species Act of 1973, as amended	Requires remedial agency to consult with Fish and Wildlife Service if action may affect endangered species or critical habitat.	Not likely ARAR	Potential risks to endangered species or critical habitat were not identified previously at Site.
National Historical Preservation Act 16 USC §661 et seq. 36 CFR Part 65	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at the Site, work in the area of the Site affected by such discovery will be halted pending the completion of any data recovery and preservation activities required pursuant to the act and its implementing regulations.	Not likely ARAR	May be ARAR during the remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy.
Fish and Wildlife Coordination Act (16 USC 661 et seq)	The Act provides protection and consultation with the U S. Fish and Wildlife Service and state counterpart for actions that would affect streams, wetlands, other water bodies, or protected habitats Action taken should protect fish or wildlife, and measures should be developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife	ARAR	The Act is considered an ARAR for construction activities performed during the implementation of remedies that may affect the wetlands and Davy Creek
Protection of Wetlands—Executive Order 11990 40 CFR 6, Subpart A	Requires actions to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands Appendix A	ARAR	Wetlands are present onsite

Regulation	Requirement	ARAR Status	Analysis
50 CFR Part 6, Appendix A	requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If none is available, effects from implementing the chosen alternative must be mitigated. Public notice and review of activities involving wetlands is required.		
Executive Order 11988 50 CFR Part 6, Appendix A	Requires actions to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains.	TBC	Site is within a floodplain
Rivers and Harbors Act 33 CFR Part 332, Section 10.	A permit is required for work in or affecting navigable waters of the U.S. This includes dredging, disposal of fill material, filling or modification of said waters below the ordinary high water level (OHWL).	Not likely ARAR	Remedial actions are not likely to affect Davy Creek.
Action-Specific ARARs/TBC			
Executive Orders 11988 and 11990 40 CFR 6, Subpart A	Requires federal agencies to avoid whenever possible, adversely affecting flood plains or wetlands and to evaluate potential effects of actions in these designated areas	TBC	Applicable to wetlands and Davy Creek.
Occupational Safety and Health Act (29 U.S.C. 61 et seq.)	The Occupational Safety and Health Act was passed in 1970 to ensure worker safety on the job. The U.S. Department of Labor oversees the Act. Worker safety at hazardous waste sites is specifically addressed under 29 CFR 1910 120: Hazardous Waste Operations and Emergency Response; general worker safety is covered elsewhere within the law.	ARAR	The Act is considered an ARAR for construction activities performed during the implementation of remedies
40 CFR 50-99	The Clean Air Act amendments of 1990 greatly expanded the role of National Emission Standards for Hazardous Air Pollutants by designating 179 new hazardous air pollutants and directed USEPA to attain maximum achievable control technology standards for emission sources. Such emission standards are potential ARARs if remedial technologies (such as incinerators or air strippers) produce air emissions of regulated hazardous air pollutants. Specifies requirements for air emissions such as particulates, sulfur dioxide, VOCs, hazardous air pollutants, and asbestos.	ARAR	The existing groundwater treatment system did not require air emission controls so it is unlikely re-starting the treatment system with lower VOC concentrations will require air emission controls. The substantive requirements of an air permit will need to be re-evaluated.
40 CFR 122.21– Application for Permit	Permit application must include a detailed description of the proposed action, including a listing of all required environmental permits.	Not an ARAR	Administrative requirement applicable only for discharges to offsite surface water
40 CFR 122.44– Establishing Limitations, Standards, and Other Permit Conditions	Federally approved state water quality standards. These may be in addition to or more stringent than federal water quality standards under the CWA.	Not an ARAR	All substantive requirements under the cited sections of 40 CFR 122 would be applicable to the direct discharge of effluent to an onsite or offsite surface water body
40 CFR 122.44(i)– Monitoring Requirements	Requires monitoring of discharges to ensure compliance. Monitoring programs shall include data on the mass, volume, and frequency of all discharge events	ARAR	Substantive requirement is used by WDNR in setting discharge limits for onsite groundwater treatment.

Regulation	Requirement	ARAR Status	Analysis
40 CFR 125–USEPA Regulations on Criteria and Standards for the NPDES	The Site operator shall develop a best management practice (BMP) program and shall incorporate it into the operations plan or the NPDES permit application if required.	ARAR	Substantive and administrative requirements of 40 CFR 125 would be applicable to the direct discharge of treatment system effluent to offsite surface water body.
40 CFR 136–Guidelines Establishing Test Procedures for the Analysis of [Water] Pollutants	These sections require adherence to sample preservation procedures including container materials and sample holding times	ARAR	Applicable to direct discharge of treatment system effluent
40 CFR 144–Underground Injection Control Program	Establishes the requirements for underground injection wells and for discharge of wastewaters and hazardous wastes. Reinjection is prohibited except for reinjection of contaminated groundwater into the same formation from which it was withdrawn pursuant to CERCLA activities.	ARAR	Applicable to injection activities for remediation of the groundwater or soil.
40 CFR 146–Underground Injection Control Program: Criteria and Standards	Establishes the technical criteria for the UIC program, including the construction, operating, monitoring and reporting requirements	ARAR	Applicable to injection activities for remediation of the groundwater or soil.
40 CFR 147–Regulations on State UIC Programs (Subpart YY)	The proposed action is required to be in compliance with State underground injection requirements	ARAR	Applicable to injection activities for remediation of the groundwater or soil.
Resource Conservation and Recovery Act (RCRA), (42 U S.C 321 et seq.)	RCRA was passed in 1976. It amended the Solid Waste Disposal Act by including provisions for hazardous waste management.	Possible ARAR	There is no documented evidence of disposal of listed hazardous waste at the Site. Soil excavated for offsite ex situ treatment or offsite disposal may however be characteristic hazardous waste.
40 CFR 268 Subpart C–Prohibitions on Land Disposal	The land disposal restriction under this subpart prohibits land-based disposal of certain solvent-containing wastes, dioxin-containing wastes, and listed wastes.	ARAR	The rules in 40 CFR 268 restrict land disposal of several types of hazardous wastes and as such, may affect the implementation of several potential actions, including actions involving disposal of contaminated soils. The land disposal ban may be applicable or relevant and appropriate to the proposed cleanup because qualifying hazardous wastes might be present in onsite soils. The LDRs delegate primary responsibility to the states except to the extent that promulgated federal regulations are not yet incorporated.
40 CFR 268 Land Disposal Restrictions	The land disposal restrictions require treatment before land disposal for a wide range of hazardous wastes.	Possible ARAR	ARAR for disposal of hazardous waste Applicable to soils that are a characteristic hazardous waste or that contain a listed waste Contaminated soils must meet the higher of 10 x the universal treatment standard or a 90% reduction of the contaminant concentration.
Hazardous Materials Transportation Act; 49 CFR 100-109 Transportation of hazardous materials	Specific DOT requirements for labeling, packaging, shipping papers, and transport by rail, aircraft, vessel, and highway.	Possible ARAR	Off-site shipment of hazardous waste may occur.
40 CFR 262 and 263	Establishes responsibilities for transporters of hazardous waste in handling, transportation, and management of the waste Sets requirements for manifesting, recordkeeping, and emergency response action in case of a spill.	Possible ARAR	Applicability depends on waste classification of groundwater treatment residuals and excavated soil.

Regulation	Requirement	ARAR Status	Analysis
NR 140 28(5)–Criteria for Granting a Temporary Exemption Where Infiltration or Injection is Utilized for a Remedial Action	Describes the criteria for requesting an exemption from WDNR to exceed the PALs or ES at a point of standard application for a remedial action including the infiltration or injection of contaminated groundwater.	Possible ARAR	Contaminant concentrations in the effluent may require variance to discharge the treated groundwater and this standard may be applied to remedial fluid injection.
NR 141–Groundwater Monitoring Well Requirements	Establishes minimum standards for the installation, construction and abandonment of monitoring wells.	ARAR	Construction and abandonment of monitoring wells must conform to standards specified.
NR 200–Application for Discharge Permit	Specifies requirements for applying for permit for discharges to surface water and to land areas where water may percolate or seep to groundwater.	ARAR	WPDES permit may be required for discharge to Davy Creek but not required for onsite discharges All the substantive requirements, however, must be met.
NR 207–Water Quality Antidegradation Policy	Establishes implementation procedures for the antidegradation policy in NR 102.	ARAR	Applicable for discharges to Davy Creek. Establishes procedure to follow when proposing new or increased discharges to a surface water body.
NR 214–Land Treatment of Industrial Liquid Wastes, By-Product Solids and Sludges	Establishes the design for all land treatment systems that receive wastewater and require approval of plans and specifications by WDNR. Effluent limits, discharge permits and groundwater monitoring requirements are also specified Use of injection wells of any sort is prohibited unless approved by WDNR.	Not an ARAR	Land treatment is not included in remedial alternatives.
NR 217 - Effluent Standards and Limitations	Establishes effluent standards and limitations for pollutants in effluent discharged to surface waters.	ARAR	Applicable for groundwater treatment system discharge to Davy Creek
NR 219–Analytical Test Methods and Procedures	Establishes analytical test methods, preservation procedures, requirements for laboratories, and procedures applicable to effluent limits for discharges to surface waters.	ARAR	Procedures applicable to effluent limitations for discharges from point sources under 144 and 147 stats.
NR 220–Categories and Classes of Point Sources and Effluent Limits	Required WDNR to establish effluent limits for uncategorized point sources (i.e , not included in NR 221 to 299 inclusive) and to base those limits on best practicable control technology currently available or best available control technology economically achievable.	ARAR	The substantive requirements of obtaining a WPDES permit would be necessary.
NR 600 to NR 685–Hazardous Waste Management Requirements	Specifies minimum requirements for storage or treatment of hazardous wastes.	ARAR	Applies to actions involving excavation and disposal of contaminated soil exceeding TCLP limits.
NR 605–Hazardous Waste Classification	Establishes criteria for the classification of hazardous waste.	ARAR	Contaminated soil may exceed TCLP toxicity characteristic levels and be considered a hazardous waste if recovered from ground.
NR 610 to NR 615–Small and Large Quantity Generator Standards	Specifies transportation standards for hazardous waste based on RCRA standards.	ARAR	Relevant and appropriate for offsite management of hazardous substances Would also apply to any treatment residuals from water treatment units, including spent activated carbon.
NR 670–Miscellaneous Unit Standards	Establishes standards for environmental performance of miscellaneous treatment units.	ARAR	Placement of treated or untreated soil that is classified as hazardous waste may make NR 660 applicable, unless exemption under NR 680.04 is granted.

Regulation	Requirement	ARAR Status	Analysis
NR 675–Land Disposal Restrictions	Identifies hazardous wastes that are restricted from land disposal and defines exceptions	ARAR	Soils and debris exceeding TCLP level or considered to contain listed waste-type contamination may not be disposed in a landfill without treatment. After treatment, characteristic waste-type soils and debris may be disposed of in a Subtitle D landfill Soils and debris with listed waste-type contamination after treatment must be disposed of in a Subtitle C landfill.
NR 718–Management of Solid Wastes Excavated During Response Actions	Describes requirements for temporary storage, treatment, transportation, and disposal of contaminated soil and other non-hazardous solid wastes resulting from cleanup activities.	ARAR	Applicable if excavated soil are not hazardous and relevant and appropriate for hazardous wastes (as defined by NR 600.03)
NR 722–Standards for Selecting Remedial Actions	Describes requirements for identifying and evaluating remedial action options and selecting remedial actions.	ARAR	Requirements specified are consist with remedy selection in FS process.
NR 724–Remedial and Interim Action Design, Implementation, Operation, Maintenance, and Monitoring Requirements	Specifies the requirements for the design, implementation, operation, maintenance and monitoring of remedial actions	ARAR	Design and implementation will conform to requirements specified.
NR 812–Well Construction and Pump Installation	Establishes the standards and methods for construction of new extraction wells and requirements for new pump installations.	ARAR	Construction of extraction wells will conform to standards specified.
NR 812 05–Disposal of Pollutants; Injection Prohibition	Specifies that injection of any waste to surface or subsurface water is allowed if approved by WDNR.	ARAR	Injection of treated groundwater will require approval from WDNR
NR 812 37–Water Treatment	Describes the requirements for installation of point of use or in-house water treatment systems and establishes the need for WDNR approval	Not ARAR	Point-of-use or in-house water treatment devices are not included in remedial alternatives.
Chapter 147 Statutes–Pollution Discharge Elimination	Requires point source discharges to obtain a permit from WDNR.	ARAR	Substantive requirements in obtaining a permit would have to be met for discharges to Davy Creek
Note: Federal ARARs are included above however where the State of Wisconsin has authorization for the program the State of Wisconsin ARARs apply.			