Geosyntec consultants

10600 N. Port Washington Road
Suite 100
Mequon, WI 53092
PH 262.377.9828
www.geosyntec.com

RECEIVED
SEP 21 2020
By

Letter of Transmittal

[X] U.S. Mail [ ] Overnight Mail [ ] Delivered

To: Ms. Jennifer Dorman
Environmental Program Associate
Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
2300 N. Dr. Martin Luther King Jr. Drive
Milwaukee, WI 53212-3128

Date: September 11, 2020

Project Name: Metro North Service Center

Geosyntec Proj. No.: CHE8094OQ

[ ] Letter [ ] Proposal

[ ] Report [ ] Computer Disks/CDs

[ ] Work Plan [X] Other

Number of Copies	Date	Description
		Infiltration and Injection Request
1	9/11/2020	WDNR submital portal email confirmation
1	9/11/2020	WDNR Form 4400-237
1	9/11/2020	WDNR review fee check

[X] For Review [ ] As Requested [ ] Other

[ ] For File [ ] For Distribution

Comments:	**WDNR FID #: 241311510**
	WDNR BRRTS #: 02-41-583015

cc: Frank Dombrowski, WEC Energy Group - Business Services
David Jaeckels, WEC Energy Group - Business Services

From: Jeremiah Johnson
262.834.0228
jpjohnson@geosyntec.com

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Technical Assistance, Environmental Liability Clarification or Post-Closure Modification Request

Form 4400-237 (R 12/18)

RECEIVED
SEP 21 2020
BY

Notice: Use this form to request **a written response (on agency letterhead)** from the Department of Natural Resources (DNR) regarding technical assistance, a post-closure change to a site, a specialized agreement or liability clarification for Property with known or suspected environmental contamination. A fee will be required as is authorized by s. 292.55, Wis. Stats., and NR 749, Wis. Adm. Code., unless noted in the instructions below. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records law [ss. 19.31 - 19.39, Wis. Stats.].

Definitions

"Property" refers to the subject Property that is perceived to have been or has been impacted by the discharge of hazardous substances.

"Liability Clarification" refers to a written determination by the Department provided in response to a request made on this form. The response clarifies whether a person is or may become liable for the environmental contamination of a Property, as provided in s. 292.55, Wis. Stats.

"Technical Assistance" refers to the Department's assistance or comments on the planning and implementation of an environmental investigation or environmental cleanup on a Property in response to a request made on this form as provided in s. 292.55, Wis. Stats.

"Post-closure modification" refers to changes to Property boundaries and/or continuing obligations for Properties or sites that received closure letters for which continuing obligations have been applied or where contamination remains. Many, but not all, of these sites are included on the GIS Registry layer of RR Sites Map to provide public notice of residual contamination and continuing obligations.

Select the Correct Form

This from should be used to request the following from the DNR:

- Technical Assistance
- Liability Clarification
- Post-Closure Modifications
- Specialized Agreements (tax cancellation, negotiated agreements, etc.)

Do not use this form if one of the following applies:

- Request for an **off-site liability exemption or clarification** for Property that has been or is perceived to be contaminated by one or more hazardous substances that originated on another Property containing the source of the contamination. Use DNR's Off-Site Liability Exemption and Liability Clarification Application Form 4400-201.
- Submittal of an Environmental Assessment for the **Lender Liability Exemption**, s 292.21, Wis. Stats., **if no response or review by DNR is requested**. Use the Lender Liability Exemption Environmental Assessment Tracking Form 4400-196.
- Request for an **exemption to develop on a historic fill site** or licensed landfill. Use DNR's Form 4400-226 or 4400-226A.
- **Request for closure** for Property where the investigation and cleanup actions are completed. Use DNR's Case Closure - GIS Registry Form 4400-202.

All forms, publications and additional information are available on the internet at: dnr.wi.gov/topic/Brownfields/Pubs.html.

Instructions

1. Complete sections 1, 2, 6 and 7 for all requests. Be sure to provide adequate and complete information.
2. Select the type of assistance requested: Section 3 for technical assistance or post-closure modifications, Section 4 for a written determination or clarification of environmental liabilities; or Section 5 for a specialized agreement.
3. Include the fee payment that is listed in Section 3, 4, or 5, unless you are a "Voluntary Party" enrolled in the Voluntary Party Liability Exemption Program **and** the questions in Section 2 direct otherwise. Information on to whom and where to send the fee is found in Section 8 of this form.
4. Send the completed request, supporting materials and the fee to the appropriate DNR regional office where the Property is located. See the map on the last page of this form. A paper copy of the signed form and all reports and supporting materials shall be sent with an electronic copy of the form and supporting materials on a compact disk. For electronic document submittal requirements see: http://dnr.wi.gov/files/PDF/pubs/rr/RR690.pdf"

The time required for DNR's determination varies depending on the complexity of the site, and the clarity and completeness of the request and supporting documentation.

Section 1. Contact and Recipient Information

Requester Information

This is the person requesting technical assistance or a post-closure modification review, that his or her liability be clarified or a specialized agreement and is identified as the requester in Section 7. DNR will address its response letter to this person.

Last Name	First	MI	Organization/ Business Name		
Dombrowski	Frank		WEC Energy Group - Business Services		
Mailing Address			City	State	ZIP Code
333 W. Everett St., A231			Milwaukee	WI	53203
Phone # (include area code)	Fax # (include area code)		Email		
(414) 221-2156			frank.dombrowski@wecenergygroup.com		

The requester listed above: (select all that apply)

- ☒ Is currently the owner
- ☐ Is considering selling the Property
- ☐ Is renting or leasing the Property
- ☐ Is considering acquiring the Property
- ☐ Is a lender with a mortgagee interest in the Property
- ☐ Other. Explain the status of the Property with respect to the applicant:

Contact Information (to be contacted with questions about this request) ☒ Select if same as requester

Contact Last Name	First	MI	Organization/ Business Name		
Dombrowski	Frank		WEC Energy Group - Business Services		
Mailing Address			City	State	ZIP Code
333 W. Everett St., A231			Milwaukee	WI	53203
Phone # (include area code)	Fax # (include area code)		Email		
(414) 221-2156			frank.dombrowski@wecenergygroup.com		

Environmental Consultant (if applicable)

Contact Last Name	First	MI	Organization/ Business Name		
Johnson	Jeremiah		Geosyntec Consultants		
Mailing Address			City	State	ZIP Code
10600 N. Port Washington Rd, Suite 100			Mequon	WI	53092
Phone # (include area code)	Fax # (include area code)		Email		
(262) 834-0228			jpjohnson@geosyntec.com		

Section 2. Property Information

Property Name			FID No. (if known)		
We Energies Metro North Service Center			241311510		
BRRTS No. (if known)			Parcel Identification Number		
02-41-583015			3261641000		
Street Address			City	State	ZIP Code
3100 W. North Ave.			Milwaukee	WI	53208
County	Municipality where the Property is located		Property is composed of:		Property Size Acres
Milwaukee	◉ City ○ Town ○ Village of		◉ Single tax parcel ○ Multiple tax parcels		6

1. Is a response needed by a specific date? (e.g., Property closing date) Note: Most requests are completed within 60 days. Please plan accordingly.

○ No ◉ Yes

Date requested by: 10/23/2020

Reason: Remedial action implementation will be conducted in conjunction with Site building reconstruction scheduled to begin at the end of October/early November.

2. Is the "Requester" enrolled as a Voluntary Party in the Voluntary Party Liability Exemption (VPLE) program?

◉ No. **Include the fee that is required for your request in Section 3, 4 or 5.**

○ Yes. **Do not include a separate fee.** This request will be billed separately through the VPLE Program.

Fill out the information in Section 3, 4 or 5 which corresponds with the type of request:
Section 3. Technical Assistance or Post-Closure Modifications;
Section 4. Liability Clarification; or Section 5. Specialized Agreement.

Section 3. Request for Technical Assistance or Post-Closure Modification

Select the type of technical assistance requested: **[Numbers in brackets are for WI DNR Use]**

☐ No Further Action Letter (NFA) (Immediate Actions) - NR 708.09, [183] - **Include a fee of $350.** Use for a written response to an immediate action after a discharge of a hazardous substance occurs. Generally, these are for a one-time spill event.

☐ Review of Site Investigation Work Plan - NR 716.09, [135] - **Include a fee of $700.**

☐ Review of Site Investigation Report - NR 716.15, [137] - **Include a fee of $1050.**

☐ Approval of a Site-Specific Soil Cleanup Standard - NR 720.10 or 12, [67] - **Include a fee of $1050.**

☐ Review of a Remedial Action Options Report - NR 722.13, [143] - **Include a fee of $1050.**

☐ Review of a Remedial Action Design Report - NR 724.09, [148] - **Include a fee of $1050.**

☐ Review of a Remedial Action Documentation Report - NR 724.15, [152] - **Include a fee of $350**

☐ Review of a Long-term Monitoring Plan - NR 724.17, [25] - **Include a fee of $425.**

☐ Review of an Operation and Maintenance Plan - NR 724.13, [192] - **Include a fee of $425.**

Other Technical Assistance - s. 292.55, Wis. Stats. [97] (For request to build on an abandoned landfill use Form 4400-226)

☐ Schedule a Technical Assistance Meeting - **Include a fee of $700.**

☐ Hazardous Waste Determination - **Include a fee of $700.**

☒ Other Technical Assistance - **Include a fee of $700.** Explain your request in an attachment.

Post-Closure Modifications - NR 727, [181]

☐ Post-Closure Modifications: Modification to Property boundaries and/or continuing obligations of a closed site or Property; sites may be on the GIS Registry. This also includes removal of a site or Property from the GIS Registry. **Include a fee of $1050, and:**

☐ Include a fee of $300 for sites with residual soil contamination; and

☐ Include a fee of $350 for sites with residual groundwater contamination, monitoring wells or for vapor intrusion continuing obligations.

Attach a description of the changes you are proposing, and documentation as to why the changes are needed (if the change to a Property, site or continuing obligation will result in revised maps, maintenance plans or photographs, those documents may be submitted later in the approval process, on a case-by-case basis).

Skip Sections 4 and 5 if the technical assistance you are requesting is listed above and complete Sections 6 and 7 of this form.

Section 4. Request for Liability Clarification

Select the type of liability clarification requested. Use the available space given or attach information, explanations, or specific questions that you need answered in DNR's reply. Complete Sections 6 and 7 of this form. **[Numbers in brackets are for DNR Use]**

☐ "Lender" liability exemption clarification - s. 292.21, Wis. Stats. [686]

❖ **Include a fee of $700.**

Provide the following documentation:

(1) ownership status of the real Property, and/or the personal Property and fixtures;

(2) an environmental assessment, in accordance with s. 292.21, Wis. Stats.;

(3) the date the environmental assessment was conducted by the lender;

(4) the date of the Property acquisition; for foreclosure actions, include a copy of the signed and dated court order confirming the sheriff's sale.

(5) documentation showing how the Property was acquired and the steps followed under the appropriate state statutes.

(6) a copy of the Property deed with the correct legal description; and,

(7) the Lender Liability Exemption Environmental Assessment Tracking Form (Form 4400-196).

(8) If no sampling was done, please provide reasoning as to why it was **not** conducted. Include this either in the accompanying environmental assessment or as an attachment to this form, and cite language in s. 292. 21(1)(c)2.,h.-i., Wis. Stats.:

h. The collection and analysis of representative samples of soil or other materials in the ground that are suspected of being contaminated based on observations made during a visual inspection of the real Property or based on aerial photographs, or other information available to the lender, including stained or discolored soil or other materials in the ground and including soil or materials in the ground in areas with dead or distressed vegetation. The collection and analysis shall identify contaminants in the soil or other materials in the ground and shall quantify concentrations.

i. The collection and analysis of representative samples of unknown wastes or potentially hazardous substances found on the real Property and the determination of concentrations of hazardous waste and hazardous substances found in tanks, drums or other containers or in piles or lagoons on the real Property.

☐ "Representative" liability exemption clarification (e.g. trustees, receivers, etc.) - s. 292.21, Wis. Stats. [686]

❖ **Include a fee of $700.**

Provide the following documentation:

(1) ownership status of the Property;

(2) the date of Property acquisition by the representative;

(3) the means by which the Property was acquired;

(4) documentation that the representative has no beneficial interest in any entity that owns, possesses, or controls the Property;

(5) documentation that the representative has not caused any discharge of a hazardous substance on the Property; and

(6) a copy of the Property deed with the correct legal description.

☐ Clarification of local governmental unit (LGU) liability exemption at sites with: (select all that apply)

☐ hazardous substances spills - s. 292.11(9)(e), Wis. Stats. [649];

☐ Perceived environmental contamination - [649];

☐ hazardous waste - s. 292.24 (2), Wis. Stats. [649]; and/or

☐ solid waste - s. 292.23 (2), Wis. Stats. [649].

❖ **Include a fee of $700, a summary of the environmental liability clarification being requested, and the following:**

(1) clear supporting documentation showing the acquisition method used, and the steps followed under the appropriate state statute(s).

(2) current and proposed ownership status of the Property;

(3) date and means by which the Property was acquired by the LGU, where applicable;

(4) a map and the ¼, ¼ section location of the Property;

(5) summary of current uses of the Property;

(6) intended or potential use(s) of the Property;

(7) descriptions of other investigations that have taken place on the Property; and

(8) (for solid waste clarifications) a summary of the license history of the facility.

Section 4. Request for Liability Clarification (cont.)

☐ Lease liability clarification - s. 292.55, Wis. Stats. [646]

- ❖ **Include a fee of $700 for a single Property, or $1400 for multiple Properties and the information listed below:**

(1) a copy of the proposed lease;

(2) the name of the current owner of the Property and the person who will lease the Property;

(3) a description of the lease holder's association with any persons who have possession, control, or caused a discharge of a hazardous substance on the Property;

(4) map(s) showing the Property location and any suspected or known sources of contamination detected on the Property;

(5) a description of the intended use of the Property by the lease holder, with reference to the maps to indicate which areas will be used. Explain how the use will not interfere with any future investigation or cleanup at the Property; and

(6) all reports or investigations (e.g. Phase I and Phase II Environmental Assessments and/or Site Investigation Reports conducted under s. NR 716, Wis. Adm. Code) that identify areas of the Property where a discharge has occurred.

General or other environmental liability clarification - s. 292.55, Wis. Stats. [682] - Explain your request below.

- ❖ **Include a fee of $700 and an adequate summary of relevant environmental work to date.**

☐ No Action Required (NAR) - NR 716.05, [682]

- ❖ **Include a fee of $700.**

Use where an environmental discharge has or has not occurred, and applicant wants a DNR determination that no further assessment or clean-up work is required. Usually this is requested after a Phase I and Phase II environmental assessment has been conducted; the assessment reports should be submitted with this form. This is not a closure letter.

☐ Clarify the liability associated with a "closed" Property - s. 292.55, Wis. Stats. [682]

- ❖ **Include a fee of $700.**

- Include a copy of any closure documents if a state agency other than DNR approved the closure.

Use this space or attach additional sheets to provide necessary information, explanations or specific questions to be answered by the DNR.

Section 5. Request for a Specialized Agreement

Select the type of agreement needed. Include the appropriate draft agreements and supporting materials. Complete Sections 6 and 7 of this form. More information and model draft agreements are available at: dnr.wi.gov/topic/Brownfields/lgu.html#tabx4.

☐ Tax cancellation agreement - s. 75.105(2)(d), Wis. Stats. [654]

- ❖ **Include a fee of $700, and the information listed below:**

(1) Phase I and II Environmental Site Assessment Reports,

(2) a copy of the Property deed with the correct legal description.

☐ Agreement for assignment of tax foreclosure judgement - s.75.106, Wis. Stats. [666]

- ❖ **Include a fee of $700, and the information listed below:**

(1) Phase I and II Environmental Site Assessment Reports,

(2) a copy of the Property deed with the correct legal description.

☐ Negotiated agreement - Enforceable contract for non-emergency remediation - s. 292.11(7)(d) and (e), Wis. Stats. [630]

- ❖ **Include a fee of $1400, and the information listed below:**

(1) a draft schedule for remediation; and,
(2) the name, mailing address, phone and email for each party to the agreement.

Section 6. Other Information Submitted

Identify all materials that are included with this request.

Send both a paper copy of the signed form and all reports and supporting materials, and an electronic copy of the form and all reports, including Environmental Site Assessment Reports, and supporting materials on a compact disk.

Include one copy of any document from any state agency files that you want the Department to review as part of this request. The person submitting this request is responsible for contacting other state agencies to obtain appropriate reports or information.

☐ Phase I Environmental Site Assessment Report - Date: _____

☐ Phase II Environmental Site Assessment Report - Date: _____

☐ Legal Description of Property (required for all liability requests and specialized agreements)

☐ Map of the Property (required for all liability requests and specialized agreements)

Analytical results of the following sampled media: Select all that apply and include date of collection.

☐ Groundwater ☐ Soil ☐ Sediment ☐ Other medium - Describe: _____

Date of Collection: _____

☐ A copy of the closure letter and submittal materials

☐ Draft tax cancellation agreement

☐ Draft agreement for assignment of tax foreclosure judgment

☐ Other report(s) or information - Describe: _____

For Property with newly identified discharges of hazardous substances only: Has a notification of a discharge of a hazardous substance been sent to the DNR as required by s. NR 706.05(1)(b), Wis. Adm. Code?

◯ Yes - Date (if known): _____

◯ No

Note: The Notification for Hazardous Substance Discharge (non-emergency) form is available at: dnr.wi.gov/files/PDF/forms/4400/4400-225.pdf.

Section 7. Certification by the Person who completed this form

☒ I am the person submitting this request (requester)

☐ I prepared this request for: _____
Requester Name

I certify that I am familiar with the information submitted on this request, and that the information on and included with this request is true, accurate and complete to the best of my knowledge. I also certify I have the legal authority and the applicant's permission to make this request.

Signature	Date Signed: 9-11-20
Principal Environmental Consultant	(414) 221-2156
Title	Telephone Number (include area code)

Section 8. DNR Contacts and Addresses for Request Submittals

Send or deliver one paper copy and one electronic copy on a compact disk of the completed request, supporting materials, and fee to the region where the property is located to the address below. Contact a DNR regional brownfields specialist with any questions about this form or a specific situation involving a contaminated property. For electronic document submittal requirements see: http://dnr.wi.gov/files/PDF/pubs/rr/RR690.pdf.

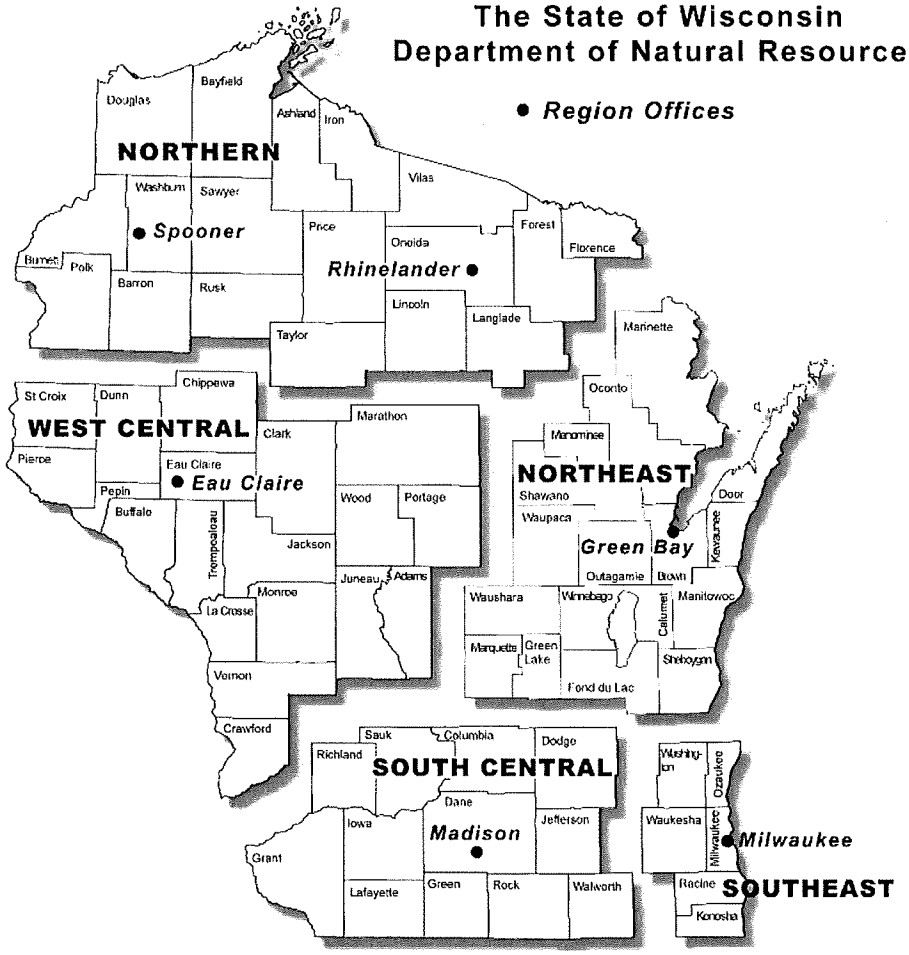
DNR NORTHERN REGION
Attn: RR Program Assistant
Department of Natural Resources
223 E Steinfest Rd Antigo, WI 54409

DNR NORTHEAST REGION
Attn: RR Program Assistant
Department of Natural Resources
2984 Shawano Avenue
Green Bay WI 54313

DNR SOUTH CENTRAL REGION
Attn: RR Program Assistant
Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg WI 53711

DNR SOUTHEAST REGION
Attn: RR Program Assistant
Department of Natural Resources
2300 North Martin Luther King Drive
Milwaukee WI 53212

DNR WEST CENTRAL REGION
Attn: RR Program Assistant
Department of Natural Resources
1300 Clairemont Ave.
Eau Claire WI 54702



Note: These are the Remediation and Redevelopment Program's designated regions. Other DNR program regional boundaries may be different.

DNR Use Only			
Date Received	Date Assigned	BRRTS Activity Code	BRRTS No. (if used)
DNR Reviewer	Comments		
Fee Enclosed? ◯ Yes ◯ No	Fee Amount $	Date Additional Information Requested	Date Requested for DNR Response Letter
Date Approved	Final Determination		

We Energies
231 W. Michigan Street
Milwaukee, WI 53203

www.we-energies.com

September 11, 2020

Ms. Theadora Jorgensen
Environmental Program Associate
Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
2300 N. Dr. Martin Luther King Jr. Drive
Milwaukee, WI 53212-3128

Subject: **INFILTRATION/INJECTION REQUEST**
Metro North Service Center
3100 West North Avenue, Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

Dear Ms. Jorgensen,

Please find attached the Infiltration/Injection Request (I/I Request) for the subject site for Wisconsin Department of Natural Resources (WDNR) review and approval.

This I/I Request is being submitted via WDNR's online Submittal Portal. Pursuant to WDNR's current Covid-19 policy, a hard copy of the report is not being submitted. The review fee check and Form 4400-237 are being submitted via regular mail under a separate transmittal.

This I/I Request has been prepared pursuant to NR 140 and NR 812 and in accordance with WDNR guidance *Infiltration and Injection Requests* (WDNR PUB-RR-935). The NR 712.09 submittal certification is attached.

This I/I Request includes the following components pursuant to WDNR PUB-RR-935:

1	Cover Sheet Components
2	I/I Request Components
2b	Additional Information Needed for Injection of Reactive Materials
3	WPDES Notice of Intent

It is understood that the Remediation and Redevelopment (RR) Program Project Manager will coordinate the review of this submittal with the WDNR Drinking and Groundwater Program and the WDNR Water Quality/Wastewater Program.

Please feel free to contact me at your convenience at (414) 587-4467 (cell) or via email at frank.dombrowski@wecenergygroup.com if you have any questions.

Sincerely,

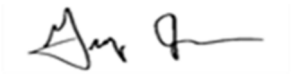
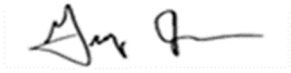
Frank Dombrowski
Principal Environmental Consultant
WEC Energy Group – Business Services

Attachment

Cc: Project File
David Jaeckels, WEC Energy Group – Business Services
Jeremiah Johnson, Geosyntec Consultants
Linda Stanek, WDNR

NR 712.09 Submittal certification.

Document Name	**Infiltration/Injection Request (I/I Request)**
Document Date	September 11, 2020
Site Name	Metro North Service Center
WDNR BRRTS #	02-41-583015

"I, Greg Johnson, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
 Greg Johnson, P.H., P.G., P.E. Senior Engineer P.E. #: 29898-006	 9/11/2020
Signature, title and P.E. number	P.E. stamp
"I, Greg Johnson, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
 Greg Johnson, P.H., P.G., P.E. Senior Engineer	9/11/2020
Signature and title	Date
"I, _____, hereby certify that I am a scientist as that term is defined in s. NR 712.03 (3), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
NA	NA
Signature and title	Date

Geosyntec consultants

10600 N. Port Washington Road, Suite 100
Mequon, WI 53092
PH 262.377.9828
www.geosyntec.com

1 - COVER SHEET COMPONENTS

INFILTRATION/INJECTION REQUEST In-Situ Chemical Oxidation (ISCO) Direct Mixing Metro North Service Center 3100 West North Avenue Milwaukee, Wisconsin 53208 WDNR BRRTS # 02-41-583015 WDNR FID # 241311510	
BRRTS Activity #	02-41-583015
Site name, address, city, zip code	**Metro North Service Center** 3100 West North Avenue Milwaukee, Wisconsin 53208
Responsible party contact information	We Energies Frank Dombrowski Principal Environmental Consultant WEC Energy Group - Business Services 333 Everett Street, Milwaukee, WI 53203 Email: frank.dombrowski@wecenergygroup.com Office: 414.221.2156 Mobile: 414.587.4467
Environmental consultant contact information	Jeremiah Johnson, P.G. Project Manager Geosyntec Consultants 10600 North Port Washington Rd. Suite 100, Mequon, WI 53092 Email: jpjohnson@geosyntec.com Office: 262.834.0228 Mobile: 414.322.1164
Type of request	Infiltration and Injection Request
Amount of fee that is attached	$700
RR Project Manager	Linda Stanek

*****

Geosyntec consultants

10600 N. Port Washington Road, Suite 100
Mequon, WI 53092
PH 262.377.9828
www.geosyntec.com

2 - I/I REQUEST COMPONENTS

INFILTRATION/INJECTION REQUEST In-Situ Chemical Oxidation (ISCO) Direct Mixing Metro North Service Center 3100 West North Avenue Milwaukee, Wisconsin 53208 WDNR BRRTS # 02-41-583015 WDNR FID # 241311510	
Site information	Metro North Service Center 3100 West North Avenue Milwaukee, Wisconsin 53208 [refer to **Attachment 2-1 (Figure 1**)]
Identifying numbers	WDNR BRRTS # 02-41-583015 WDNR FID # 241311510
Identify if compounds are being injected or infiltrated or both	Unsaturated Soil (prior to excavation): direct mixing Shallow Groundwater/Saturated Soil: direct mixing
Compound(s) or material(s) being injected	Unsaturated Soil: sodium permanganate (Carus RemOx® L ISCO Reagent) Shallow Groundwater/Saturated Soil: blend of sodium permanganate and sodium persulfate [Carus Mixed Liquid Oxidant (MLO)]
Type(s) of contaminants being treated	tetrachloroethene (PCE) A summary of the soil sample data for the planned unsaturated soil treatment area is included in **Attachment 2-2 (Table 1)**. A summary of the shallow groundwater and saturated soil data for the planned shallow groundwater/ saturated soil treatment area is included in **Attachment 2-2 (Table 2)**. The laboratory reports were included in the April 30, 2020 *Site Investigation and Remedial Action Options Report* or the March 12, 2019 *Site Investigation Work Plan*.
Implementation plan for injection/infiltration	Scope As documented in the June 29, 2020 *Remedial Action Design Report*, ISCO has been selected in combination with soil removal to reduce source area contaminant (PCE) mass. Prior to source area unsaturated soil excavation, a portion of the impacted soil [with concentrations exceeding the PCE land disposal restriction (LDR) concentration] will be treated by ISCO to allow for landfill disposal. Following excavation [to the depth of groundwater (approximately 8 feet below ground surface (bgs)] and prior to backfill, ISCO will be conducted in source area shallow groundwater by direct mixing of the oxidant in saturated soil at the bottom of excavation. Source area shallow groundwater ISCO is being conducted to reduce source area PCE mass and enhance groundwater monitored natural attenuation (MNA). This remedial action component makes use of the access to shallow groundwater by the source area soil removal.

	Treatability Study and Oxidant Selection A bench-scale treatability study was conducted by Carus LLC (Carus) to evaluate the use of ISCO for source area soil and shallow groundwater. The following two Carus oxidants were evaluated: ▪ sodium permanganate (Carus RemOx® L ISCO Reagent) ▪ 1:1 blend of sodium permanganate and sodium persulfate [Carus Mixed Liquid Oxidant (MLO)] Based on the Carus study results, both tested oxidants were found to be effective for PCE removal over a range of dosing concentrations. The *Carus Bench-Scale Treatability Study Report* is provided as **Attachment 2-3** (previously provided to WDNR in the April 30, 2020 *Site Investigation and Remedial Action Options Report*). Based on the study results and as documented in the June 29, 2020 *Remedial Action Design Report*, a 10% concentration of RemOx® L (sodium permanganate) was selected for soil pre-treatment (to reduce average PCE soil concentration of approximately 4,500 mg/kg to less than 60 mg/kg in portion of planned soil removal area). Based on the study results and as documented in the June 29, 2020 *Remedial Action Design Report*, a 5% concentration of MLO was selected for shallow groundwater/saturated soil. MLO was selected because of the benefits of the combined chemistry of MLO. Both permanganate and persulfate are strong oxidants capable of PCE destruction, although the reaction kinetics of un-activated persulfate are slow. One of the byproducts of sodium permanganate ($NaMnO_4$) oxidation is manganese dioxide (MnO_2). Manganese dioxide serves as an activator for persulfate, creating sulfate radicals, which increase the persulfate reaction kinetics and make it a suitable complement to permanganate for PCE oxidative destruction. One of the benefits of this combined chemistry is that sulfate radicals have a lower affinity for natural soil organic material than permanganates (Brown, et. al, 2003). Therefore, activated persulfate is less likely to be "wasted" on reactions with naturally occurring soil organic materials. Given this and its relative stability in the subsurface, activated persulfate may provide more effective PCE destruction in groundwater over a larger area than permanganate alone. Unsaturated Soil Treatment Implementation (prior to excavation) The planned unsaturated soil treatment area (prior to excavation), as depicted in **Attachment 2-1 (Figure 3)**, is approximately 900 square feet (sf). Based on a planned treatment depth of 8 feet bgs, the treatment volume will be approximately 300 cubic yards (cy). As documented in Section 2B, approximately 1,050 gallons of 40% oxidant will be mixed with 4,150 gallons of water (prior to application) to generate an approximate 5,200-gallon 10% RemOx® L application volume. A non-chlorinated water source will be used [as demonstrated by laboratory analysis of volatile organic compounds (VOCs) and chlorine by EPA Methods 524.2 and 4500, respectively].

	The oxidant will be evenly distributed within the treatment zone by thoroughly mixing with the excavator bucket. Following oxidant application, a temporary cover will be placed over the treatment area for a period of 72 hours. Following the 72-hour treatment period, treatment verification samples will be collected and analyzed in accordance with the June 29, 2020 *Remedial Action Design Report*. Following receipt of acceptable verification sample data (PCE < 60 mg/kg), unsaturated soil excavation and transport to the disposal facility will be conducted in accordance with the June 29, 2020 *Remedial Action Design Report*. <u>Shallow Groundwater/Saturated Soil Treatment Implementation</u> Following excavation to the depth of groundwater (approximately 8 feet bgs) and prior to backfill, shallow groundwater/saturated soil will be treated by MLO. The planned treatment area, as depicted in **Attachment 2-1 (Figure 4)**, is approximately 5,400 sf. Based on a planned treatment zone thickness of 3 feet, the treatment volume will be approximately 600 cy. As documented in Section 2B, approximately 3,200 gallons of 40% oxidant will be mixed with 30,000 gallons of water (prior to application) to generate an approximate 33,200-gallon 5% MLO application volume. Consistent with soil ISCO, a non-chlorinated water source will be used. Shallow groundwater MLO application will consist of evenly distributing oxidant within 3-foot treatment zone (below bottom of completed excavation) by thoroughly mixing with the excavator bucket. Horizontal perforated piping will be placed at the bottom of the excavation (and connected to a riser pipe) to allow for potential future oxidant placement. The piping will be bedded and backfilled within granular backfill to two feet above the top of the pipe. The planned piping layout and details are depicted in **Attachment 2-3 (Figure 4)**. *Note: an addendum to this I/I Request will be submitted to WDNR for approval prior to future oxidant placement using the installed piping system. Future oxidant addition will be based on MNA groundwater monitoring, with particular focus on the results of the initial year of semi-annual MNA groundwater monitoring.*
Any necessary constraints on the injection system (e.g. location/depth of nearby private wells that may be affected)	No constraints have been identified.
Time frame for which approval is needed (i.e. beginning and end dates or injection/infiltration and implementation of remedy which is reliant on infiltration or injection) 5 year maximum	It is anticipated that the oxidant mixing will be completed within an approximate one-month period following the start of remedial action (following building demolition and slab and pavement removal). It is estimated that oxidant mixing will be conducted in 4Q2020 or 1Q2021.

Locations of proposed injection wells, infiltration zones, etc.	Unsaturated Soil Treatment Location The planned treatment area, as depicted in **Attachment 2-1 (Figure 3)**, is approximately 900 sf. Based on a planned treatment depth of 8 feet bgs, the treatment volume will be approximately 300 cy. Shallow Groundwater/Saturated Soil Treatment Location The planned treatment area, as depicted in **Attachment 2-1 (Figure 4)**, is approximately 5,400 sf. Based on a planned treatment zone thickness of 3 feet, the treatment volume will be approximately 600 cy.
An injection-specific monitoring plan, designed to monitor the effectiveness of the remedy and determine the extent of migration of the injected material and/or its breakdown products	Residual MLO concentrations in groundwater will be evaluated in the field using a Hach DR 890 colorimeter. MNA groundwater monitoring, as described in the June 29, 2020 *Remedial Action Design Report* (and summarized in Section 2B of this submittal) will commence in accordance with a WDNR-approved Groundwater Monitoring Plan when residual MLO concentration is less than approximately 0.5 mg/L.
Pre-injection vapor screening, vapor potential and safety plan	Air monitoring will be conducted during ISCO implementation in accordance with an Ambient Air Monitoring Plan (AAMP) to assess the need to implement volatile organic compound (VOC) vapor emissions suppression activities (e.g., foam and/or misting suppressant application). Suppression activities will be immediately implemented if any exceedances of air quality action levels are observed. Worker breathing zone vapor screening will be conducted during ISCO implementation activities in accordance with the Contractor's Health and Safety Plan. An active vapor mitigation system (VMS) is being installed in the overlying building reconstruction area.

REFERENCES

Brown, R.A., D. Robinson and G. Skladany (2003). *Response to Naturally Occurring Organic Material: Permanganate verses Persulfate*, ConSoil 2003, Ghent Belgium.

Geosyntec (2019). *Site Investigation Work Plan*, Metro North Service Center, 3100 West North Avenue, Milwaukee, Wisconsin; prepared for We Energies; March 12, 2019.

Geosyntec (2020a). *Site Investigation and Remedial Action Options Report*, Metro North Service Center, 3100 West North Avenue, Milwaukee, Wisconsin; prepared for We Energies; April 30, 2020.

Geosyntec (2020b). *Remedial Action Design Report*, Metro North Service Center, 3100 West North Avenue, Milwaukee, Wisconsin; prepared for We Energies; June 29, 2020.

ATTACHMENTS

2-1 Figures (from June 29, 2020 *Remedial Action Design Report*)
2-2 Tables
2-3 Carus *Bench-Scale Treatability Study Report*

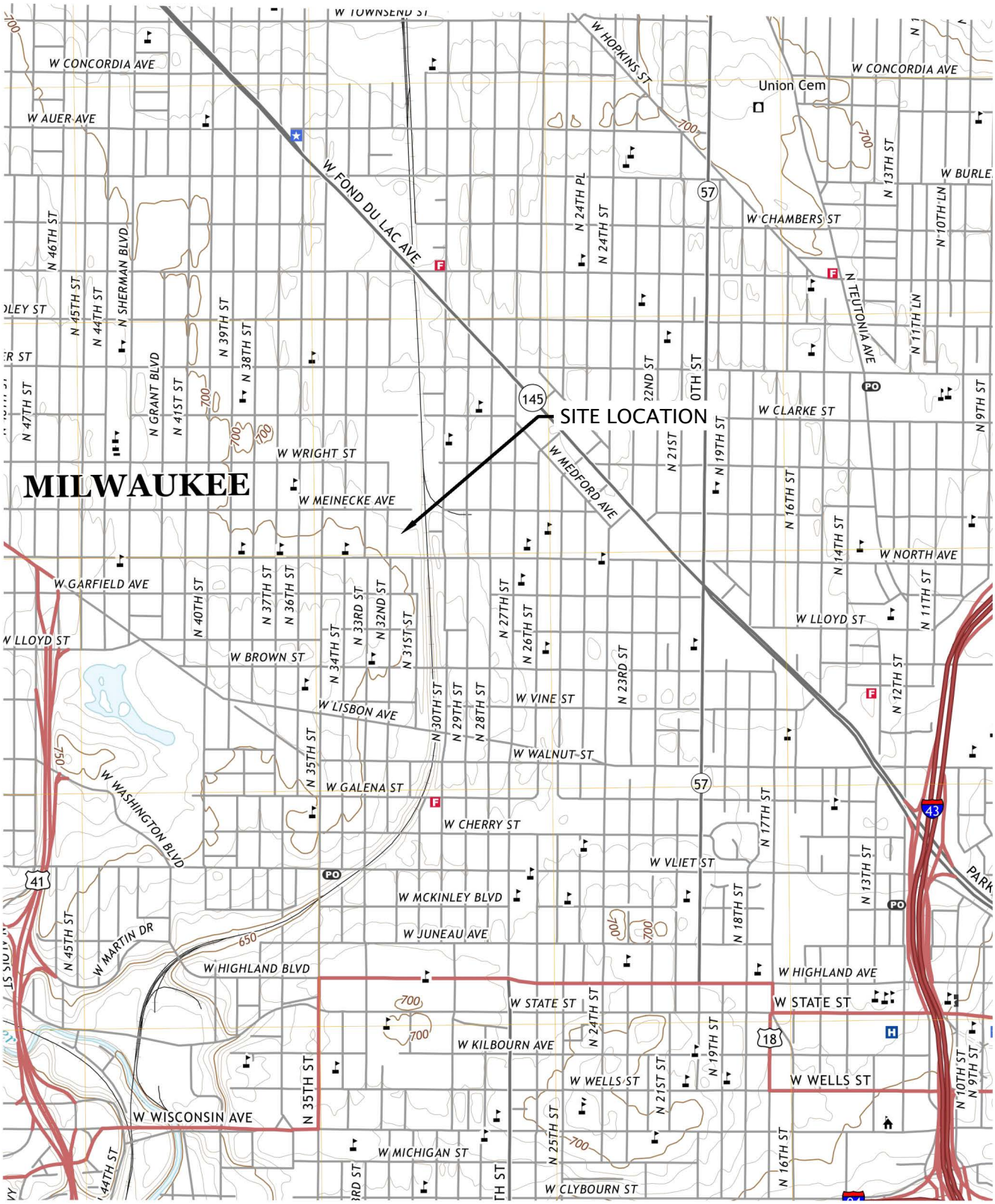
*****

ATTACHMENT 2-1

Figures

(from June 29, 2020 Remedial Action Design Report)

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510



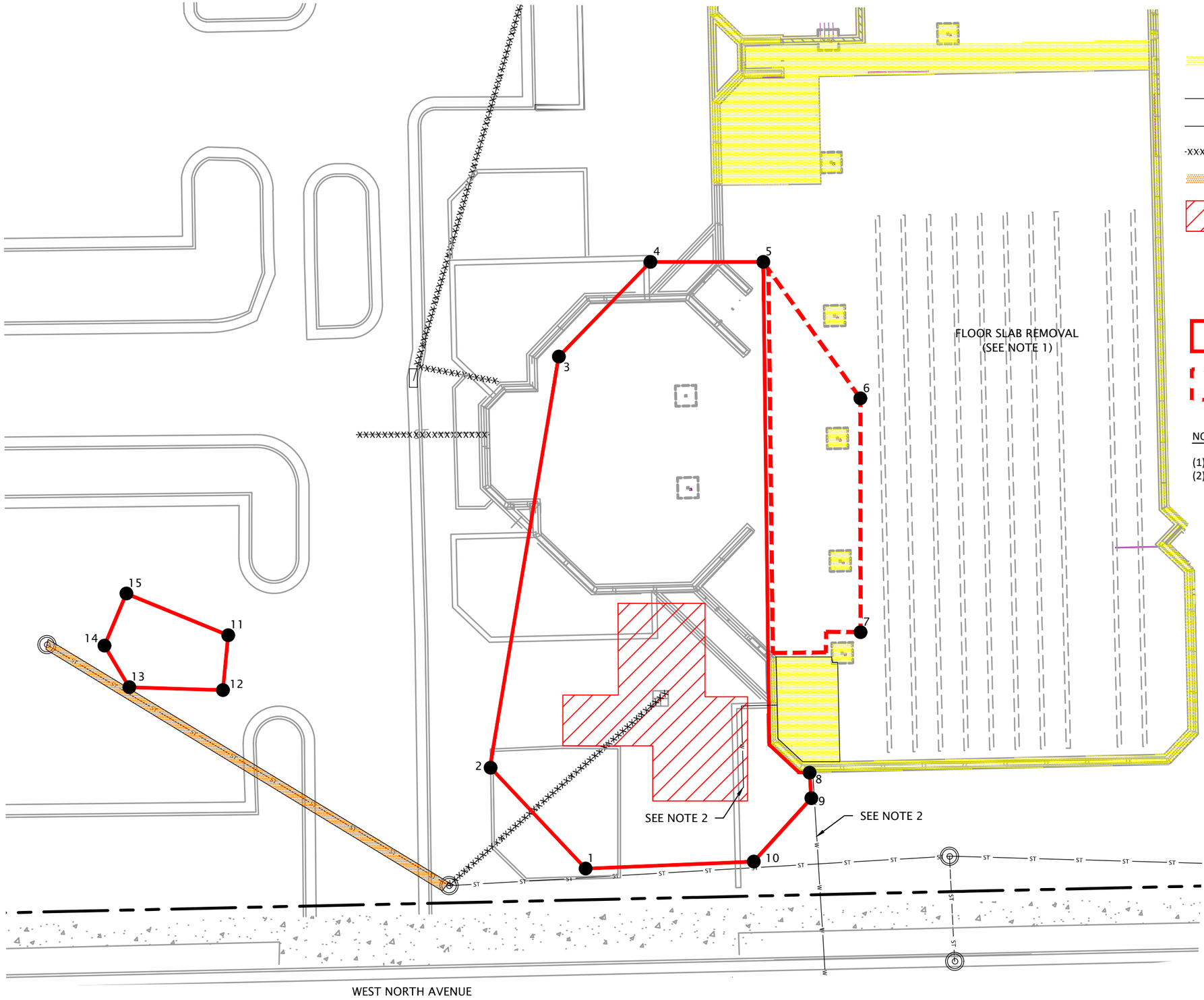
SOURCE: USGS MILWAUKEE, WISCONSIN QUADRANGLE TOPOGRAPHIC MAPS 2018

SCALE IN FEET

0 2,000'

Geosyntec consultants

CLIENT:	WE ENERGIES
PROJECT:	METRO NORTH SERVICE CENTER (MNSC) 3100 WEST NORTH AVENUE MILWAUKEE, WISCONSIN
TITLE:	SITE LOCATION MAP
PROJECT: CHE8094OQ	FIGURE NO.: 1
DATE: June 11, 2020	FILE NO.: 2005MNSCP2001
DRAWING NO.:	1 OF 8



LEGEND:

- EXISTING BUILDING FOUNDATION AND FLOOR SLAB TO REMAIN
- ST ST — EXISTING STORM SEWER TO REMAIN
- W W — EXISTING WATER LINE (SEE NOTE 2)
- STORM SEWER TO BE REMOVED
- STORM SEWER TO BE REMOVED AND REPLACED
- APPROXIMATE SOIL PRE-TREATMENT AREA
- 7 — SOIL REMOVAL CONTROL POINT

SOURCE AREA UNSATURATED SOIL REMOVAL:

- APPROXIMATE 8-FT BGS (DEPTH TO GROUNDWATER)
- APPROXIMATE FIELD ESTABLISHED DEPTH (TO MAINTAIN STABILITY OF BUILDING FOUNDATIONS AND UTILITIES TO REMAIN)

NOTES:

(1) UNDERFLOOR ELECTRICAL DUCTS TO BE REMOVED WITH FLOOR SLAB.
(2) FIELD VERIFY EXISTING WATER LINE LOCATION PRIOR TO SOIL REMOVAL; EXISTING WATER LINE TO BE REMOVED AND REPLACED.

SOIL REMOVAL CONTROL POINTS

CONTROL POINT	NORTHING	EASTING
1	393525.17	2514907.51
2	393544.91	2514888.91
3	393625.36	2514902.24
4	393643.88	2514920.20
5	393643.87	2514942.26
6	393617.18	2514961.29
7	393571.44	2514961.33
8	393543.95	2514951.36
9	393538.94	2514951.68
10	393526.53	2514940.41
11	393570.84	2514837.54
12	393560.11	2514836.50
13	393560.67	2514818.16
14	393568.80	2514813.32
15	393579.00	2514817.60

SCALE IN FEET
0 20'

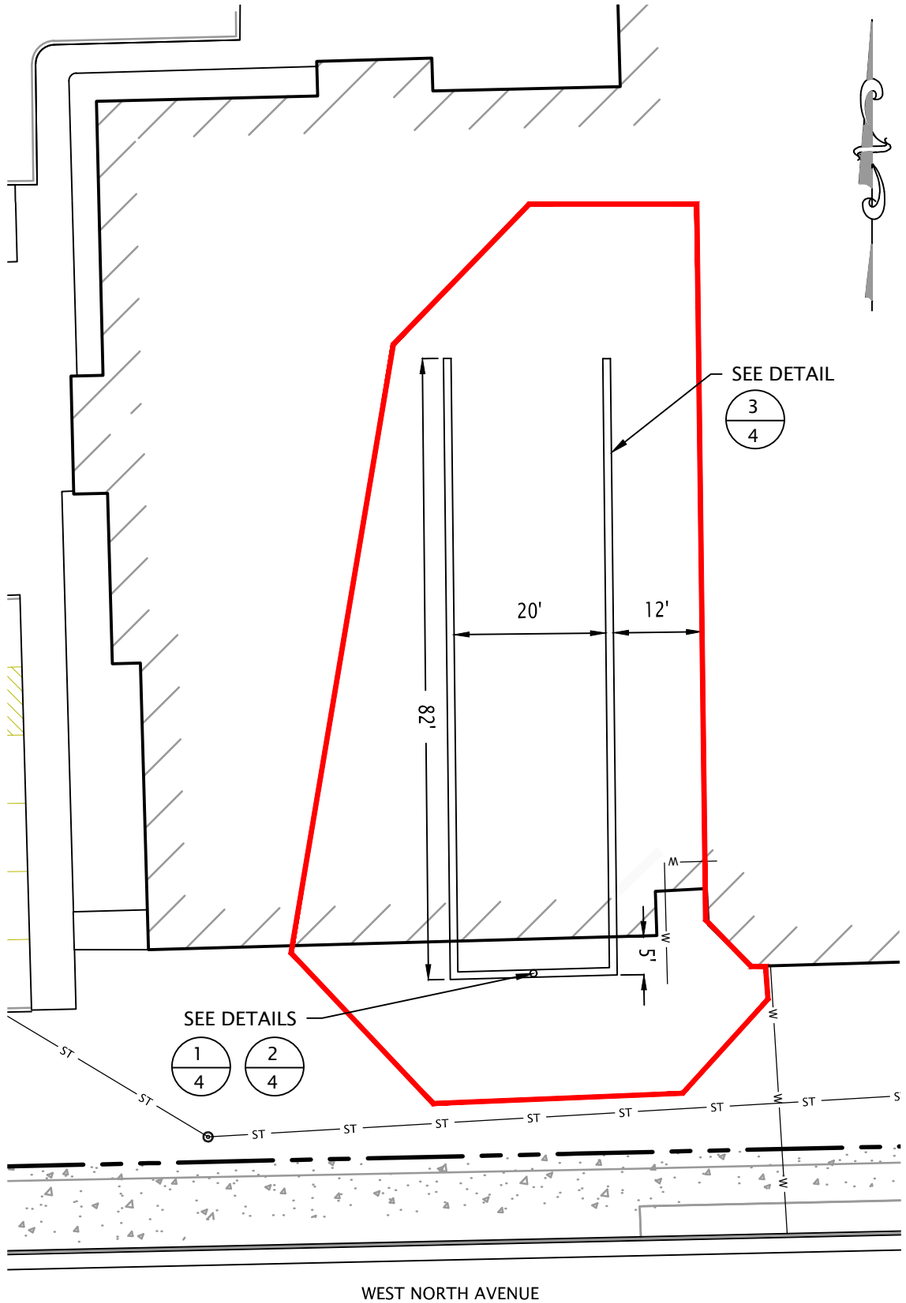
Geosyntec consultants

CLIENT: WE ENERGIES

PROJECT: METRO NORTH SERVICE CENTER (MNSC)
3100 WEST NORTH AVENUE
MILWAUKEE, WISCONSIN

TITLE: UNSATURATED SOIL EXCAVATION PLAN

PROJECT: CHE8094OQ	FIGURE NO.: 3	DRAWING NO.: 3 OF 8
DATE: June 25, 2020	FILE NO.20-05 MNSCP2 003	

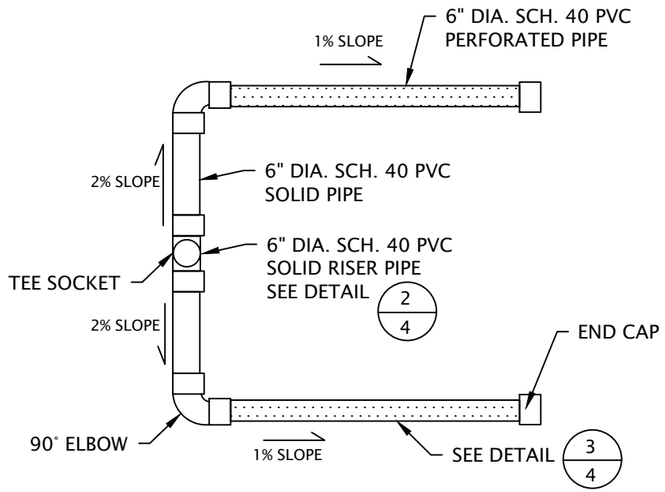


LEGEND:

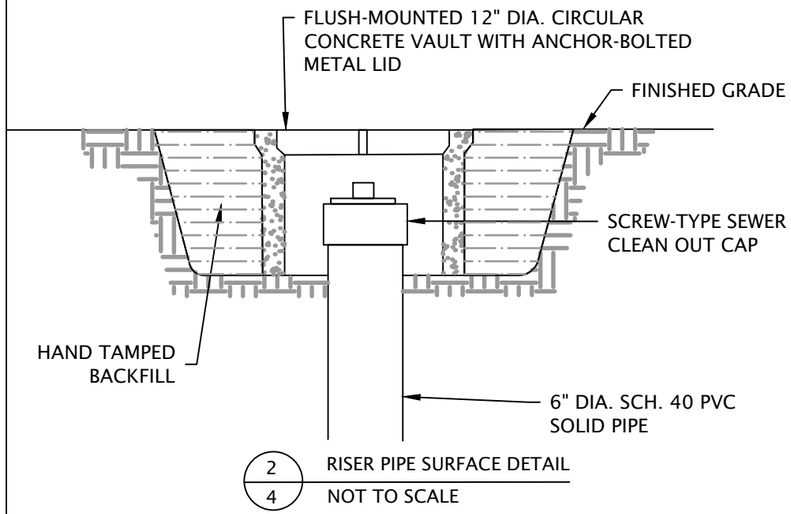
ST	EXISTING STORM SEWER TO REMAIN
W	EXISTING WATER LINE (SEE NOTE 2 ON FIGURE 3)
	APPROXIMATE SHALLOW GROUNDWATER REMEDIAL ACTION AREA

SCALE IN FEET

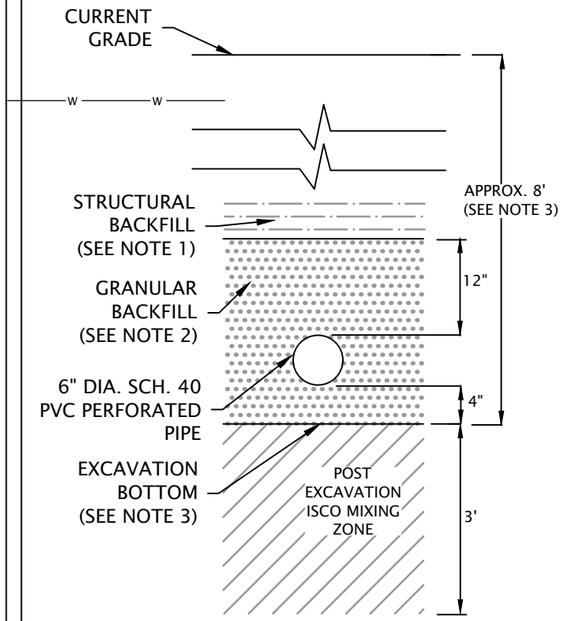
0 20'



1/4 PIPING LAYOUT DETAIL
NOT TO SCALE



2/4 RISER PIPE SURFACE DETAIL
NOT TO SCALE



NOTES:

(1) STRUCTURAL BACKFILL IN ACCORDANCE WITH BUILDING RECONSTRUCTION SPECIFICATIONS

(2) BACKFILL COMPACTION IN ACCORDANCE WITH BUILDING RECONSTRUCTION SPECIFICATIONS

(3) THE EXCAVATION WILL BE ADVANCED TO THE DEPTH OF GROUNDWATER (APPROXIMATELY 8 FEET BELOW CURRENT GROUND SURFACE)

ISCO - IN-SITU CHEMICAL OXIDATION

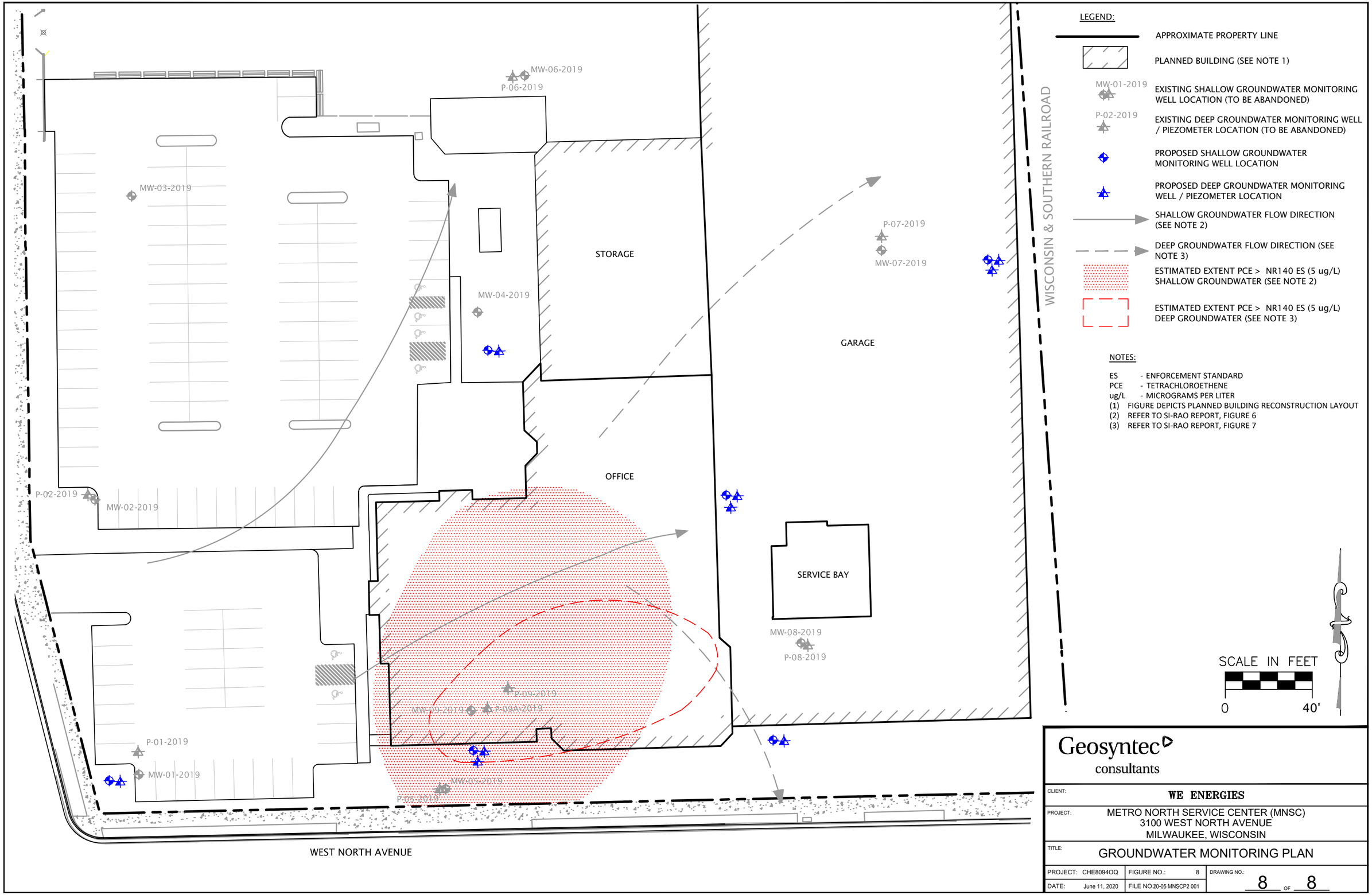
PVC - POLYVINYL CHORIDE

3/4 TYPICAL PIPING SECTION
NOT TO SCALE

Geosyntec consultants

CLIENT:	WE ENERGIES
PROJECT:	METRO NORTH SERVICE CENTER (MNSC) 3100 WEST NORTH AVENUE MILWAUKEE, WISCONSIN
TITLE:	SHALLOW GROUNDWATER REMEDIAL ACTION PLAN AND DETAILS

PROJECT: CHE8094OQ	FIGURE NO.: 4	DRAWING NO.: 4 OF 8	
DATE: June 23, 2020	FILE NO.20-05 MNSCP2 003		



Geosyntec consultants

CLIENT:	WE ENERGIES
PROJECT:	METRO NORTH SERVICE CENTER (MNSC) 3100 WEST NORTH AVENUE MILWAUKEE, WISCONSIN
TITLE:	GROUNDWATER MONITORING PLAN

PROJECT: CHE8094OQ	FIGURE NO.: 8	DRAWING NO.: 8 OF 8
DATE: June 11, 2020	FILE NO.20-05 MNSCP2 001	

ATTACHMENT 2-2

Tables

Table 1
Summary of Soil Sample Analytical Results - Soil Treatment Area
Metro North Service Center (MNSC)
3100 West North Avenue
Milwaukee, Wisconsin

Soil Boring	**GP-05**	**GP-03-2019**		**GP-04-2019**		**GP-10-2019**			**GP-12-2019**			**GP-13-2019**		
Sample Collection Date	12/11/2018	7/10/2019		7/10/2019		11/15/2019			11/15/2019			11/15/2019		
Sample Depth (feet, bgs)	4-5	2-3	7-8	3-4	7-8	2-3	5-6	7-8	2-3	5-6	7-8	2-3	5-6	7-8
Detected VOCs (ug/kg)														
1,2-Dichlorobenzene	<75,300	<1000	<25000	<312	<2500	<10100	<50000	<52100	41.5J	<500	<1000	<25.0	<100	<1000
Tetrachloroethene (PCE)	**30,400,000**	**187,000**	**3,560,000**	46,800	**404,000**	**1,720,000**	**13,100,000**	**12,600,000**	17,200	**75,300**	**160,000**	1,020	21,000	**189,000**
1,2,3-Trichloropropane	<75,300	<1000	<25000	<312	<2500	<15100	<74900	1,310,000	<38.2	<749	<1500	<37.4	<150	<1500

Notes:
bold: PCE concentration exceeds LDR (60,000 ug/kg)
bgs - below ground surface
J - estimated concentration at or above the limit of detection and below the limit of quantitation
LDR - land disposal restriction
ug/kg - micrograms per kilogram
VOCs - volatile organic compounds

Table 2
Summary of Groundwater and Saturated Soil Sample Analytical Results - Groundwater Treatment Area
Metro North Service Center (MNSC)
3100 West North Avenue
Milwaukee, Wisconsin

Groundwater Data

Well	**GPTW-05**	**MW-09-2019**		
Screen Interval (ft bgs)	5-15	5-15		
Date	12/12/2018	9/11/2019	3/19/2020	7/15/2020
Detected VOCs (µg/L)				
Benzene	<49.3	<493	<0.25	<123
Bromomethane*	<194	<1,940	<0.97	<486
sec-Butylbenzene	<170	<1,700	<0.85	<424
Chloromethane*	<438	<4,380	<2.2	<1090
Isopropylbenzene	<78.6	<786	<1.7	<843
p-Isopropyltoluene	<160	<1,600	<0.80	<400
n-Propylbenzene	<162	<1,620	<0.81	<405
1,1,1,2-Tetrachloroethane	<53.8	<0.27	0.48 J	<135
Tetrachloroethene (PCE)	**201,000**	**112,000**	**45,600**	**25,100**
Toluene	<34.4	<344	0.30 J	<135
Trichloroethene	69.7 J	778.00	50.20	<128
Xylene, total	<145.5	<1,455	<0.73	<364

Saturated Soil Data

Soil Boring	**GP-04**	**GP-05**
Sample Collection Date	12/11/2018	12/11/2018
Sample Depth (feet bgs)	11-12	11-12
Detected VOCs (µg/kg)		
Tetrachloroethene (PCE)	**246,000**	**12,100,000**

Notes:
bold - PCE data
* common laboratory preservative artifact
ft bgs - feet below ground surface
J - estimated concentration at or above the limit of detection and below the limit of quantitation
µg/kg - micrograms per kilogram
µg/L - milligrams per liter
VOCs - volatile organics compounds

ATTACHMENT 2-3

Carus Bench-Scale Treatability Study Report

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

Bench Scale Treatability Study Report

RemOx® L ISCO Reagent and Mixed Liquid Oxidant (MLO) Demand Analysis and Tetrachloroethylene (PCE) Removal in Site Specific Soil and Groundwater, Milwaukee Site

Geosyntec Consultants

16th March 2020

Dan Hartsough
Technical Product Manager
Carus LLC

SUMMARY

RemOx® L ISCO Reagent and Mixed Liquid Oxidant (MLO) were evaluated for treatment of soil and groundwater from a Geosyntec site. The contaminant of concern at the site is tetrachloroethylene (PCE), found at about 50 mg/kg in the soil sample and about 50 mg/L in the groundwater sample received by Carus.

Lab batch reactions were conducted to observe contaminant removal and oxidant demand over a two-week period. RemOx® L and MLO were dosed between 100 – 400 g/kg for soil, and 30 – 100 g/L for groundwater.

All treatment conditions were highly effective for PCE removal from soil and groundwater. Over 99.0% removal of PCE was achieved at all treatment compositions and concentrations within 24 hours. No "rebound" of PCE was observed within the two-week study.

Table 1 summarizes PCE treatment and oxidant demand for the soil treatment study. The oxidant demand is a small fraction (15 – 25%) of the available oxidant dose. MLO demand is lower at all dosages than for RemOx® L, by 15 – 30%. Less oxidant is used for MLO treatment because permanganate demand is higher than persulfate demand. The demand in groundwater was negligible for both oxidants.

It is likely that soil dosages lower than 100 g/kg would effectively treat the contaminant. Even at the lowest study dose (100 g/kg), demand was only 25% of product dosed.

TABLE 1: PCE Removal and Soil Oxidant Dose and Demand - Batch Testing using RemOx® L and MLO

Oxidant	Total Oxidant Dose g/kg	100% $NaMnO_4$ Dose g/kg	100% $Na_2S_2O_8$ Dose g/kg	Total Oxidant Demand g/kg	100% $NaMnO_4$ Demand g/kg	100% $Na_2S_2O_8$ Demand g/kg	PCE Removal 24 hrs
RemOx® L 40%	400	400	0	90	90		> 99%
RemOx® L 20%	200	200	0	46	46		> 99%
RemOx® L 10%	100	100	0	25	25		> 99%
MLO 40%	400	200	200	63	45	18	> 99%
MLO 20%	200	100	100	40	26	14	> 99%
MLO 10%	100	50	50	20	17	3	> 99%

1. BACKGROUND

The oxidant in RemOx® L is sodium permanganate. Oxidation of contaminants by permanganate (MnO_4^-) relies on the high oxidation potential of the permanganate ion and permanganate's ability to cleave double bonds. As a result, chlorinated ethenes are readily broken down without formation of potentially harmful chlorinated by-products. Permanganate also has the longest half-life of commonly applied chemical oxidants.

MLO (Mixed Liquid Oxidant) consists of a blend of sodium permanganate and sodium persulfate. Oxidation of contaminants by persulfate ($S_2O_8^{2-}$) relies on persulfate activation/decomposition that forms the sulfate radical (SO_4•), similar to a Fenton reaction with hydrogen peroxide. Factors that contribute to the rate of persulfate radical formation include the presence and quantity of contaminant, persulfate, and elements such as Mn(+4). As persulfate and transition metal concentrations increase, the rate at which persulfate will activate to form radicals will increase. For favorable remediation results, radical formation is preferred to increase kinetics and rate of contaminant removal.

Permanganate can provide a suitable Mn(IV) compound for persulfate activation assisting in the radical formation needed for persulfate activation. Permanganate oxidation of contaminants or natural organic matter results in the reduction of soluble permanganate (MnO_4^-) ions to insoluble manganese dioxide (MnO_2). The MnO_2 that is formed can contribute to the sulfate radical formation in the presence of persulfate. This allows the two oxidants to work together.

Sealed site soil and groundwater samples were received from the Milwaukee site on February 11th, 2020. The soil was labeled SB-17-3-4, and the tech number assigned to the project was 20-026. Samples were stored sealed in a refrigerator for two days before background demand testing, and six days before the treatability study. The soil is characterized as a heavy, wet clay.

2. EXPERIMENTAL

a. 48 Hour PNOD and NOD Pre-Testing

One soil sample labeled SB-17-3-4 was received from Geosyntec. The soil sample was analyzed for permanganate (RemOx® L and MLO) natural oxidant demand (PNOD) and persulfate (MLO) natural oxidant demand (NOD). The background soil demand is required to estimate oxidant dosing of the soil.

The samples were analyzed for permanganate natural oxidant demand (PNOD) following ASTM D7262-10 Test Method A. A brief summary follows:

To determine the PNOD for RemOx® L and MLO oxidants, the soil was baked at 105°C for 24 hours and allowed to cool to room temperature. The dried soil was blended and passed through a U.S. #10 sieve (2 mm). For RemOx® L PNOD, reactors were loaded with 50 grams of soil and 100 mL of 20 g/L $KMnO_4$ for an initial dose of 40 g/kg $KMnO_4$ on a dry soil weight basis at a 1:2 soil to aqueous reagent ratio. For MLO PNOD, the dried and screened soil was treated with a mix of 10 g/L $NaMnO_4$ and 10 g/L $Na_2S_2O_8$, using the same soil and liquid weights

Each soil dose was performed in triplicate. The reaction vessels were shaken vigorously to disperse the heavy clay. Residual permanganate (MnO_4^-) was determined at 48 hours. The demands were calculated as grams $NaMnO_4$ per kg dry soil. In addition, residual persulfate (MLO) was determined at 48 hours.

b. Batch Testing using RemOx® L and Mixed Liquid Oxidant (MLO)

40 mL sacrificial VOA vials were charged with as-received site soil and oxidant solution to near-zero headspace (27 g of each). See Table 2 for the treatment matrix. Groundwater samples were also dosed with oxidants in VOA vials; see Table 3 for dosing matrix. All samples were prepared in duplicate with controls present of measured variables.

At each sample time (24hrs, 48hrs, 72 hours, 144 hours, and 2 Weeks), the following conditions were analyzed: PCE concentration, permanganate concentration, and persulfate concentration.

PCE concentration was determined using an Agilent Gas Chromatography – Mass Spectrometer (GC-MS). Samples were removed immediately and diluted in an ascorbic acid solution to quench any oxidant present. The following dilution was stored in an airtight VOA vial with no headspace and analyzed using a method developed by Carus to determine PCE concentration present. Given the high concentration of PCE initially present, the lowest standard used for calibration was 100 ug/L and is identified as the detection limit. Lower levels can be read but will be less accurate.

Permanganate concentrations were determined by Standard Method, 4500 – $KMnO_4$. A sample volume is removed from the reactor and filtered through a 0.22 syringe filter. The resulting volume was then diluted to within the instrument's calibration curve (<50 mg/L as $KMnO_4$) and absorbance was read via UV-Vis at 525nm using a Hach DR6000. Permanganate concentration was then calculated from the resulting absorbance.

Persulfate concentrations were determined using a Dionex / ThermoFisher ICS-2000 with a Dionex IonPac AG11 2mm specific conditioned column with conductivity detection. A sample volume was removed from the reactor and filtered through a 0.22 syringe filter. The resulting volume is then diluted to within the instrument's calibration curve (<50 mg/L as S_2O_8) and ran on the Ion Chromatography specific method developed by Carus. Instrument response (conductivity, μS) was measured at the respective retention time. Persulfate concentration was then calculated from the resulting response.

3. RESULTS

Tables and graphs for all analyses can be found in the *Additional Information* section.

a. 48 Hour PNOD and MLO NOD Testing Tables 4 - 5

The permanganate or persulfate demand is the amount of oxidant consumed by background soil given a fixed dose of oxidant in 48 hours. The 48-hour PNOD and MLO NOD results are shown in Tables 4 - 5. The permanganate demand (PNOD) of the soil is 3.9 g/kg for RemOx® L and 3.2 g/kg for MLO. The lower value is expected for MLO since the initial dose of permanganate is lower. The persulfate demand (NOD) of the soil is negligible.

b. Batch Testing using RemOx® L and Mixed Liquid Oxidant (MLO)

i. PCE Removal Graphs 1.1 – 1.4

For both soil and groundwater, greater than 99.0% PCE removal from a starting concentration of 50,000 ug/kg to < 500 ug/kg was achieved within the first 24 hours for all treatment options (See Graphs 1.1 – 1.4). Final PCE concentrations of roughly 10 ug/kg or less were attained at about 144 hours. PCE concentrations less than 100 ug/kg are below the concentration of the lowest calibration standard and therefore less accurate. There is not enough difference in removal among the various treatments to comment on relative effectiveness. There was no "rebound" in PCE concentration during the two-week study, indicating that the contaminant was destroyed and not merely adsorbed.

Some variability was observed in soil controls and treated samples, as evidenced by high standard deviations for the duplicate samples. See error bars in the graphs. Variability in groundwater samples was less. This can be explained by the high dilutions employed and variability of PCE release from soil. Clearly good mixing in the field will be required to achieve good contact of the clay soil with oxidants. The variability does not impact the overall excellent treatment results.

ii. Permanganate Oxidant Concentration Graph 2.1 – 2.4

Permanganate oxidant concentrations over time were measured for each treatment concentration with controls. It should be noted that in soil or groundwater samples, the oxidation of any compound by permanganate or persulfate is dependent on the initial dose of oxidant and the reaction time available. As the oxidant dose is increased, the reaction rate and oxidant consumption may also increase. Some compounds that are not typically oxidized by permanganate at low dose can become reactive with permanganate at higher concentrations.

For soil treatment, the permanganate demand increased with increasing permanganate dose concentration for both RemOx® L and MLO (Graphs 2.1 – 2.2). Most of the permanganate demand occurred in the first 24 hours, corresponding to the removal of 99% of PCE. Residual groundwater permanganate concentration did not change during the study under any treatment condition (Graph 2.3 – 2.4). This indicates there is little background demand in the groundwater for permanganate.

iii. Persulfate Oxidant Concentration Graphs 3.1 – 3.2

The NOD test indicating negligible soil background demand for persulfate. Some persulfate demand was observed during the MLO treatability study. This could be due to oxidation of PCE by activated persulfate, or to increased oxidation of background soil components at the higher persulfate concentrations employed. Persulfate demand was quite variable in the soil test (Graph 3.1), although generally following the trend of higher demand at higher oxidant concentration. Residual groundwater persulfate concentration did not change during the study at any MLO oxidant concentration (Graph 3.2). This indicates there is little background demand in the groundwater for persulfate.

4. CONCLUSIONS

The PNOD test showed a background permanganate demand of 3 – 4 g oxidant/kg dry soil, where a dose of two percent oxidant was used (20 g/kg). A higher dose will be required to treat contaminated soil. Doses of 100, 200, and 400 grams oxidant per kilogram wet soil were used for the treatability study.

All doses used in the lab treatability study were highly effective for PCE removal from soil. Over 99.0% removal of PCE was achieved at all treatment compositions and concentrations within 24 hours. No "rebound" of PCE was observed within the two-week study.

The lowest oxidant dose employed (100 g sodium permanganate or MLO per kg soil) was as effective as higher doses. At this dose, one quarter of the applied oxidant was consumed. It is likely that a lower dose such as 5% oxidant (50 g/kg soil) would achieve treatment goals and give a more efficient use of oxidant. It was also observed that MLO demand was lower at all dosages than for RemOx® L, while achieving the same contaminant removal. Five percent MLO is likely to be the most efficient treatment option.

PCE impacted groundwater was treated at 100, 50, and 30 g oxidant per kg water. All conditions achieved > 99% removal of PCE within 24 hours. The lowest dose of either RemOx® L or MLO may be employed.

ADDITIONAL INFORMATION

TABLE 2: Treatment Scheme of Soil - Batch Testing using RemOx® L and MLO

SB-17-3-4 Soil Treatment Scheme	Permanganate Conc. (%)	Persulfate Conc. (%)	Total Oxidant Conc. (%)	PCE Conc. (µg/kg)
RemOx® L 40%	40%	0%	40%	50,000
RemOx® L 20%	20%	0%	20%	50,000
RemOx® L 10%	10%	0%	10%	50,000
MLO 40%	20%	20%	40%	50,000
MLO 20%	10%	10%	20%	50,000
MLO 10%	5%	5%	10%	50,000

TABLE 3: Treatment Scheme of Groundwater - Batch Testing using RemOx® L and MLO

GW Treatment Scheme	Permanganate Conc. (%)	Persulfate Conc. (%)	Total Oxidant Conc. (%)	PCE Conc. (µg/L)
RemOx® L 10%	10%	0%	10%	50,000
RemOx® L 5%	5%	0%	5%	50,000
RemOx® L 3%	3%	0%	3%	50,000
MLO 10%	5%	5%	10%	50,000
MLO 5%	2.5%	2.5%	5%	50,000
MLO 3%	1.5%	1.5%	3%	50,000

Table 4: 48-Hour PNOD *

Oxidant	Average and Standard Deviation (g/kg)	Replicate 1 (g/kg)	Replicate 2 (g/kg)	Replicate 3 (g/kg)
RemOx® L	3.9 +/- 0.2	4.0	3.6	4.0
MLO 1:1	3.2 +/- 0.1	3.1	3.3	3.2

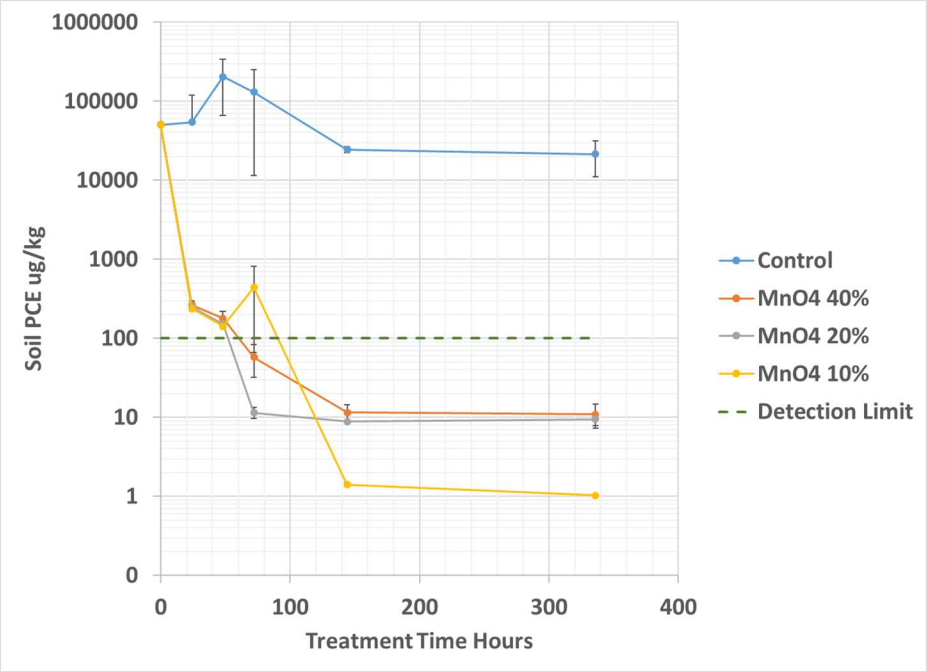
*Demands were calculated on a weight $NaMnO_4$/dry soil weight basis from an initial dose of 40.0 g/kg $NaMnO_4$ or 40 g/kg MLO dosed at a 1:2 soil to aqueous solution ratio.

Table 5: 48-Hour MLO (Persulfate) NOD *

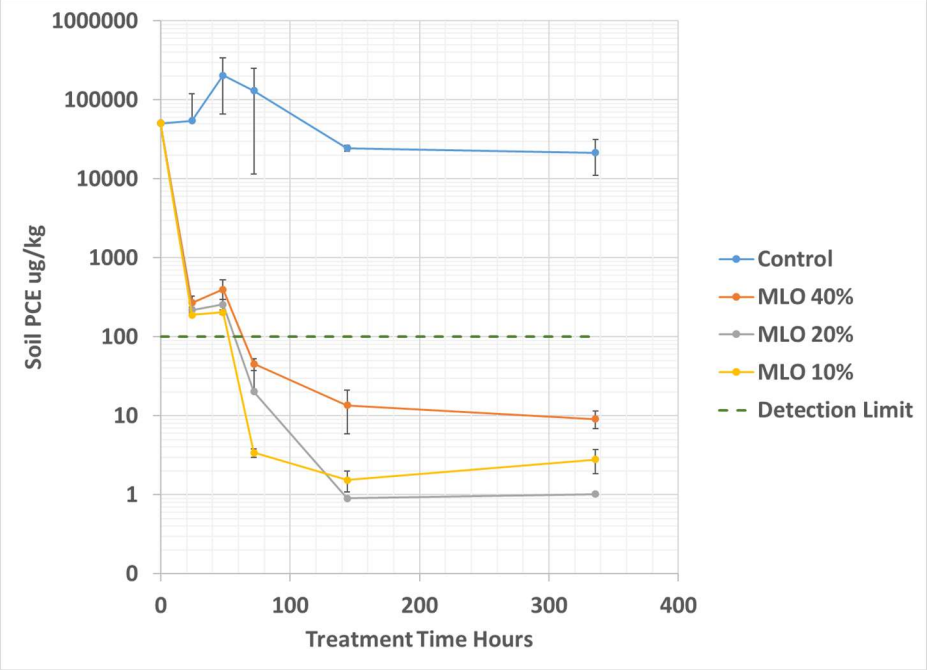
Oxidant	Average and Standard Deviation (g/kg)	Replicate 1 (g/kg)	Replicate 2 (g/kg)	Replicate 3 (g/kg)
MLO 1:1	-0.4 +/- 0.6	-1.0	-0.5	0.2

*Demands were calculated on a weight $Na_2S_2O_8$/dry soil weight basis from an initial dose of 40.0 g/kg MLO dosed at a 1:2 soil to aqueous solution ratio.

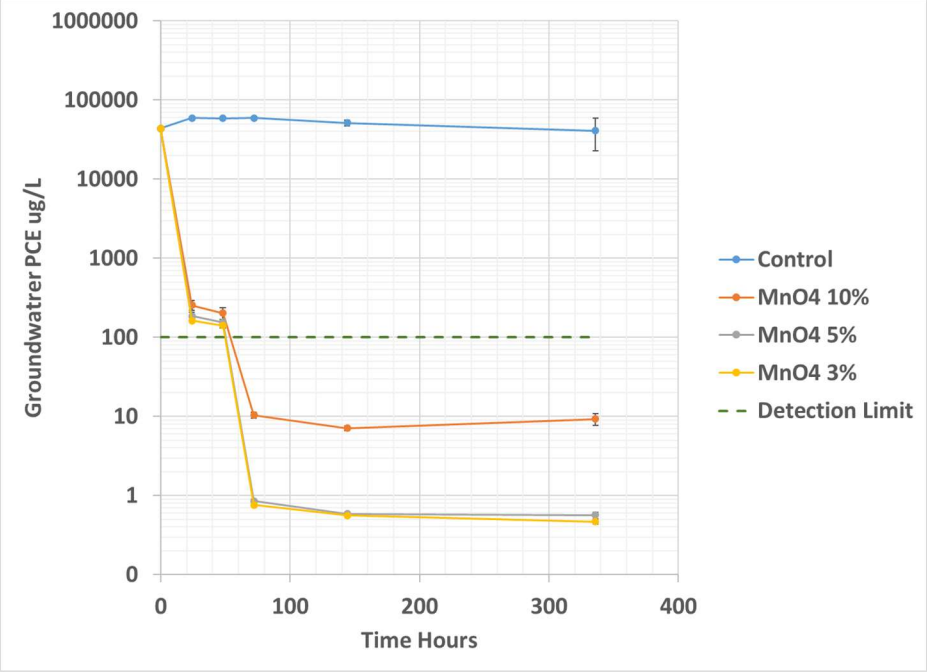
GRAPH 1.1 Soil PCE Concentrations over Time - RemOx® L Treatment



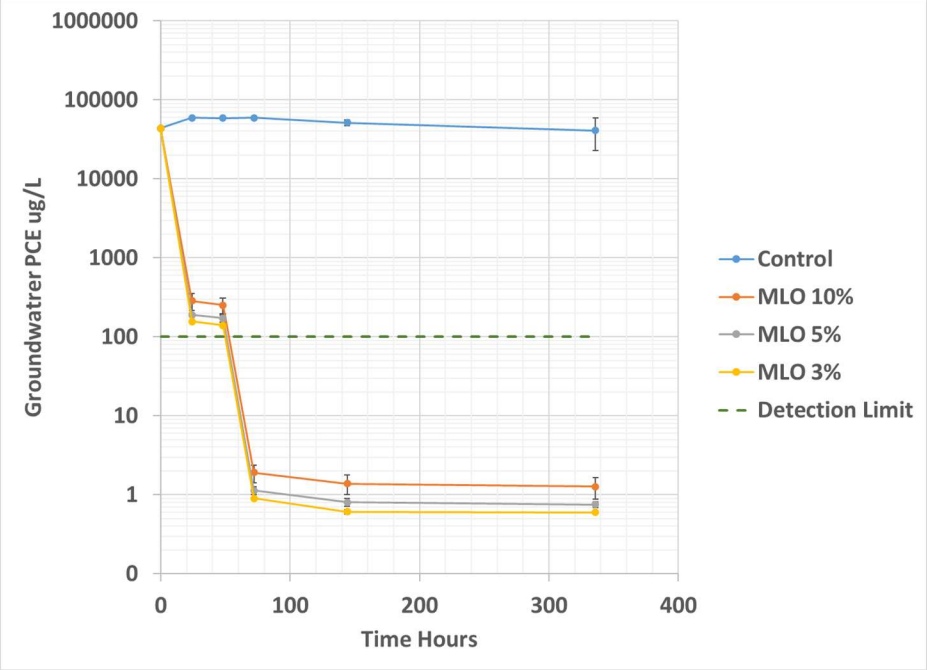
GRAPH 1.2 Soil PCE Concentrations over Time - MLO Treatment



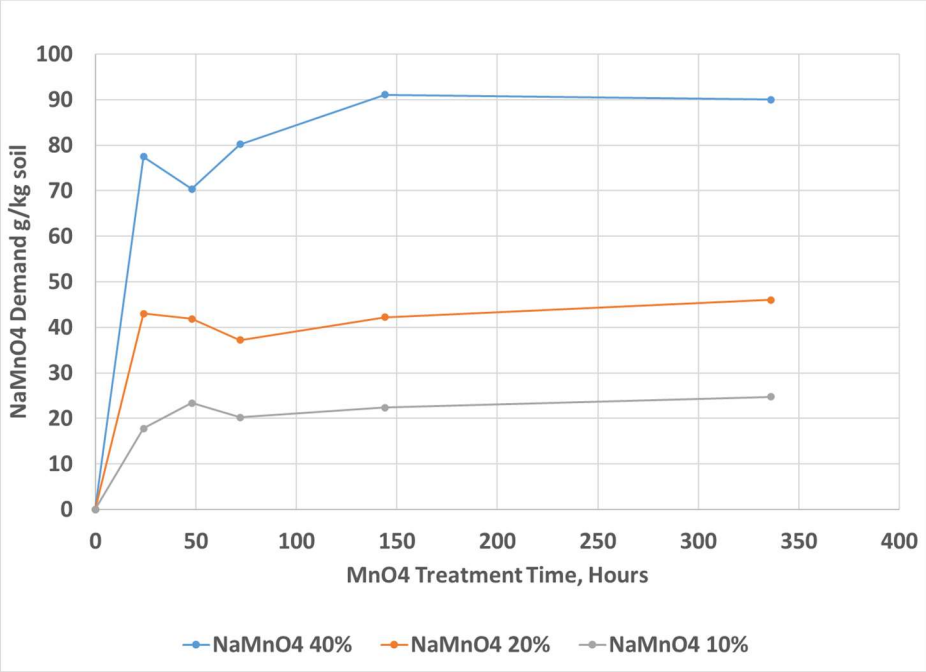
GRAPH 1.3 GW PCE Concentrations over Time - RemOx® L Treatment



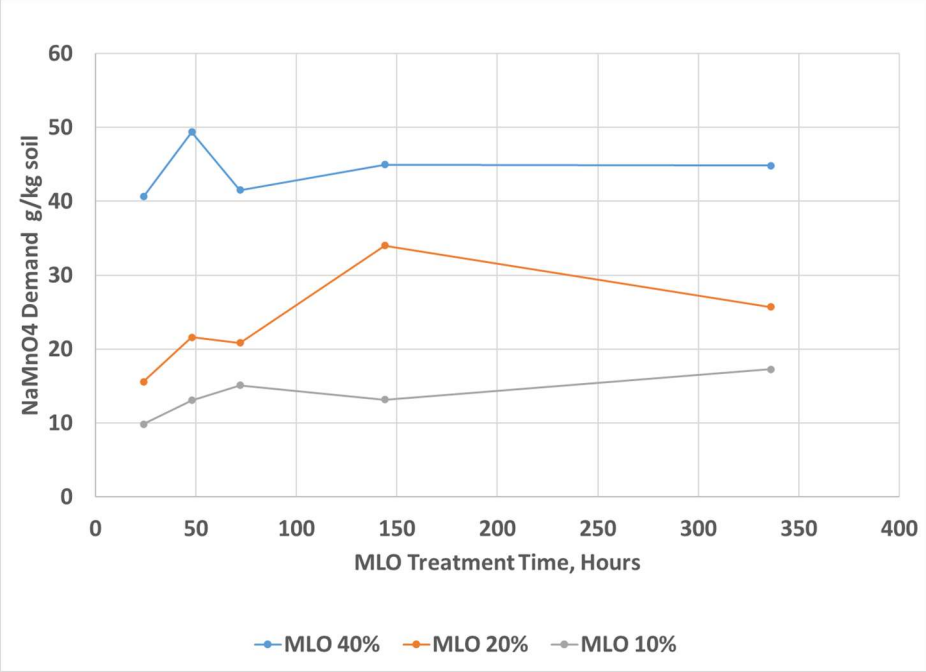
GRAPH 1.4 GW PCE Concentrations over Time - MLO Treatment



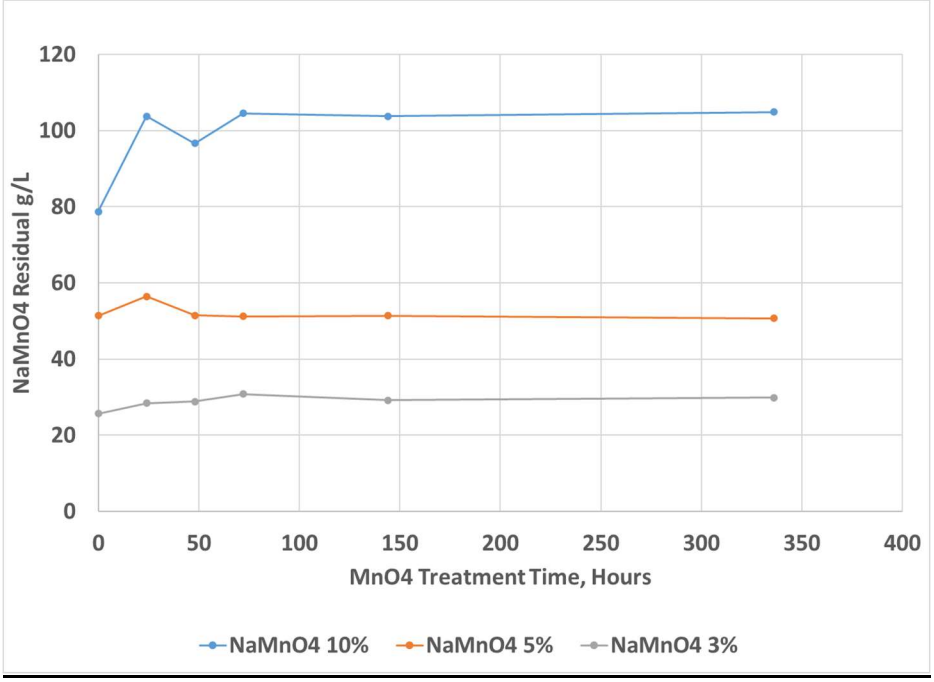
GRAPH 2.1 Permanganate Soil Demand over Time - RemOx® L Treatment



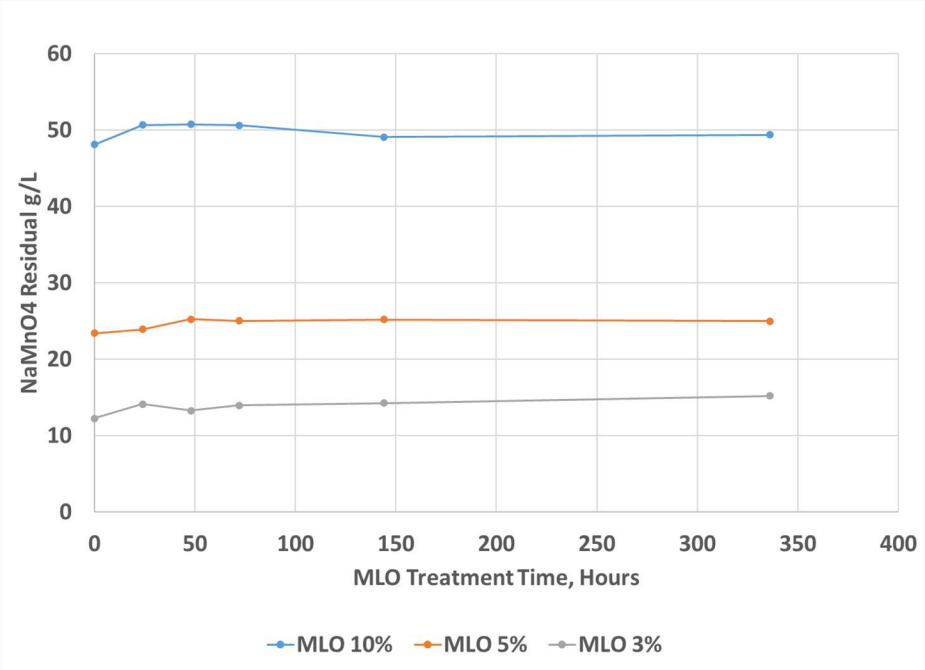
GRAPH 2.2 Permanganate Soil Demand over Time – MLO Treatment



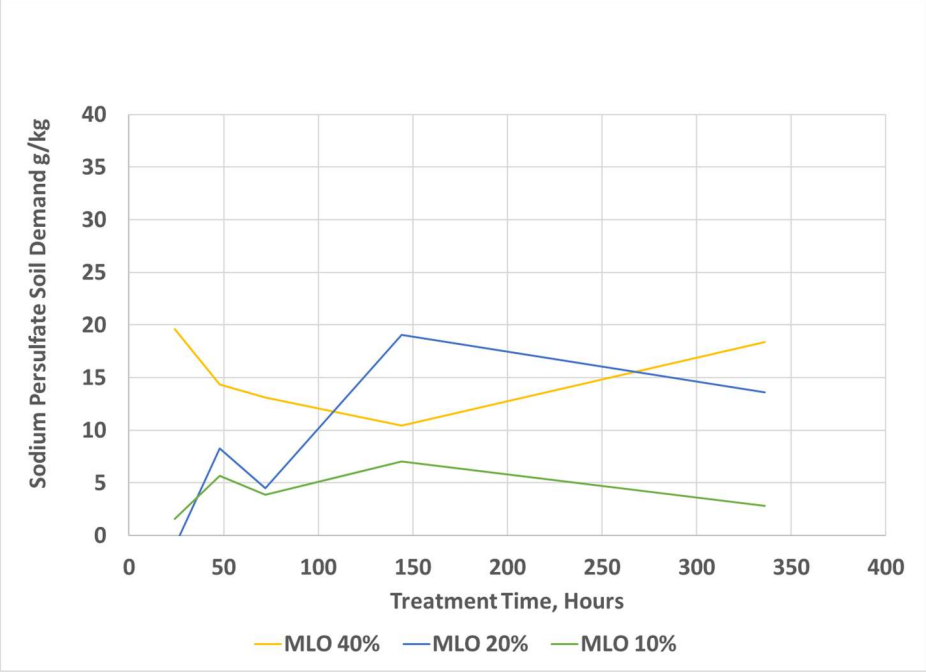
GRAPH 2.3 Permanganate GW Concentration over Time - RemOx® L Treatment



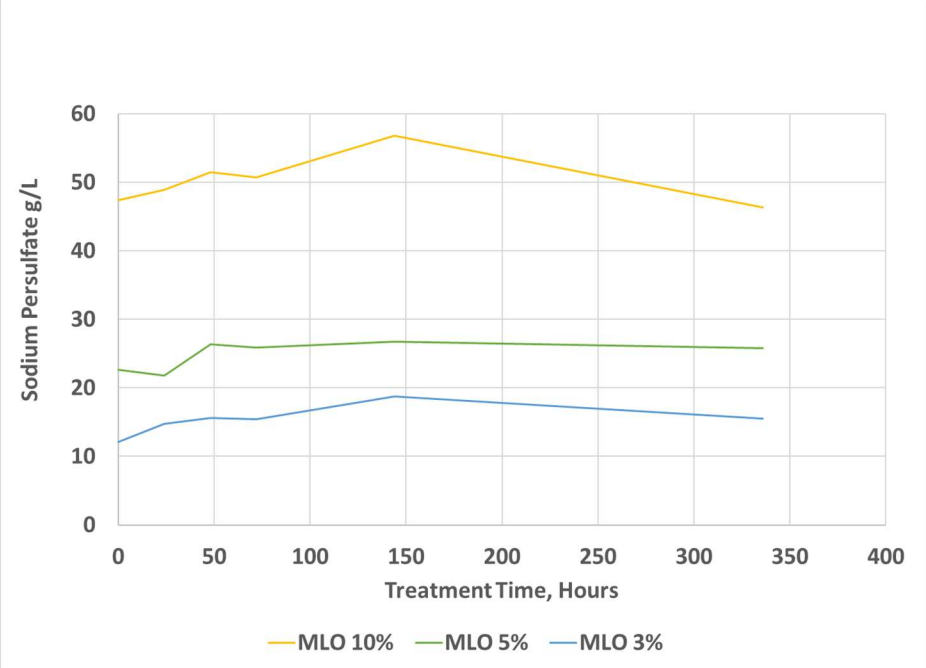
GRAPH 2.4 Permanganate GW Concentration over Time – MLO Treatment



GRAPH 3.1 Persulfate Soil Demand over Time - MLO Treatment



GRAPH 3.2 Persulfate GW Concentration over Time – MLO Treatment



Geosyntec consultants

10600 N. Port Washington Road, Suite 100
Mequon, WI 53092
PH 262.377.9828
www.geosyntec.com

2B - ADDITIONAL INFORMTION NEEDED FOR INJECTION OF REACTIVE MATERIALS

INFILTRATION AND INJECTION REQUEST In-Situ Chemical Oxidation Direct Mixing Metro North Service Center 3100 West North Avenue Milwaukee, Wisconsin 53208 WDNR BRRTS # 02-41-583015 WDNR FID # 241311510	
Chemical analysis of the proposed injectant/remedial material	Unsaturated Soil: sodium permanganate (Carus RemOx® L ISCO Reagent). The safety data sheet (SDS) for Carus RemOx® L is provided as **Attachment 2B-1.** Shallow Groundwater/Saturated Soil: blend of sodium permanganate and sodium persulfate (Carus MLO). The SDS for MLO is provided as **Attachment 2B-2**.
Mass balance of the injectant vs. natural oxidant demand and contaminant demand (limit addition of excess injectant)	Unsaturated Soil (prior to excavation) As documented in the Carus *Bench-Scale Treatability Study Report* (**Attachment 2-3**), a natural oxidant demand (NOD) of 3.9 g/kg was established for RemOx® L. **Attachment 2B-3** provides a Carus estimation spreadsheet for RemOx® L placement including: the treatment area and volume, the soil characteristics/ analysis, the RemOx® L injection volume and total injection volume (water + RemOx® L). This estimation documents approximately 1,050 gallons of 40% oxidant will be mixed with 4,150 gallons of water (prior to placement) to generate an approximate 5,200-gallon 10% RemOx® L application volume. Shallow Groundwater/Saturated Soil As documented in the Carus *Bench-Scale Treatability Study Report* (**Attachment 2-3**), a NOD of 3.2 g/kg was established for MLO. **Attachment 2B-4** provides the Carus estimation spreadsheet for MLO placement in shallow groundwater/saturated soil. This estimation documents approximately 3,200 gallons of 40% oxidant will be mixed with 30,000 gallons of water (prior to placement) to generate an approximate 33,200-gallon 5% MLO application volume.
Concentrations of the injectant in the groundwater necessary to oxidize the environment	
Expected persistence of injectant in the groundwater (i.e. how long will it be effective)	Once placed into shallow groundwater, MLO is expected to persist for up to 1 year.
Description of the monitoring system in place that can determine the extent of the area affected by the injectant	Residual MLO concentrations in groundwater will be evaluated in the field using a Hach DR 890 colorimeter. MNA groundwater monitoring, as described in the June 29, 2020 *Remedial Action Design Report*, will commence in accordance with a WDNR-approved Groundwater Monitoring Plan when residual MLO concentration is less than approximately 0.5 mg/L.
Collection of analytical results for groundwater	

Use of sentinel wells as part of the monitoring program to show that the injectant is confined to the area to be treated A plan for monitoring the injectant and trace metals until those compounds have returned to background levels	As documented in the June 29, 2020 *Remedial Action Design Report*, MNA groundwater monitoring will generally consist of the following: ▪ Monitoring well network depicted in **Attachment 2-1 (Figure 8)**. The monitoring well network includes a downgradient (sentinel) well nest. As documented in the April 30, 2020 *Site Investigation and Remedial Action Options Report*, PCE impacts were not detected in Site investigation groundwater monitoring wells (at similar downgradient well locations). ▪ Semi-annual groundwater sampling. Groundwater monitoring parameters will include field parameters (pH, ORP, DO), VOCs and dissolved manganese. Manganese will be introduced into shallow groundwater through the addition of oxidant and will be monitored for changes relative to background. For the initial two semi-annual MNA sampling events, the sampling will be expanded to include dissolved RCRA metals and the presence of MLO.

ATTACHMENTS

2B-1 Carus RemOx® L ISCO Reagent SDS
2B-2 Carus MLO SDS
2B-3 Carus Estimation Spreadsheet for RemOx® L
2B-4 Carus Estimation Spreadsheet for MLO

*****

ATTACHMENT 2B-1

Carus RemOx® L ISCO Reagent SDS

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

SAFETY DATA SHEET

1. Identification of the substance or mixture and of the supplier

1.1 GHS product identifier **LIQUOX® sodium permanganate**

1.2 Other means of identification

SDS number -

1.3 Recommendations and restrictions on the use of substances or mixtures

Recommended use Liquid oxidant recommended for applications that require a concentrated permanganate solution.

Recommended restrictions Use in accordance with supplier's recommendations.

1.4 Supplier's details

Manufacturer/Supplier CARUS CORPORATION

Address 315 Fifth Street,
Peru, IL 61354, USA

Telephone 815 223-1500 - All other non-emergency inquiries about the product should be directed to the company

e-mail salesmkt@caruscorporation.com

Website www.caruscorporation.com

Contact person Dr. Chithambarathanu Pillai

Emergency telephone number For Hazardous Materials [or Dangerous Goods] Incidents ONLY

(spill, leak, fire, exposure or accident), call CHEMTREC at
CHEMTREC®, Thailand (toll free): 001-800-13-203-9987
CHEMTREC®, India (toll free): 000-800-100-7141
CHEMTREC®, Other countries: 001 (703) 527-3887

2. Hazards identification

2.1 GHS classification of substance or mixture, and national or regional information

Physical hazards	Oxidizing liquids	Category 2
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1

2.2 GHS label elements

Hazard symbol(s)

Signal word Danger

Hazard Statement(s) May intensify fire; oxidiser. Harmful if swallowed. Causes severe skin burns and eye damage. May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.

Precautionary Statement(s)

Prevention Keep away from heat. Take any precaution to avoid mixing with combustibles. Keep/Store away from clothing and other combustible materials. Wear protective gloves/protective clothing/eye protection/face protection. Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product. Do not breathe mist or vapour. Use only outdoors or in a well-ventilated area. Avoid release to the environment.

Response In case of fire: Use water for extinction. IF SWALLOWED: Immediately call a POISON CENTRE or doctor/physician. Rinse mouth. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing. Collect spillage.

Storage Store locked up. Store in a well-ventilated place. Keep container tightly closed.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

2.3 Other hazards which do not result in GHS classification Not available.

3. Composition/information on ingredients

3.2 Mixture

Chemical identity	Common name and synonym	CAS number and other unique identifiers	Concentration or concentration range
Sodium permanganate		10101-50-5	36 - 40

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

4.1 Description of first-aid measures

Inhalation Remove victim to fresh air and keep at rest in a position comfortable for breathing. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.

Skin contact Take off immediately all contaminated clothing. (Caution: Solution may ignite certain textiles). Immediately flush skin with plenty of water. Get medical attention immediately. Wash contaminated clothing before reuse.

Contact with skin may leave a brown stain of insoluble manganese dioxide. This can be easily removed by washing with a mixture of equal volume of household vinegar and 3% hydrogen peroxide, followed by washing with soap and water.

Eye contact Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Continue rinsing. Get medical attention immediately.

Ingestion Immediately rinse mouth and drink plenty of water. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention immediately.

4.2 Most important symptoms/effects, acute and delayed Contact with this material will cause burns to the skin, eyes and mucous membranes. Permanent eye damage including blindness could result.

4.3 Indication of immediate medical considerations and important specific treatment that should be performed Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen. Decomposition products are alkaline. Brown stain is insoluble manganese dioxide.

5. Fire-fighting measures

5.1 Prohibited extinguishing media and suitable extinguishing media

Suitable extinguishing media Flood with water from a distance, water spray or fog.

Unsuitable extinguishing media The following extinguishing media are ineffective: Dry chemical. Foam. Carbon dioxide (CO_2). Halogenated materials.

5.2 Specific hazards arising from chemicals May intensify fire; oxidiser. May ignite combustibles (wood, paper, oil, clothing, etc.). Contact with incompatible materials or heat (135 ºC / 275 ºF) could result in violent exothermic chemical reaction. Oxidizing agent, may cause spontaneous ignition of combustible materials. By heating and fire, corrosive vapours/gases may be formed.

5.3 Special protective equipment and precautions for fire-fighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for firefighting: follow the general fire precautions indicated in the workplace.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep upwind. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid inhalation of vapours and contact with skin and eyes. Wear protective clothing as described in Section 8 of this safety data sheet. Local authorities should be advised if significant spillages cannot be contained.

6.2 Environmental precautions Do not allow to enter drains, sewers or watercourses. Contact local authorities in case of spillage to drain/aquatic environment.

6.3 Methods and materials for containment and cleaning up

Keep combustibles (wood, paper, oil etc) away from spilled material. Should not be released into the environment. This product is miscible in water. Stop leak if possible without any risk. Dike the spilled material, where this is possible. Proceed with either of the following two options depending upon the size of the spill and the availability of the neutralising agents:

Option # 1: Dilute to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralise with sodium carbonate to neutral pH, if acid was used. Decant or filter and deposit sludge in approved landfill. Where permitted, the sludge may be drained into sewer with large quantities of water.

Option # 2: Absorb with inert media like diatomaceous earth or inert floor dry, collect into a drum and dispose of properly. Do not use saw dust or other incompatible media. Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to permanganates.

To clean contaminated floors, flush with abundant quantities of water into sewer, if permitted by federal, state, and local regulations. If not, collect water and treat as described above.

Never return spills in original containers for re-use. For waste disposal, see Section 13.

7. Handling and storage

7.1 Precautions for safe handling, use and storage

Take any precaution to avoid mixing with combustibles. Do not get this material in your eyes, on your skin, or on your clothing. Do not breathe mist or vapour. If clothing becomes contaminated, remove and wash off immediately. Spontaneous ignition may occur in contact with cloth or paper. When using, do not eat, drink or smoke. Good personal hygiene is necessary. Wash hands and contaminated areas with water and soap before leaving the work site. Avoid release to the environment. Use Personal Protective Equipment recommended in section 8 of the SDS.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed and in a well-ventilated place. Store in a cool, dry place. Store away from incompatible materials (See Section 10). Store locked up. Follow applicable local/national/international recommendations on storage of oxidisers.

8. Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Sodium permanganate (CAS 10101-50-5)	TWA	0.1 mg/m3	Inhalable fraction.
		0.02 mg/m3	Respirable fraction.

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines Follow standard monitoring procedures.

8.2 Appropriate engineering controls Provide adequate general and local exhaust ventilation. An eye wash and safety shower must be available in the immediate work area.

8.3 Personal protective measures

Eye/face protection Wear safety glasses with side shields (or goggles). Wear face shield if there is risk of splashes.

Skin protection

Hand protection Wear chemical-resistant, impervious gloves. Use protective gloves made of: Rubber or plastic. Suitable gloves can be recommended by the glove supplier.

Other Wear appropriate chemical resistant clothing.

Respiratory protection In case of inadequate ventilation or risk of inhalation of vapors, use suitable respiratory equipment.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations When using, do not eat, drink or smoke. Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practices.

9. Physical and chemical properties

9.1 Appearance Dark purple liquid.

Physical state Liquid.

Form Aqueous solution.

Colour Dark purple.

9.2 Odor Odourless.

9.3 Odor threshold limit	Not available.
9.4 pH	5 - 8
9.5 Melting point/freezing point	< -4 °C (< 24.8 °F)
9.6 Initial boiling point and boiling range	> 101 °C (> 213.8 °F)
9.7 Flash point	Does not flash.
9.8 Evaporation rate	As water.
9.9 Flammability (solid, gas)	Not applicable.
9.10 Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not applicable.
Flammability limit - upper (%)	Not applicable.
Explosive limit - lower (%)	Not available.
Explosive limit – upper (%)	Not available.
9.11 Vapor pressure	760 mm Hg (105 °C)
9.12 Vapor density	Not available.
9.13 Relative density	1.37 - 1.4 (20 °C) (Water = 1)
9.14 Solubilit(ies)	Miscible with water.
9.15 Partition coefficient: n-octanol/water	Not available.
9.16 Auto-ignition temperature	Not available.
9.17 Decomposition temperature	Not available.
9.18 Viscosity	Not available.
Other information	
Explosive properties	Not explosive. Can explode in contact with sulphuric acid, peroxides and metal powders.
Oxidizing properties	Strong oxidising agent.

10. Stability and reactivity

10.1 Reactivity	The product is non-reactive under normal conditions of use, storage and transport.
10.2 Chemical stability	Stable at normal conditions.
10.3 Possibility of hazardous reactions	Contact with combustible material may cause fire. Can explode in contact with sulphuric acid, peroxides and metal powders.
10.4 Conditions to avoid	Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction.
10.5 Incompatible materials	Acids. Peroxides. Reducing Agents. Combustible material. Metal powders.
10.6 Hazardous decomposition products	By heating and fire, corrosive vapours/gases may be formed. Contact with hydrochloric acid liberates chlorine gas.

11. Toxicological information

11.1 Information on likely routes of exposure	
Ingestion	Harmful if swallowed.
Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
11.2 Symptoms related to physical, chemical and toxicological characteristics	Contact with this material will cause burns to the skin, eyes and mucous membranes. Permanent eye damage including blindness could result.
11.3 Delayed and immediate effects, including chronic effects from short- and long-term exposure	Occupational exposure to the substance or mixture may cause adverse effects.
11.4 Numerical values of toxicity	
Acute toxicity	Harmful if swallowed.

Components	Species	Test results
Potassium permanganate (CAS 7722-64-7)		
Acute		
Dermal		
LD50	Rat	2000 mg/kg
Oral		
LD50	Rat	2000 mg/kg

Toxicity data are not available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate.

Skin corrosion/irritation Causes severe skin burns.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitisation

Respiratory sensitisation Not classified.

Skin sensitisation Not classified.

Germ cell mutagenicity Not classified.

Carcinogenicity Not classified.

Reproductive toxicity Not classified.

Specific target organ toxicity - single exposure May cause irritation of respiratory tract.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not classified.

Further information Chronic effects are not expected when this product is used as intended. Prolonged exposure, usually over many years, to manganese oxide fume/dust can lead to chronic manganese poisoning, chiefly affecting the central nervous system.

12. Ecological information

12.1 Ecological toxicity Very toxic to aquatic life with long lasting effects.

Components		Species	Test results
Potassium permanganate (CAS 7722-64-7)			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	2.7 mg/l, 96 hours, static
			2.3 mg/l, 96 hours, flow through
			2.3 mg/l, 96 hours
			1.8 - 5.6 mg/l
		Carp (Cyprinus carpio)	3.16 - 3.77 mg/l, 96 hours
			2.97 - 3.11 mg/l, 96 hours
		Goldfish (Carassius auratus)	3.3 - 3.93 mg/l, 96 hours, static
		Milkfish, salmon-herring (Chanos chanos)	> 1.4 mg/l, 96 hours
		Rainbow trout (Oncorhynchus mykiss)	1.8 mg/l, 96 hours
			1.08 - 1.38 mg/l, 96 hours
			0.77 - 1.27 mg/l, 96 hours
		Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.275 - 0.339 mg/l, 96 hours

Toxicity data are not available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate.

12.2 Persistence and degradability Expected to be readily converted by oxidisable materials to insoluble manganese oxide.

12.3 Bioaccumulative potential Potential to bioaccumulate is low.

12.4 Mobility in soil The product is miscible with water. May spread in water systems.

12.5 Other adverse effects None known.

13. Disposal considerations

Disposal instructions Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Waste from residues / unused products	Do not allow this material to drain into sewers/water supplies.
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Rinse container at least three times to an absence of pink color before disposing. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

ADR

14.1 UN number	UN3214
14.2 UN proper shipping name	Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate)
14.3 Transport hazard class(es)	
Class	5.1
Label(s)	5.1
14.4 Packing group	II
14.5 Environmental hazards	Yes
14.6 Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

RID

14.1 UN number	UN3214
14.2 UN proper shipping name	Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate)
14.3 Transport hazard class(es)	
Class	5.1
Label(s)	5.1
14.4 Packing group	II
14.5 Environmental hazards	Yes

IATA

14.1 UN number	UN3214
14.2 UN proper shipping name	Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate)
14.3 Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
14.4 Packing group	II
14.5 Environmental hazards	Yes
ERG Code	5L
14.6 Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Cargo aircraft only	Allowed.

IMDG

14.1 UN number	UN3214
14.2 UN proper shipping name	PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. (Sodium permanganate)
14.3 Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
14.4 Packing group	II
14.5 Environmental hazards	
Marine pollutant	Yes
EmS	F-H, S-Q
14.6 Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

15. Regulatory information

Federal regulations

Thailand. Notification of the Ministry of Interior, Re: Work Safety Relating to Dangerous Chemicals

Not regulated.

Thailand. Notification of the Ministry of Interior, Re: Work Safety Relating to More Dangerous Chemicals

Not regulated.

Thailand. Reportable Hazardous Substances (Notification of Ministry of Industry Re: Bases respecting report of quantity of hazardous materials under Department of Industrial Works, B.E. 2547)

Not regulated.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 27-November-2013

Revision date -

Version No. 01

Disclaimer The information contained herein is accurate to the best of our knowledge. However, data, safety standards and government regulations are subject to change and, therefore, holders and users should satisfy themselves that they are aware of all current data and regulations relevant to their particular use of product. CARUS CORPORATION DISCLAIMS ALL LIABILITY FOR RELIANCE ON THE COMPLETENESS OR ACCURACY OR THE INFORMATION INCLUDED HEREIN. CARUS CORPORATION MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTIABILITY OR FITNESS FOR PARTICULAR USE OR PURPOSE OF THE PRODUCT DESCRIBED HEREIN. All conditions relating to storage, handling, and use of the product are beyond the control of Carus Corporation, and shall be the sole responsibility of the holder or user of the product.

(Carus and design) is a registered service mark of Carus Corporation. LIQUOX® is a registered trademark of Carus Corporation. Copyright 1998.

ATTACHMENT 2B-2

Carus MLO SDS

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

SAFETY DATA SHEET

1. Identification

Product identifier	**RemOx® MLO Reagent**
Other means of identification	None.
Recommended use	Remediation.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Company name	CARUS CORPORATION
Address	315 Fifth Street, Peru, IL 61354, USA
Telephone	+1 815 223-1500 - All other non-emergency inquiries about the product should be directed to the company
E-mail	salesmkt@caruscorporation.com
Website	www.caruscorporation.com
Contact person	Shelley Corban
Emergency Telephone	For Hazardous Materials [or Dangerous Goods] Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC at CHEMTREC®, USA: 001 (800) 424-9300 CHEMTREC®, Mexico (Toll-Free - must be dialed from within country): 01-800-681-9531 CHEMTREC®, Other countries: 001 (703) 527-3887

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 1B
	Serious eye damage/eye irritation	Category 1
	Sensitization, respiratory	Category 1
	Sensitization, skin	Category 1
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Harmful if swallowed. Causes severe skin burns and eye damage. May cause an allergic skin reaction. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention	Do not breathe mist/vapors. Use only outdoors or in a well-ventilated area. In case of inadequate ventilation wear respiratory protection. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace. Avoid release to the environment.

Response	If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation or rash occurs: Get medical advice/attention. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Wash contaminated clothing before reuse. Collect spillage.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Sodium permanganate	10101-50-5	1 - 28
Sodium persulfate	7775-27-1	1 - 28

All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.
Skin contact	Take off immediately all contaminated clothing. (Caution: Solution may ignite certain textiles). Immediately flush skin with plenty of water. Get medical attention immediately. Wash contaminated clothing before reuse. Contact with skin may leave a brown stain of insoluble manganese dioxide. This can be easily removed by washing with a mixture of equal volume of household vinegar and 3% hydrogen peroxide, followed by washing with soap and water.
Eye contact	Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Continue rinsing. Get medical attention immediately.
Ingestion	Immediately rinse mouth and drink plenty of water. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention immediately.
Most important symptoms/effects, acute and delayed	Contact with this material will cause burns to the skin, eyes and mucous membranes. Permanent eye damage including blindness could result. May cause an allergic skin reaction. Dermatitis. Rash. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause respiratory irritation.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen. Decomposition products are alkaline. Brown stain is insoluble manganese dioxide.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Flood with water from a distance, water spray or fog.
Unsuitable extinguishing media	The following extinguishing media are ineffective: Dry chemical. Foam. Carbon dioxide (CO2). Halogenated materials.
Specific hazards arising from the chemical	May ignite combustibles (wood, paper, oil, clothing, etc.). Contact with incompatible materials or heat (135 ºC / 275 ºF) could result in violent exothermic chemical reaction. Oxidizing agent, may cause spontaneous ignition of combustible materials. During fire, gases hazardous to health may be formed such as: Sodium oxides. Manganese oxides. Sulfur Oxides (SOx).
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for firefighting: follow the general fire precautions indicated in the workplace.
Fire fighting equipment/instructions	Move container from fire area if it can be done without risk. Cool containers exposed to flames with water until well after the fire is out. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Dike fire control water for later disposal. Water runoff can cause environmental damage.

General fire hazards The product is not flammable. May ignite combustibles (wood, paper, oil, clothing, etc.). Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep upwind. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid inhalation of vapors and contact with skin and eyes. Wear protective clothing as described in Section 8 of this safety data sheet. Local authorities should be advised if significant spillages cannot be contained.

Methods and materials for containment and cleaning up Keep combustibles (wood, paper, oil, etc.) away from spilled material. Should not be released into the environment. This product is miscible in water. Stop leak if possible without any risk. Dike the spilled material, where this is possible. Proceed with either of the following two options depending upon the size of the spill and the availability of the neutralizing agents:

Option # 1: Dilute to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Decant or filter and deposit sludge in approved landfill. Where permitted, the sludge may be drained into sewer with large quantities of water.

Option # 2: Absorb with inert media like diatomaceous earth or inert floor dry, collect into a drum and dispose of properly. Do not use saw dust or other incompatible media. Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to permanganates.

To clean contaminated floors, flush with abundant quantities of water into sewer, if permitted by federal, state, and local regulations. If not, collect water and treat as described above.

Never return spills in original containers for re-use. For waste disposal, see section 13 of the SDS.

Environmental precautions Do not allow to enter drains, sewers or watercourses. Contact local authorities in case of spillage to drain/aquatic environment.

7. Handling and storage

Precautions for safe handling Take any precaution to avoid mixing with combustibles. Keep away from clothing and other combustible materials. Do not get this material in your eyes, on your skin, or on your clothing. Do not breathe mist or vapor. Use Personal Protective Equipment recommended in section 8 of the SDS. If clothing becomes contaminated, remove and wash off immediately. Spontaneous ignition may occur in contact with cloth or paper. When using, do not eat, drink or smoke. Good personal hygiene is necessary. Wash hands and contaminated areas with water and soap before leaving the work site. Avoid release to the environment.

Conditions for safe storage, including any incompatibilities Store locked up. Keep container tightly closed and in a well-ventilated place. Store in a cool, dry place. Store away from incompatible materials (See Section 10).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Sodium permanganate (CAS 10101-50-5)	Ceiling	5 mg/m3

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Sodium permanganate (CAS 10101-50-5)	TWA	0.1 mg/m3	Inhalable fraction.
		0.02 mg/m3	Respirable fraction.
Sodium persulfate (CAS 7775-27-1)	TWA	0.1 mg/m3	

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
Sodium permanganate (CAS 10101-50-5)	STEL	3 mg/m3	Fume.
	TWA	1 mg/m3	Fume.

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines	Follow standard monitoring procedures.
Appropriate engineering controls	Provide adequate general and local exhaust ventilation. An eye wash and safety shower must be available in the immediate work area.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles). Wear face shield if there is risk of splashes.
Skin protection	
Hand protection	Wear chemical-resistant, impervious gloves. Use protective gloves made of: Rubber or plastic.
Skin protection	
Other	Wear appropriate chemical resistant clothing. Rubber or plastic apron.
Respiratory protection	In case of inadequate ventilation or risk of inhalation of vapors, use suitable respiratory equipment. In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA 29 CFR 1910.134.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	When using, do not eat, drink or smoke. Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Appearance	Purple liquid.
Physical state	Liquid.
Form	Liquid.
Color	Dark purple
Odor	Odorless
Odor threshold	Not available.
pH	5.5 - 7.2
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	1.05 - 1.4 at 22°C
Solubility(ies)	
Solubility (water)	Soluble
Partition coefficient (n-octanol/water)	Not applicable for inorganic substances.
Auto-ignition temperature	Not available.
Decomposition temperature	172.4 °F (78 °C)
Viscosity	Not available.
Other information	
Density	1.05 - 1.40 at 22°C
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Stable at normal conditions.
Possibility of hazardous reactions	Contact with combustible material may cause fire. Can explode in contact with sulfuric acid, peroxides and metal powders.
Conditions to avoid	Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction.
Incompatible materials	Acids. Peroxides. Reducing agents. Combustible material. Metal powders.
Hazardous decomposition products	By heating and fire, corrosive vapors/gases may be formed. Contact with hydrochloric acid liberates chlorine gas.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system. May cause allergic respiratory reaction.
Skin contact	Causes severe skin burns. May cause allergic skin reaction.
Eye contact	Causes serious eye damage.
Ingestion	Harmful if swallowed. Causes digestive tract burns.
Symptoms related to the physical, chemical and toxicological characteristics	Contact with this material will cause burns to the skin, eyes and mucous membranes. Permanent eye damage including blindness could result. May cause an allergic skin reaction. Rash. Dermatitis. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause respiratory irritation.

Information on toxicological effects

Acute toxicity Harmful if swallowed.

Components	Species	Test Results
Potassium permanganate (CAS 7722-64-7)		
Acute		
Dermal		
LD50	Rat	2000 mg/kg
Oral		
LD50	Rat	2000 mg/kg
Sodium persulfate (CAS 7775-27-1)		
Acute		
Dermal		
LD50	Rat	> 2000 mg/kg, 24 Hours
Inhalation		
LC50	Rat	> 5.1 mg/l, 4 Hours
Oral		
LD50	Rat	742 mg/kg

Toxicity data are not available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate.

Skin corrosion/irritation	Causes severe skin burns.
Serious eye damage/eye irritation	Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization	May cause allergic respiratory reaction.
Skin sensitization	May cause allergic skin reaction.
Germ cell mutagenicity	Not classified.
Carcinogenicity	Not classified.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Reproductive toxicity Not classified.

Specific target organ toxicity - single exposure May cause irritation of respiratory tract.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not classified.

Chronic effects Chronic effects are not expected when this product is used as intended. Prolonged exposure, usually over many years, to manganese oxide fume/dust can lead to chronic manganese poisoning, chiefly affecting the central nervous system.

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Components		Species	Test Results
Potassium permanganate (CAS 7722-64-7)			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	2.7 mg/l, 96 hours static
			2.3 mg/l, 96 hours flow through
			2.3 mg/l, 96 hours
			1.8 - 5.6 mg/l
		Carp (Cyprinus carpio)	3.16 - 3.77 mg/l, 96 hours
			2.97 - 3.11 mg/l, 96 hours
		Goldfish (Carassius auratus)	3.3 - 3.93 mg/l, 96 hours static
		Milkfish, salmon-herring (Chanos chanos)	> 1.4 mg/l, 96 hours
		Rainbow trout (Oncorhynchus mykiss)	1.8 mg/l, 96 hours
			1.08 - 1.38 mg/l, 96 hours
			0.77 - 1.27 mg/l, 96 hours

Toxicity data are not available for sodium permanganate. Toxicity is expected to be similar to that of potassium permanganate.

Persistence and degradability Expected to be readily converted by oxidizable materials to insoluble manganese oxide.

Bioaccumulative potential Potential to bioaccumulate is low.

Mobility in soil The product is miscible with water. May spread in water systems.

Other adverse effects None known.

13. Disposal considerations

Disposal instructions Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose of in accordance with local regulations.

Hazardous waste code The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products Do not allow this material to drain into sewers/water supplies. Dispose of in accordance with local regulations.

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Rinse container at least three times to an absence of pink color before disposing. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number UN1760

UN proper shipping name Corrosive liquids, n.o.s. (Sodium permanganate; sodium persulfate)

Transport hazard class(es)

Class 8

Subsidiary risk -

Label(s) 8

Packing group	II
Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	B2, IB2, T11, TP2, TP27
Packaging exceptions	154
Packaging non bulk	202
Packaging bulk	242

IATA

UN number	UN1760
UN proper shipping name	Corrosive liquid, n.o.s. (Sodium permanganate; sodium persulfate)
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	Yes
ERG Code	8L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1760
UN proper shipping name	CORROSIVE LIQUID, N.O.S. (Sodium permanganate; sodium persulfate)
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	Yes
EmS	F-A, S-B
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.
General information	DOT Regulated Marine Pollutant.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Sodium permanganate (CAS 10101-50-5) Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Toxic Substances Control Act (TSCA) All components of the mixture on the TSCA 8(b) inventory are designated “active”.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes
Classified hazard categories	Acute toxicity (any route of exposure) Skin corrosion or irritation Serious eye damage or eye irritation Respiratory or skin sensitization Specific target organ toxicity (single or repeated exposure)

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Sodium permanganate	10101-50-5	1 - 20

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Sodium permanganate (CAS 10101-50-5)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

Sodium permanganate (CAS 10101-50-5) 6588

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Sodium permanganate (CAS 10101-50-5) 15 %WT

DEA Exempt Chemical Mixtures Code Number

Sodium permanganate (CAS 10101-50-5) 6588

US state regulations

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Sodium permanganate (CAS 10101-50-5)
Sodium persulfate (CAS 7775-27-1)

US. Pennsylvania Worker and Community Right-to-Know Law

Sodium permanganate (CAS 10101-50-5)

US. Rhode Island RTK

Not regulated.

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 2016 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	23-May-2019
Revision date	22-August-2019
Version #	02
Further information	HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings

Health: 3*
Flammability: 0
Physical hazard: 0

NFPA ratings

List of abbreviations

GHS: Globally Harmonized System of Classification and Labeling of hazardous properties of Chemicals.

TWA: Time weighted average.
LD50: Lethal Dose, 50%.
LC50: Lethal Concentration, 50%.
IMDG: International Maritime Dangerous Goods.
IATA: International Air Transport Association.
MARPOL: International Convention for the Prevention of Pollution from Ships.
STEL: Short-term Exposure Limit.

References

HSDB® - Hazardous Substances Data Bank
Registry of Toxic Effects of Chemical Substances (RTECS)
IARC Monographs. Overall Evaluation of Carcinogenicity
National Toxicology Program (NTP) Report on Carcinogens
ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices

Disclaimer

The information contained herein is accurate to the best of our knowledge. However, data, safety standards and government regulations are subject to change and, therefore, holders and users should satisfy themselves that they are aware of all current data and regulations relevant to their particular use of product. CARUS CORPORATION DISCLAIMS ALL LIABILITY FOR RELIANCE ON THE COMPLETENESS OR ACCURACY OR THE INFORMATION INCLUDED HEREIN. CARUS CORPORATION MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTIABILITY OR FITNESS FOR PARTICULAR USE OR PURPOSE OF THE PRODUCT DESCRIBED HEREIN. All conditions relating to storage, handling, and use of the product are beyond the control of Carus Corporation, and shall be the sole responsibility of the holder or user of the product.

(Carus and design) is a registered service mark of Carus Corporation.
RemOx® is a registered trademark of Carus Corporation

ATTACHMENT 2B-3

Carus Estimation Spreadsheet for RemOx® L

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

CRT
Carus Remediation Technologies

RemOx® L
ISCO Reagent
Estimation Spreadsheet

Input data into box with black font

Site Name: Metro North Service Center
Date: 8/27/2020

	Estimates	Units
Treatment Area Volume		
Length	**30**	ft
Width	**30**	ft
Area	900	sq ft
Thickness	**8**	ft
Total Volume	267	cu yd
Soil Characteristics/Analysis		
Porosity	**30**	%
Total Plume Pore Volume	16,158	gal
Avg Contaminant Conc	**4,500**	ppm
Mass of Contaminant	606.80	lb
PNOD	**3.9**	g/kg
Effective PNOD	**60**	%
Effective PNOD Calculated	2.340	
PNOD Oxidant Demand	1,853.28	lb
Avg Stoichiometric Demand	**1.3**	lb/lb
Contaminant Oxidant Demand	788.84	lb
Theoretical Oxidant Demand	2,642.12	lb
Confidence Factor	**2**	
Calculated Oxidant Demand	5,284.23	

	Estimates	Units
Injection Volume for RemOx L		
Injection Concentration	**10.0%**	%
Calculated Specific Gravity	1.09	g/ml
Total Volume of Injection Fluid	5,209	gal
Pore Volume Replaced	32.24	%
Amount of RemOx L Estimated:	**11,863**	**pounds**
	1,038	**gallons**

ATTACHMENT 2B-4

Carus Estimation Spreadsheet for MLO

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

CRT

Carus Remediation Technologies

Mixed Liquid Oxidant (MLO)
ISCO Reagent
Estimation Spreadsheet

Input data into box with black font

Site Name: Metro North Service Center

Date: 8/27/2020

	Estimates	Units
Treatment Area Volume		
Length	**120**	ft
Width	**45**	ft
Area	5,400	sq ft
Thickness	**3**	ft
Total Volume	600	cu yd
Soil Characteristics/Analysis		
Porosity	**30**	%
Total Plume Pore Volume	36,355	gal
Avg Contaminant Conc	**12,100**	ppm
Mass of Contaminant	3,671.13	lb
PNOD	**3.2**	g/kg
Effective PNOD	**60**	%
Effective PNOD Calculated	1.920	
PNOD Oxidant Demand	3,421.44	lb
Avg Stoichiometric Demand	**2**	lb/lb
Contaminant Oxidant Demand	7,342.25	lb
Theoretical Oxidant Demand	10,763.69	lb
Confidence Factor	**1.5**	
Calculated Oxidant Demand	16,145.54	

	Estimates	Units
Injection Volume for MLO		
Injection Concentration	**5.0%**	%
Calculated Specific Gravity Total	1.05	g/ml
Volume of Injection Fluid Pore	33,226	gal
Volume Replaced	91.39	%
Amount of MLO Estimated:	**36,247**	**pounds**
	3,171	**gallons**

Geosyntec consultants

10600 N. Port Washington Road, Suite 100
Mequon, WI 53092
PH 262.377.9828
www.geosyntec.com

3 - WPDES NOTICE OF INTENT

INFILTRATION/INJECTION REQUEST
In-Situ Chemical Oxidation (ISCO) Direct Mixing
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin 53208
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

ATTACHMENTS

3-1 Notice of Intent (NOI), Contaminated Groundwater from Remedial Action Operations, WPDES Permit No. WI-0046566-07-0
3-2 Unsaturated Soil Additive Review Worksheet (RemOx® L)
3-3 Shallow Groundwater/Saturated Soil Additive Review Worksheet (MLO)

*****

ATTACHMENT 3-1

Notice of Intent (NOI), Contaminated Groundwater from Remedial Action Operations, WPDES Permit No. WI-0046566-07-0

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

State of Wisconsin
Department of Natural Resources
Bureau of Water Quality
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Notice of Intent (NOI)
Contaminated Groundwater from Remedial Action Operations
WPDES Permit No. WI-0046566-07-0
Rev. 06/2018

Notice: Pursuant to chs. NR 200 and 205, Wis. Adm. Code, this notice of intent (NOI) is required to request coverage under the Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-0046566-07-0 for discharges of contaminated groundwater to waters of the state of Wisconsin. Failure to complete this form in its entirety may result in a returned NOI or a denied NOI. Personal information collected will be used for administrative purposes and may be provided to requestors to the extent required by Wisconsin Open Records law [ss. 19.31-19.39, Wis. Stats.].

SECTION I: FACILITY/PROJECT LOCATION INFORMATION			
Facility/Project Name **Metro North Service Center**		Facility Mailing Address (i.e. PO Box, Street, or Route)	
Facility/Project Physical Address (i.e. Street or Route) **3100 West North Avenue**		City, State, Zip Code **Milwaukee, WI 53208**	
County **Milwaukee**	Facility Phone No.	Facility Fax No.	Facility Email Address
SECTION II: FACILITY CONTACT INFORMATION			
Facility Operator/Plant Manager **David Jaeckels**		Title **Project Manager - Facility Management**	
Company **WEC Energy Group - Business Services**		Contact Mailing Address (i.e. PO Box, Street, or Route) **333 W. Everett Street**	
City, State, Zip Code **Milwaukee, WI 53203**		Contact Phone No. **414.221.4204**	Alternative Phone No. **414.510.0383**
Contact Fax No.		Contact Email Address **david.jaeckels@wecenergygroup.com**	
Discharge Monitoring Contact Name **Jeremiah Johnson**		Title **Project Manager**	
Company **Geosyntec Consultants**		Contact Mailing Address (i.e. PO Box, Street, or Route) **10600 N. Port Washington Road, Suite 100**	
City, State, Zip Code **Mequon, WI 53092**		Contact Phone No. **262.834.0228**	Alternative Phone No. **414.322.1164**
Contact Fax No.		Contact Email Address **jpjohnson@geosyntec.com**	
Authorized Representative Name **Frank Dombrowski**		Title **Principal Environmental Consultant**	
Company **WEC Energy Group - Business Services**		AR Mailing Address (i.e. PO Box, Street, or Route) 333 Everett Street	
City, State, Zip Code **Milwaukee, WI 53203**		AR Phone No. **414.221.2156**	Alternative Phone No. **414.587.4467**
AR Fax No.		AR Email Address **frank.dombrowski@wecenergygroup.com**	

State of Wisconsin
Department of Natural Resources
Bureau of Water Quality
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Notice of Intent (NOI)
Contaminated Groundwater from Remedial Action Operations
WPDES Permit No. WI-0046566-07-0
Rev. 06/2018

SECTION III: FACILITY OWNER MAILING ADDRESS (if different from Authorized Representative)		
Facility Owner Name **Wisconsin Electric Power Company** **(d.b.a, We Energies)**	Title	
Parent Company **WEC Energy Group**	Owner Mailing Address (i.e. PO Box, Street, or Route) **231 W. Michigan Street**	
City, State, Zip Code **Milwaukee, WI 53203**	Owner Phone No.	Alternative Phone No.
Contact Fax No.	Contact Email Address	

SECTION IV: DISCHARGE CHARACTERIZATION

Type of Wastewater (check all that apply):	**Discharge Frequency** (e.g. Annual, Monthly, Daily)	**Average Daily Flow** (gallons of water discharged per day)	**Type of Wastewater** (check all that apply):	**Discharge Frequency** (e.g. Annual, Monthly, Daily)	**Average Daily Flow** (gallons of water discharged per day)
☐ Treated wastewater from groundwater remediation project			☐ Cleaning or decontamination wastewaters from the cleaning of treatment equipment for a remediation project		
☒ Infiltration or injection of a substance or remedial material for remediation of soil or groundwater	**single direct mixing event**	**5,200 gal (soil)** **33,200 gal (shallow groundwater/ saturated soil)**	☐ Other (describe type)		
☐ Treated wastewater from dewatering of construction trenches or pits			☐ Other (describe type)		
☐ Landspreading or spray irrigation of agricultural chemical contaminated wastewater			☐ Other (describe type)		

State of Wisconsin
Department of Natural Resources
Bureau of Water Quality
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

SECTION V: ELIGIBILITY CHECKLIST

1. Is the wastewater discharged from and/or to properties within tribal lands (i.e. land owned by or held in trust for the tribes and land within recognized reservation boundaries)?

☐ Yes. **Your discharge is not eligible for this General Permit.** *If all discharges from your facility go to or come from properties in tribal lands, you do not require regulation under a WPDES discharge permit. Therefore, skip the rest of the NOI and sign the last page. We will remove you from our tracking system. The Tribe or United States Environmental Protection Agency (EPA) regulates discharges within tribal lands.*

☒ No. **Proceed to question 2.**

2. Is the wastewater discharged to a Publicly Owned Treatment Works (i.e. sanitary sewer)? A septic system is not considered a sanitary sewer.

☐ Yes. **Your discharge is not eligible for this General Permit.** *If all discharges from your facility go to a sanitary sewer, you do not require regulation under a WPDES discharge permit. Therefore, skip the rest of the NOI and sign the last page. We will remove you from our tracking system. If at some point in the future operations at your facility result in a discharge, you will need to inform the Department. If only some or no discharges from your facility go to the sanitary sewer, please proceed to question 3.*

☒ No. **Proceed to question 3.**

3. Are any of the following wastewaters discharged or mixed with the above wastewaters to surface water or groundwater: Contact or noncontact cooling water, water from boiler cleaning operations, air compressor condensate contaminated with oil and grease, softener regeneration backwash, municipal wastewater, domestic wastewater, or process wastewaters from the production of any material or product, or other wastewater not otherwise cover by this general permit?

☐ Yes. **Your discharge is not eligible for this General Permit.** *Skip the rest of the NOI and complete the certification on last page. Contact the Department to obtain application for an individual WPDES discharge permit.*

☒ No. **Proceed to question 4.**

4. What is the receiving water for your discharge? If your facility has more than one outfall, indicate in the space provided which outfalls go to groundwater and which go to surface waters. *(check all that apply)*

☒ **Groundwater Discharge** (*any wastewater that is allowed to infiltrate or seep into the soil from a permeable surface including but not limited to any drain field, agricultural field, ditch, swale, depression, trench or pit, adsorption pond, infiltration pond, rain garden, prairie, or vegetative area that may impact groundwater quality*). **If you will only be discharging to groundwater, please proceed to question 5.**

Outfall #(s):

☐ **Wetland Discharge** (*any discernible, confined and discrete conveyance system including but not limited to any pipe, ditch, channel, tunnel, conduit, swale, or storm sewer that will carry wastewater to a wetland. Wetlands mean an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions*). **If you will only be discharging to wetlands, please proceed to question 5.**

Outfall #(s):

Note: *The Department will need to determine if your discharge would cause significant adverse impacts to wetlands*

☐ **Surface Water Discharge** *(any discernible, confined and discrete conveyance system including but not limited to any pipe, ditch, channel, tunnel, conduit, swale, or storm sewer that will carry wastewater to a creek, stream,*

pond, marsh, bay, reservoir, river, lake, or other surface water within the state of Wisconsin). **Proceed to question 4A.**

Outfall #(s): **NA**

A. What is the name(s) of the surface water your discharge enters?

NA

Proceed to question 4B.

B. What is the Water Body Identification Code (WBIC) of the surface water your discharge enters?

NA

Proceed to question 4C.

Note: The WBIC for a specific surface water can be found at: http://dnr.wi.gov/water/waterSearch.aspx.

C. Is the discharge directly to a surface water classified as an outstanding or exceptional resource waters as defined in ch. NR 102, Wis. Adm. Code.?

☐ Yes. **Your discharge is not eligible for this General Permit.** *Skip the rest of the NOI and complete the certification on last page. Contact the Department to obtain application for an individual WPDES discharge permit.*

☐ No. **Proceed to question 4D.**

D. Is the discharge directly to a surface water classified as a public water supply (i.e. Lake Superior, Lake Michigan and Lake Winnebago) in ch. NR 104, Wis. Adm. Code?

☐ Yes. **Your discharge is not eligible for this General Permit.** *Skip the rest of the NOI and complete the certification on last page. Contact the Department to obtain application for an individual WPDES discharge permit.*

☐ No. **Proceed to question 5.**

5. Does the discharge contain water treatment additives (i.e. biocides such as microbicides, fungicides, molluscicdes, chlorine, etc.) or water quality conditioners (i.e. scale and corrosion inhibitors, pH adjustment chemicals, oxygen scavengers, conditioning agents, water softening compounds, etc.) that may enter surface water or groundwater without receiving wastewater treatment or that are used in a treatment process but are not expected to be removed by wastewater treatment?

☒ Yes. **For each additive used, please fill out and attach an Additive Review Worksheet.** *Additive Review Worksheets must be completed to receive coverage under this general permit. The Additive Review Worksheet is not required for additives with active ingredients consisting of chlorine, hypochlorite, sulfuric acid, hydrochloric acid or sodium hydroxide. Also, chemicals used in an industrial process generating wastewater that eventually receives treatment or chemicals added as part of wastewater treatment process (such as ferric chloride, alum or pickle liquor) are not considered water treatment additives and need not require an additive review.* **Proceed to question 6.**

☐ No. **Proceed to question 6.**

6. Will chlorine-based compounds be used to control the growth of micro-organisms in the treatment system or used to decontaminate the treatment system after completion of the remediation project?

☐ Yes. **Proceed to question 6A.**

☒ No. **Proceed to question 7.**

State of Wisconsin
Department of Natural Resources
Bureau of Water Quality
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

A. Will chemicals be used to dechlorinate the wastewater prior to discharge to surface water?

☐ Yes. **The wastewater will be dechlorinated with chemicals. Proceed to question 7.**

☒ No. **The wastewater will not be dechlorinated with chemicals. Proceed to question 7.**

7. Is a discharge management plan attached to this NOI that includes all the information necessary from Section 3 of the permit?

☒ Yes. **Proceed to question 8.**

☐ No. **This form will be considered incomplete and returned to you.**

8. Has the groundwater at the site been analyzed for contaminants and are the results attach to the discharge management plan?

☒ Yes. **Proceed to question 9.**

☐ No. **This form will be considered incomplete and returned to you.**

9. If a treatment facility is required for the treatment of contaminated groundwater, have the plans and specifications been submitted to or approved by the department under s. 281.41, Wis. Stats., and ch. NR 108, Wis. Adm. Code?

☐ Yes. **Proceed to Section VI.**

☒ No. **Please contact wastewater plan review staff to find out how to get the plans approved. Proceed to Section VI.**

Note: Department wastewater plan review staff can be found here: http://dnr.wi.gov/topic/wastewater/planreviewers.html.

Additionally, department plan submittal requirements can be found here: http://dnr.wi.gov/topic/wastewater/AdequateSubmittal.html.

SECTION VI: CERTIFICATION

This form must be signed by a responsible executive or municipal officer, manager, partner or proprietor as specified in s. 283.37(3), Wis. Stats., or a duly authorized representative of the officer, manager, partner or proprietor that has been delegated signature authority pursuant to s. NR 205.07(1)(g)2., Wis. Adm. Code. To delegate signatory authority to a duly authorized representative, please submit a Delegation of Signature Authority (DSA) form (Form 3400-220).

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Authorized Representative Name	Title
Frank Dombrowski	**Principal Environmental Consultant**
Authorized Representative Signature 	Date Signed 9/11/2020
Submitter Name (If different from Authorized Representative)	Title

State of Wisconsin
Department of Natural Resources
Bureau of Water Quality
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Notice of Intent (NOI)
Contaminated Groundwater from Remedial Action Operations
WPDES Permit No. WI-0046566-07-0
Rev. 06/2018

Submitter Signature	Date Signed

Please print and sign this certification page. Scan and email the completed form, certification page and any other supporting information to the department regional general permit reviewer at least thirty (30) business days before the expected start date of discharge. A listing of the general permit reviewers for each region with mailing addresses and phone numbers can be found at http://dnr.wi.gov/topic/wastewater/GeneralPermits.html. Please scroll to the "How to Apply" section and click the department region that the discharge is located in.

ATTACHMENT 3-2

Unsaturated Soil Additive Review Worksheet (RemOx® L)

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

Additive Review Worksheet

This worksheet summarizes the information to be submitted to the WDNR for review of additives. This information is required because additives are approved on a case-by-case basis.

The fields highlighted in orange are required for all additive reviews and are NOT typically found on a safety data sheet (SDS).
The fields highlighted in blue are required for all additive reviews and are typically found on a SDS.
Parts D and E need to be completed **for each species** (e.g. Daphnia -water flea); Pimephales (fathead minnow), etc) for which a toxicity test is conducted.
The fields highlighted in green are NOT typically found on a SDS and are required for toxicity tests conducted when "Other" is selected for Test Method in Part D-1.

If all of the needed information is not provided on the SDS, It is recommended that you contact the chemical distributor and/or manufacturer to obtain the required information. You do not need to conduct the toxicity test if the toxicity information is available on SDS or from the supplier/manufacturer. If the required toxicity data is not provided to the Department, the additive product may not be approved for use.

Note: Toxicity test results must address the ***commercial product formulation***. The commercial product formulation is all active ingredients and any and all carriers, buffering agents, binding agents, and additional materials – the entire product as used. Information related to active ingredient alone is not sufficient**.**

For more information on the additive review process, see the "*Water Quality Review Procedures for Additives*" guidance document.

A. General Production Information

Date of Request:

Permittee Facility Name: Metro North Service Center

Product Trade Name: RemOx® L ISCO Reagent

Product Manufacturer: Carus Corporation

Active Ingredients:

Ingredient Name*	CAS Number**	%wt or % vol
sodium permanganate	10101-50-5	36 - 40

* Must be provided unless noted to be proprietary information
** If available

Is this product replacing another additive (if yes, include product name)? ☐Yes ☒No

Current Product Name:

B. Dosage or Application Information

Purpose of additive: In-situ treatment of PCE impacted soil by oxidation

Proposed dosage rate: 100,000 lbs/day / mg/L

Estimated maximum discharge concentration: lbs/day / mg/L

C. Toxicity Test Results

Test Species	Toxicity Value Type (e.g., LC50, EC50, NOAEL)	Toxicity Value	Toxicity Value Units (e.g., mg/L, µg/L, ppm)
Bluegill (Lepomis macrochirus)	LC50	2.7 mg/l, 96 hours, static 2.3 mg/l, 96 hours, flow through 2.3 mg/l, 96 hours 1.8 - 5.6 mg/l	
Carp (Cyprinus carpio)	LC50	3.16 - 3.77 mg/l, 96 hours 2.97 - 3.11 mg/l, 96 hours	
Goldfish (Carassius auratus)	LC50	3.3 - 3.93 mg/l, 96 hours, static	
Milkfish, salmon-herring (Chanos chanos)	LC50	> 1.4 mg/l, 96 hours	
Rainbow trout (Oncorhynchus mykiss)	LC50	1.8 mg/l, 96 hours 1.08 - 1.38 mg/l, 96 hours 0.77 - 1.27 mg/l, 96 hours	
Rainbow trout,donaldson trout (Oncorhynchus mykiss)	LC50	0.275 - 0.339 mg/l, 96 hours	

Print one copy of this page for each species that has been tested.

D. Toxicity Test Parameters

1. Parameters needed for **ALL** reviews

Test species:	☐ Ceriodaphnia species (specify:) ☐ Daphnia species (specify:) ☐ Pimephales promelas (fathead minnow) ☒ Lepomis macrochirus (bluegill) ☒ Oncorhynchus mykiss (rainbow trout) ☐ Salvelinus fontalis (brook trout)
Test method:	☐ WI certified WET testing lab/method ☐ EPA method (select from those listed below) □ Acute-2002.0 □ Chronic-1000.0 □ Acute-2021.0 □ Chronic-1001.0 □ Acute-2000.0 □ Chronic-1002.0 □ Acute-2019.0 □ Chronic-1003.0 ☐ Other (additional information needed; see part D2)
Test type:	☐ Static non-renewal ☐ Static-renewal ☐ Flow-through
Control response:	☐ ≥ 90% survival ☐Other (Note: if this is selected, this data cannot be used)

2. Parameters needed when using "**other**" test methods

Dilution water:	☐Moderately hard synthetic water ☐Synthetic water ☐Receiving water ☐Ground water ☐Other (Specify:)
Number of test concentrations:	
Dilution series:	
Water chemistry analyses (check all that apply):	☐ pH ☐ Conductivity ☐ Hardness ☐ Alkalinity
Temperature:	☐ 12±1 °C ☐ 20±1 °C ☐ 25±1 °C ☐ Other (Specify:)
Number of organisms per test chamber:	
Number of replicate chambers per concentration:	
Number of organisms per concentration:	
Method for calculating the response endpoint:	

ATTACHMENT 3-3

Shallow Groundwater/Saturated Soil Additive Review Worksheet (MLO)

Infiltration/Injection Request
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

Additive Review Worksheet

This worksheet summarizes the information to be submitted to the WDNR for review of additives. This information is required because additives are approved on a case-by-case basis.

The fields highlighted in orange are required for all additive reviews and are NOT typically found on a safety data sheet (SDS).
The fields highlighted in blue are required for all additive reviews and are typically found on a SDS.
Parts D and E need to be completed **for each species** (e.g. Daphnia -water flea); Pimephales (fathead minnow), etc) for which a toxicity test is conducted.
The fields highlighted in green are NOT typically found on a SDS and are required for toxicity tests conducted when "Other" is selected for Test Method in Part D-1.

If all of the needed information is not provided on the SDS, It is recommended that you contact the chemical distributor and/or manufacturer to obtain the required information. You do not need to conduct the toxicity test if the toxicity information is available on SDS or from the supplier/manufacturer. If the required toxicity data is not provided to the Department, the additive product may not be approved for use.

Note: Toxicity test results must address the ***commercial product formulation***. The commercial product formulation is all active ingredients and any and all carriers, buffering agents, binding agents, and additional materials – the entire product as used. Information related to active ingredient alone is not sufficient**.**

For more information on the additive review process, see the "*Water Quality Review Procedures for Additives*" guidance document.

A. General Production Information

Date of Request:

Permittee Facility Name: Metro North Service Center

Product Trade Name: RemOx® MLO Reagent

Product Manufacturer: Carus Corporation

Active Ingredients:

Ingredient Name*	CAS Number**	%wt or % vol
sodium permanganate	10101-50-5	1 - 28
sodium persulfate	7775-27-1	1 - 28

* Must be provided unless noted to be proprietary information
** If available

Is this product replacing another additive (if yes, include product name)? ☐Yes ☒No

Current Product Name:

B. Dosage or Application Information

Purpose of additive: In-situ treatment of PCE impacted groundwater by oxidation

Proposed dosage rate:	50,000	lbs/day mg/L
Estimated maximum discharge concentration:		lbs/day mg/L

C. Toxicity Test Results

Test Species	Toxicity Value Type (e.g., LC50, EC50, NOAEL)	Toxicity Value	Toxicity Value Units (e.g., mg/L, µg/L, ppm)
Bluegill (Lepomis macrochirus)	LC50	2.7 mg/l, 96 hours, static 2.3 mg/l, 96 hours, flow through 2.3 mg/l, 96 hours 1.8 - 5.6 mg/l	
Carp (Cyprinus carpio)	LC50	3.16 - 3.77 mg/l, 96 hours 2.97 - 3.11 mg/l, 96 hours	
Goldfish (Carassius auratus)	LC50	3.3 - 3.93 mg/l, 96 hours, static	
Milkfish, salmon-herring (Chanos chanos)	LC50	> 1.4 mg/l, 96 hours	
Rainbow trout (Oncorhynchus mykiss)	LC50	1.8 mg/l, 96 hours 1.08 - 1.38 mg/l, 96 hours 0.77 - 1.27 mg/l, 96 hours	

Print one copy of this page for each species that has been tested.

D. Toxicity Test Parameters

1. Parameters needed for **ALL** reviews

Test species:	☐ Ceriodaphnia species (specify:) ☐ Daphnia species (specify:) ☐ Pimephales promelas (fathead minnow) ☒ Lepomis macrochirus (bluegill) ☒ Oncorhynchus mykiss (rainbow trout) ☐ Salvelinus fontalis (brook trout)
Test method:	☐ WI certified WET testing lab/method ☐ EPA method (select from those listed below) □ Acute-2002.0 □ Chronic-1000.0 □ Acute-2021.0 □ Chronic-1001.0 □ Acute-2000.0 □ Chronic-1002.0 □ Acute-2019.0 □ Chronic-1003.0 ☐ Other (additional information needed; see part D2)
Test type:	☐ Static non-renewal ☐ Static-renewal ☐ Flow-through
Control response:	☐ ≥ 90% survival ☐Other (Note: if this is selected, this data cannot be used)

2. Parameters needed when using "**other**" test methods

Dilution water:	☐Moderately hard synthetic water ☐Synthetic water ☐Receiving water ☐Ground water ☐Other (Specify:)
Number of test concentrations:	
Dilution series:	
Water chemistry analyses (check all that apply):	☐ pH ☐ Conductivity ☐ Hardness ☐ Alkalinity
Temperature:	☐ 12±1 °C ☐ 20±1 °C ☐ 25±1 °C ☐ Other (Specify:)
Number of organisms per test chamber:	
Number of replicate chambers per concentration:	
Number of organisms per concentration:	
Method for calculating the response endpoint:	