Groundwater & Environmental Services, Inc.

EASTERN NEW YORK OFFICE

August 24, 2017

Mr. Gary Priscott
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, Remedial Bureau B, 12th Floor
Albany, New York 12233-7016

Re: In-Situ Chemical Oxidation Pilot Test Work Plan
Owego Heat Treat
Owego, New York
NYSDEC Site Number 754011

Dear Mr. Priscott:

Please find the enclosed *In-Situ Chemical Oxidation Pilot Test Work Plan* prepared by Groundwater & Environmental Services, Inc. (GES), on behalf of the New York State Department of Environmental Conservation (NYSDEC), for the Owego Heat Treat facility located in Owego, New York (the Site). Your review and approval of the proposed plan for implementation of an in-situ chemical oxidation (ISCO) pilot test consisting of well installation, sodium permanganate injection, post-injection monitoring, and reporting is respectfully requested. Should you have any questions or comments regarding the information provided herein, please contact Scott McDonald at (800) 220-3069, extension 4066.

Respectfully Submitted,
Groundwater & Environmental Services, Inc.

Genevieve F. Bock, P.E.
Senior Project Engineer

Scott McDonald
Project Manager

Enclosure

In-Situ Chemical Oxidation Pilot Test Work Plan

Owego Heat Treat
(NYSDEC Site Number 754011)

Prepared for:
Gary Priscott
Engineering Geologist 2, Division of Environmental Remediation

New York State Department of Environmental Conservation
1679 Route 11
Kirkwood, New York 13795

Prepared by:

Groundwater and Environmental Services, Inc.
5 Technology Place, Suite 4
East Syracuse, New York 13057

August 2017

IN-SITU CHEMICAL OXIDATION PILOT TEST WORK PLAN

Owego Heat Treat
Owego, New York
NYSDEC Site Number 754011

Prepared for:

New York State Department of Environmental Conservation
1676 Route 11
Kirkwood, New York 13795

August 2017

Prepared by:

Genevieve F. Bock, P.E.
Senior Project Engineer

Reviewed by:

Scott McDonald
Project Manager

TABLE OF CONTENTS

1.0 INTRODUCTION

Groundwater & Environmental Services, Inc. (GES) has prepared this In-Situ Chemical Oxidation Pilot Test Work Plan (ISCO WP) for the New York State Department of Environmental Conservation (NYSDEC) pursuant to the NYSDEC Call-Out ID #129799. Activities associated with this Work Plan and Call-Out #129799 include completion of an in-situ chemical oxidation (ISCO) pilot test at the Owego Heat Treat Site in Owego, New York (the Site) consisting of injection well installation, injection of sodium permanganate into the subsurface, post-injection monitoring, and reporting. This report outlines the following information:

- Site Investigation Summary and Pilot Test Design;
- Pilot Test Implementation Plan;
- Post-Injection Monitoring Requirements;
- Reporting Requirements; and,
- Implementation Schedule.

2.0 SITE INVESTIGATION SUMMARY & PILOT TEST DESIGN

2.1 Site Investigation Summary

Historical Site use, investigations, and remediation indicate that the primary constituents-of-concern (COCs) at the Site are chlorinated solvents, specifically tetrachloroethene (PCE), trichloroethene (TCE), cis-1, 2-dichloroethene (DCE), and vinyl chloride (VC). The primary source area at the Site is identified as the area surrounding former Building #2, where a PCE tank was historically located for use in degreasing activities.

2013 Site Characterization Investigation:

Aztech Technologies, Inc. (Aztech) completed a membrane interface probe (MIP) study of the suspected source area at the Site in the vicinity of former Building #2. The MIP investigation consisted of the installation of 15 points which all indicated the presence of chlorinated solvents. Maximum responses from the MIP study were detected at depths between 7 feet and 31 feet below ground surface (bgs). Detected impacts were shallower in the eastern portion of the MIP study area and were deeper in the western portion of the MIP study area, indicating that the chlorinated plume is sinking east to west. Maps created from the MIP data indicate that there are two primary zones of chlorinated volatile organic compound (VOC) impacts; located from approximately 10 to 20 feet bgs in the eastern area of the MIP study, and from approximately 18 to 28 feet bgs in the western area of the MIP study. These two target intervals overlap in some portions of the source area.

2014 Supplemental Site Characterization:

Aztech completed supplemental Site characterization activities in 2014 which included installation of soil borings and temporary monitoring wells in the source area, groundwater sampling, infiltration testing, and hydraulic conductivity testing. Soil boring installation indicated that soils in the source area are comprised primarily of silt with 10 to 35% clay. However, a gravel pathway was identified in some soil boring locations which may be contributing to the downgradient groundwater impacts observed on-Site. Groundwater sampling also indicated that the depth of well screen in a monitoring well significantly influences the concentrations of chlorinated VOCs observed. Soil borings indicated exceedances of *Commissioner Policy CP-51/ Soil Cleanup Guidance* (CP-51 SCG) soil standards in 7 of the 8 soil boring locations, but no soil impacts were detected above commercial soil clean-up objectives (SCOs). Although the borings provided information on soil concentrations and lithology at the Site, the lateral extent of soil impacts at the Site to the north and west of the investigated source area are not defined. Hydraulic conductivity and infiltration testing were also conducted during the supplemental Site characterization which indicated that soils in the source area would accept application of chemical reagents of various viscosities. Infiltration testing at 1-inch diameter wells indicated that the subsurface would accept between 3 and 5 gallons per minute (gpm) of liquid at generally low pressures [between 0 and 12 pounds per square inch (psi)]. However, upwelling of up to 7 feet was observed at a distance of 7 feet from the injection well during infiltration testing.

2015 Site Investigation Activities:

In 2015, 32 additional soil borings were installed in the vicinity of the source area primarily to evaluate vadoze zone soil impacts. Continuous multi-channel tubing (CMT) wells were also installed in two (2) transects at the Site, one immediately downgradient of the source area (CMT1) and the second located approximately 300 feet further downgradient across Marshland Road, in the vicinity of monitoring wells MW-5 and MW-7 (CMT2). Soil boring investigations indicated that the majority of the residual

contaminant mass is located within saturated soils in the source area and not in unsaturated soils. Sampling of the CMT1 transect wells in February and June 2016 indicated that the highest PCE concentrations were observed on the western end of the transect, from CMT1-05 through CMT1-08 with the majority of dissolved-phase PCE detections above Class GA Ambient Water Quality Standards (AWQS) located at the depth intervals between 20 and 30 feet bgs.

2.2 ISCO Pilot Test Design

The purpose of the ISCO pilot test at the Site is to implement injection activities on-Site over a small portion of the treatment area as identified in the *Final Remedial Design and Optimization Report* to evaluate the ability to implement injections on-Site and determine the effectiveness of ISCO application at reducing Site contaminant concentrations.

2.2.1 Injection Area

The injection area for the pilot test was chosen based on the available Site characterization data. Specifically, the CMT1 groundwater sampling in 2016 indicates that the highest observable groundwater impacts are present in wells CMT1-05, CMT1-06, and CMT1-07. The location of groundwater impacts in CMT transect 1 coupled with the location of soil impacts from boring investigations and the MIP study on-Site indicate that groundwater is likely flowing in a northwesterly direction from the source area. Additionally, although the MIP study indicated that there are significant soil impacts in the shallower 10 to 20 feet bgs area in the eastern portion of the MIP study area, the more eastern transect wells do not show higher dissolved-phase concentrations of chlorinated VOCs. Therefore, the ISCO pilot test application area is targeted to be located directly upgradient of wells CMT1-05 and CMT1-06 so that it is most likely that chemical application to the subsurface will result in changes in dissolved-phase concentrations at these wells.

The ISCO pilot test well locations were chosen to cover an approximately 40 foot by 40 foot horizontal treatment zone upgradient of CMT1-05 and CMT1-06 consisting of 16 injection wells. This area should be sufficiently large for enough chemical to be applied during the pilot test to result in a change in both soil and groundwater concentrations in the targeted CMT transect 1 wells.

2.2.2 Injection Well Construction

The screen interval of the proposed injection wells for pilot testing was determined based on the vertical extent of dissolved-phase impacts observed in the CMT1 wells as well as the vertical extent of soil impacts observed during the MIP study. The targeted pilot testing area is located in the vicinity of MIP point #12, soil boring SB-4, and temporary wells SB-4S and SB-4D. MIP point #12 is present in an area of overlap between both the shallower and deeper observed impacts. This is also reflected in the vertical distribution of dissolved-phase impacts observed at CMT1-05 and CMT1-06. Therefore, the 16 well grid of injection points proposed for the pilot test execution will consist of 12 injection wells with 15 feet of screen from approximately 13 to 28 feet bgs on the eastern side of the pilot test area and 4 injection wells with 10 feet of screen from approximately 18 to 28 feet bgs along the western edge of the pilot test area. Although there are known soil impacts located upgradient of the pilot test area, the pilot test area represents the area of currently known highest concentrations of chlorinated VOC impacts. Therefore, ISCO application to this area should result in observable changes in soil and/or dissolved-phase concentrations of COCs.

2.2.3 Injection Chemicals

The *Final Remedial Design and Optimization Report* proposed application of sodium persulfate to the subsurface as the chemical oxidizer to reduce COC concentrations at the Site. GES is proposing that sodium permanganate be utilized as the oxidant for the pilot test instead of sodium persulfate. Both sodium persulfate and sodium permanganate are known to break down chlorinated VOCs. However, sodium permanganate has several benefits in application and monitoring for the pilot test. Sodium permanganate does not need to be activated by additional chemicals or a pH adjustment to the subsurface like sodium persulfate does. This minimizes the type of chemicals applied to the subsurface at the Site during pilot testing. Additionally, sodium permanganate is easier to observe during the pilot testing and during long term monitoring. Sodium permanganate is purple in color and the presence of the oxidizer in wells within the targeted treatment zone can be easily observed via a colorimetric observation of the water instead of requiring test kits to determine if persulfate is present. Additionally, the persistence of unreacted permanganate concentrations in the subsurface over time can be easily monitored during post-injection observations by the color of the water. Concentrations of residual permanganate can also be determined by a colorimetric analysis instead of via laboratory or test strip analysis as is required to determine residual persulfate concentrations.

3.0 PILOT TEST IMPLEMENTATION PLAN

A description of the plan to implement the ISCO pilot test at the Site is presented below. Objectives of the pilot test include the following: determine Site-specific permanganate injection flow rates and pressures, evaluate persistence of sodium permanganate in the subsurface following injection activities, and determine COC reduction following sodium permanganate application.

3.1 Well Installation

3.1.1 Injection Well Installation

The 16 injection wells will be constructed of 2-inch Sch 40 polyvinyl chloride (PVC). Screen in the injection wells will consist of Sch 40 PVC 20 slot screen. The eastern-most 12 injection wells will be constructed with a screen interval present from approximately 13 to 28 feet bgs. The four (4) western injection wells will be constructed with screen from approximately 18 to 28 feet bgs.

Prior to mobilizing the drilling crew, GES will conduct a site visit to identify the locations of subsurface utilities and select the final locations of the proposed borings. The Underground Facilities Protection Organization (UFPO) will be contacted and a public utility mark out will be performed prior to this site visit. At this time GES will not be completing hand clearing to identify any utilities before advancement of drilling tools.

Continuous Macro core samples will be collected in four foot intervals at IP-3, IP-5, IP-12, and IP-14 as the borings are advanced to an estimated termination depth of 28 feet bgs. Each sample will be field screened with a photo ionization detector (PID) to qualitatively assess the level of hydrocarbon impacts and logged for color, grain size and relative moisture content. A soil grab sample will be collected from wells IW-5, IW-12, and IW-14 at the depth which indicates the highest PID reading in the soil. These samples will be submitted for laboratory analysis of total VOCs and the results will be utilized to compare to post-injection soil samples collected at boreholes adjacent to these well locations to determine the reduction in soil VOC mass following the pilot test. Soil grab samples will also be collected from well IW-3 at a depth of approximately 17 feet bgs and at a depth of approximately 25 feet bgs. These samples will also be submitted for laboratory analysis of total VOCs. The IW-3 soil samples will be utilized to compare to post-injection soil samples at an adjacent boring to evaluate both the soil concentration reduction from the pilot test and to evaluate if soil concentration reductions were consistent at both the top and bottom of the injection well screen from a well with 15 feet of screen interval. One soil sample will also be submitted for laboratory analysis of soil oxidant demand for use in future chemical oxidant calculations. One soil sample will also be submitted to Carus Corporation's (Carus) laboratory for analysis of the Site-specific permanganate oxidant demand (POD) of the soil which is a measurement utilized in Carus' permanganate oxidant demand calculator.

The lithology at the bottom of each injection well will be checked prior to installing the well using the four foot macro core. The macro core will be advanced ahead of the augers for the final four feet at each of locations to confirm lithology and final well screen placement. Based on available Site characterization information, the depth of the permeable gravel layer should be deeper than the proposed depth of each injection well. However, if the 28 foot depth of each injection well is found to be in the gravel layer, the well will be installed so the screen interval is above the gravel and the gravel layer will be sealed with bentonite at the bottom of the borehole before installing the well. This should prevent migration of injected chemical preferentially through the gravel layer instead of being distributed into the soils across the injection well screen.

Once each borehole has reached its termination depth of 28 feet bgs, the injection well will constructed inside of the augers. A sand pack will be installed around the screen interval to 1 foot above the screen consisting of either 0 or number 1 sand depending on the type of soils observed during the drilling. Following the placement of the sand, 2 feet of hydrated bentonite will be placed on top of the sand pack to provide a seal. Once the bentonite has swelled to fill the annular space grout will be tremied into place to grade. Once the grout has set the well will be finished with a heavy-duty flush mount man way set inside a concrete pad. The top of the well will be finished with a Sch 40 PVC adapter and a threaded cap. This will allow an injection wellhead to be threaded onto each injection well during the pilot test and future chemical application events.

All soil cuttings will be staged in 55-gallon drums. Following completion of drilling activities, the soil drums will be sampled and analytical results obtained to dispose of the soils at an off-Site facility. All augers which come in contact with potentially impacted subsurface soils will be decontaminated before leaving the Site and the rinse water will be drummed for off-Site disposal. A map depicting the proposed injection wells is included as **Figure 1**, and details of the well construction are included below.

Injection Well ID	**Screen Interval** (feet bgs)
IW-1	13-28
IW-2	13-28
IW-3	13-28
IW-4	13-28
IW-5	13-28
IW-6	13-28
IW-7	13-28
IW-8	13-28
IW-9	13-28
IW-10	13-28
IW-11	13-28
IW-12	13-28
IW-13	18-28
IW-14	18-28
IW-15	18-28
IW-16	18-28

3.1.2 Monitoring Well Installation

One additional monitoring well will be installed prior to the ISCO pilot test to utilize for evaluating groundwater concentrations entering the treatment zone from the upgradient direction following the test. Monitoring well MW-12 will be located directly south east of the ISCO pilot test treatment area as shown on **Figure 1**. Monitoring well MW-12 will be constructed as a 2-inch diameter Sch 40 PVC well with a screen interval located between 15 and 20 feet bgs (based on observed depths of impacts at local MIP point #6). This well will also be installed using hollow-stem augers with a sand pack from 20 to 14 feet bgs and logged using a Macro core form grade. The borehole will be finished with bentonite and grout to grade to prevent chemical surfacing through this borehole during injection activities.

3.2 Injection Implementation

3.2.1 Injection Methodology

The ISCO pilot test at the Site will consist of a 5-day injection of sodium permanganate at the 16 injection wells. A generic chemical oxidant demand calculation was completed for the pilot test treatment area assuming a 25% activation rate for the chemical and an average soil oxidant demand for silty soils utilizing Carus' available sodium permanganate dosing calculator. This was compared to the pore volume of the injection area to determine an applicable concentration of sodium permanganate to inject: injecting the required amount of chemical to meet the theoretical oxidant demand while maximizing the pore space volume in the injection area replaced by the injected chemical.

GES proposes to inject approximately a 4,500 gallon tanker of a 5% sodium permanganate solution daily for 5 days during the pilot test. Approximately 102 gallons of the 5% sodium permanganate solution is targeted for injection per foot of injection well screen. Therefore, the 12 injection wells with 15 feet of screen (IW-1 through IW-12) are targeted to have approximately 1,535 gallons of solution injected per well, and the 4 injection wells with 10 feet of screen (IW-13 through IW-16) are targeted to have approximately 1,020 gallons of solution injected per well.

Injection activities will proceed by connecting an injection wellhead at up to six (6) wells per day for simultaneous injection. An injection contractor will provide the injection wellheads, hoses, fittings, and a 6-leg injection manifold, and an appropriate injection pump to apply the sodium permanganate solution to the injection wells. Secondary containment berms will be utilized during injection activities and will be placed under the injection manifold, the injection pump, and the connection to the chemical tanker. A total volume of up to 22,500 gallons of 5% sodium permanganate solution is targeted for injection during the pilot test. This volume is equivalent to approximately 37% of the pore volume in the targeted injection area, assuming a soil porosity of 40%. Based on the infiltration testing conducted on-Site in 2014, GES assumes that injections will be able to proceed at a flow rate of at least 2.5 gpm per well. Injections will not occur at rates higher than 5 gpm per well.

Rinse water available in totes delivered to the site on the first day of injections (1,200 gallons) will be utilized to flush residual chemical from the manifold and hoses into the subsurface daily before wellheads are disconnected. The field crew will have two (2) methods for neutralizing any spilled sodium permanganate or to neutralize any surfacing of sodium permanganate during the injections. Hand-held spray bottles with a solution of water, vinegar, and hydrogen peroxide will be utilized to neutralize small drips. Complete neutralization is visible when the sodium permanganate drips turn clean instead of purple. The second method of neutralization will be a diluted sodium thiosulfate mixture. The chemical vendor shall provide 30 gallons (two 15-gallon containers) of 30% sodium thiosulfate. These containers will be stored on a secondary containment pad consisting of poly sheeting on top of a wooden berm for the duration of the project (to be left on-Site overnight). The injection subcontractor will provide hand-pump spray bottles (approximately 3 to 5 gallon capacity) which will be utilized to store a diluted 10% sodium thiosulfate solution which will be utilized to neutralize any puddles or larger visible sodium permanganate which may surface during the injection activities. The sodium thiosulfate reacts with the permanganate causing a brown precipitate to fall out of solution. Neutralization is complete when the liquid is no longer purple but clear with brown precipitate.

3.2.2 Chemical Delivery Details

Due to the anticipated cost of pre-mixed sodium permanganate solution for this project, GES will attempt to obtain five (5) bids for the chemical vendor. The chemical vendor will be responsible for delivering a

4,500 gallon tanker of pre-mixed 5% sodium permanganate solution to the Site daily during the pilot test. The driver will stay with the tanker while it is on-Site and once the tanker volume is empty the tanker and driver will depart the Site. No sodium permanganate will be left on-Site overnight.

In addition to the sodium permanganate, 1,200 gallons of rinse water/emergency dilution water will be delivered to the Site in the morning on Day 1 of the event (prior to starting any injections). Two (2) 15-gallon containers of 30% sodium thiosulfate (30 gallons total) will also be delivered on the morning of Day 1 of the event to utilize as necessary for neutralization.

A total volume of approximately 22,500 gallons of 5% sodium permanganate will be purchased and delivered during the pilot test. All chemicals will be delivered as a pre-mixed solution of 5% sodium permanganate and no mixing or dilution of permanganate will be completed on-Site. Safety Data Sheets (SDS') for a concentrated 20% sodium permanganate solution and 30% sodium thiosulfate are included in **Appendix A**.

3.2.3 Monitoring During Injections

On a daily basis, the total volume of chemical delivered and injected will be monitored and recorded. The injection manifold will be monitored and readings collected on a minimum of an hourly basis to determine the pressure, flow rate, and injection volume to each of the injection points (up to six simultaneously). The license plate of each chemical tanker and each tanker load information will also be recorded on a daily basis.

During the injection activities, the entire injection area will be walked approximately four times daily during injections as well to look for chemical surfacing near monitoring wells or from any other areas. If any purple chemical is detected at the ground surface, it will be neutralized with sodium thiosulfate and the injection flow rate may be lowered to prevent continued surfacing of chemical.

Monitoring wells in the injection area will also be checked during injection activities. A set of baseline measurements (pre-injection) will be collected prior to the start of injection activities on Day 1 of the injection activities, and then measurements will be collected daily following completion of injections. The following wells and measurements will be monitored/collected:

- Depth to water will be recorded at wells SB-4S, SB-4D, and MW-12.
    - The interface probe utilized to measure depth to water will be neutralized of sodium permanganate with the water/vinegar/hydrogen peroxide solution and the decontamination water placed in a labeled 55-gallon drum (to be combined with auger decontamination water).
- Dedicated disposable bailers for each of the following wells will also be utilized throughout the pilot test to pull up a water sample and note the water color (clear, pink, light purple, or dark purple) from the following wells: SB-4S, SB-4D, and MW-12.
    - Water inside the bailer used for visual color observation will be placed back down the well.
- Baseline and daily readings for oxidation reduction potential (ORP) and conductivity utilizing a down-well YSI multi-parameter meter will also be collected from MW-12 which is the only available 2-inch diameter well near the injection area. If MW-12 indicates that there is any residual permanganate in the water (via the visual color observation), the ORP and conductivity readings will not be collected from the well to prevent damage to the instrument from the permanganate or from other neutralization chemicals required to clean the probe.

3.2.4 Permitting and Notifications

It is assumed that no local permits are required for the work as described in this Work Plan as long as activities are only conducted Monday through Friday. An Underground Injection Control (UIC) Notification of the proposed ISCO activities will be submitted to the United States Environmental Protection Agency (USEPA) at least 30 days prior to the proposed start of injection activities as required. A notification of the proposed injection activities will also be provided to the local fire department at least 15 days prior to the injection activities to notify them of the use and storage of chemical oxidizers in their jurisdiction.

3.3 Decontamination & Waste

The only materials which may become impacted by Site contaminants during the event are the augers during the drilling activities and well monitoring equipment. Therefore, after the augers come in contact with subsurface soils, they will either be decontaminated daily by washing the augers with a liquinox and water solution and drumming the decon water in labeled 55-gallon drums, or the augers will be stored on an impermeable surface and covered daily, then decontaminated prior to removing the equipment from the site on a weekly basis or at the end of the project. Similarly, the interface probe and YSI meter will be decontaminated daily by rinsing the equipment with liquinox and water which will be drummed with the auger rinse water.

Wastes anticipated to be generated during the pilot testing and post-test monitoring activities include: soil cuttings from the well installation activities, equipment decontamination water, groundwater sampling purge water, and disposable personal protective equipment (PPE). All waste will be stored in labeled 55-gallon drums on-site for future disposal.

4.0 POST-INJECTION MONITORING

A description of the plans for post-injection monitoring is presented below.

4.1 Soil Sampling

In order to complete a direct evaluation of soil VOC destruction from the pilot test, GES is proposing completion of a soil boring program following the pilot test to collect additional soil samples. Four (4) soil borings will be installed adjacent to injection wells IW-3, IW-5, IW-12, and IW-14. Soil grab samples will be collected from the same depth intervals at these boring locations as were collected during the installation of the injection wells. The five (5) soil samples will be submitted for laboratory analysis of VOCs.

4.2 Groundwater Monitoring

To evaluate changes in groundwater concentrations following the ISCO pilot test, GES is proposing completion of three (3) quarterly groundwater sampling events. During each event, wells from CMT1-01 through CMT1-08 will be sampled (at intervals which were also sampled during 2016). Additionally, samples will also be collected from SB-4S, SB-4D, and MW-12 during each quarterly event. All wells will be sampled utilizing low-flow sampling techniques. Groundwater samples will be submitted for laboratory analysis of VOCs, and a colorimetric analysis will be completed from water at each sample location to determine the concentration of residual permanganate in the water.

5.0 REPORTING

Following completion of the pilot test and subsequent soil and groundwater sampling activities, a Pilot Test Evaluation Report will be prepared and submitted to the NYSDEC. The report will include well installation logs for IW-1 through IW-16, a summary of injection activities during the pilot test including the volume of chemical applied per well and average chemical injection flow rates and pressures per well, a summary of all groundwater sampling and soil sampling results, and an evaluation of the pilot test effectiveness. Effectiveness of the pilot test will be evaluated on the basis of both reductions in soil and groundwater concentrations at the Site. The report will also describe residual permanganate detected in site groundwater samples over time and provide recommendations for additional injection events including anticipated injection flow rate and pressure and a recommendation if permanganate should continue to be utilized as the injected oxidant or if a change in oxidant to sodium persulfate is warranted.

6.0 IMPLEMENTATION & FEE SCHEDULE

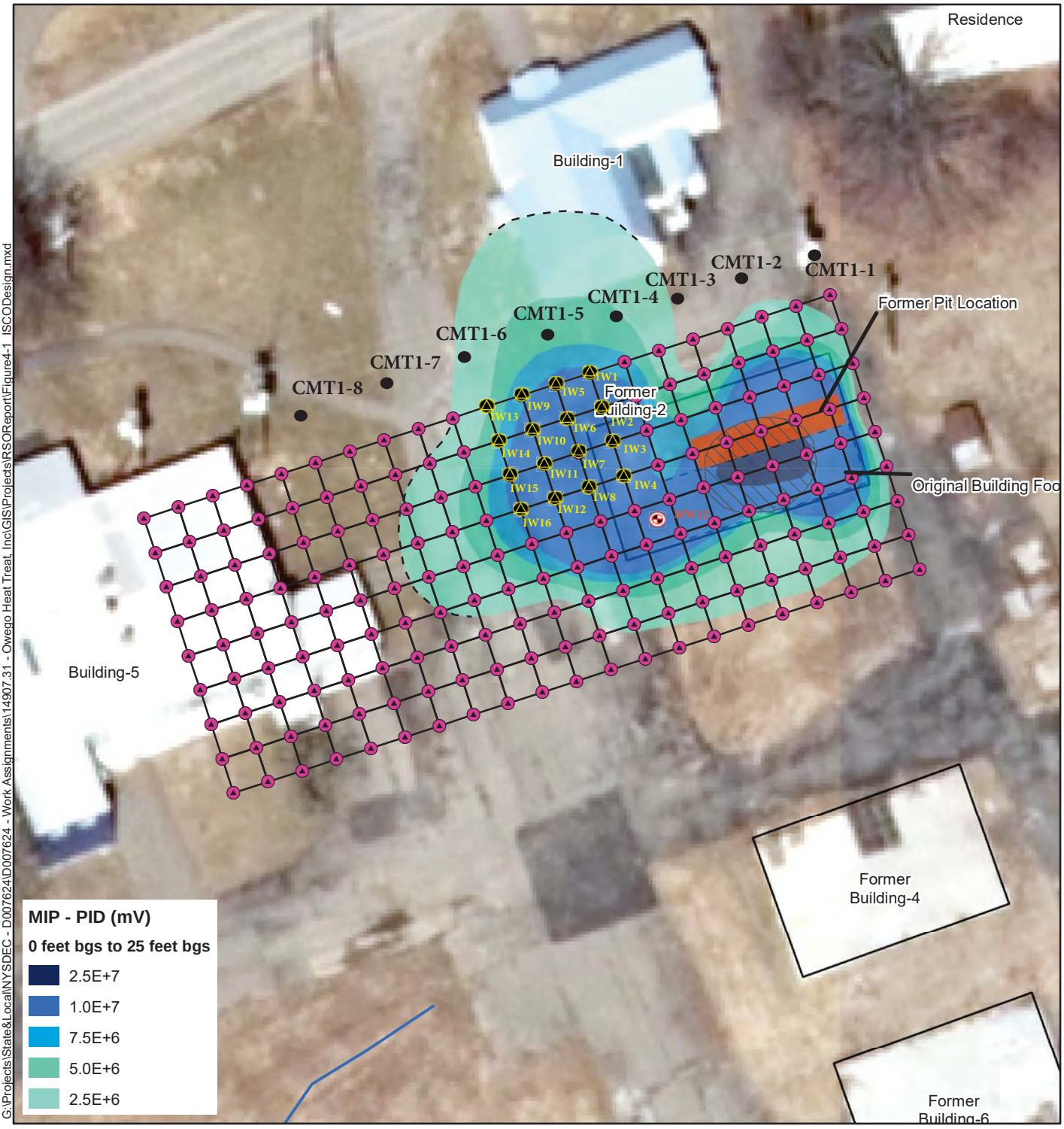
A projected implementation schedule for the ISCO pilot test is detailed below.

Task	Task Detail	Proposed Date
Permitting	Submit EPA UIC Notification and local Fire Department Notification	At least 30 days and 15 prior to the start of injection activities, respectively.
Well Installation	Installation of 16 injection wells and one (1) monitoring well.	By October 15, 2017
ISCO Implementation	Execution of a 5-day injection program on-Site.	By October 31, 2017
Soil Sampling	Post-injection soil sampling to evaluate reduction in soil mass.	Following the spring thaw, approximately April 2018.
Groundwater Monitoring	To be completed approximately quarterly following the pilot test.	January 2018, April 2018, July 2018
Reporting	Submit Report of ISCO Pilot Test Effectiveness	By October 31, 2018

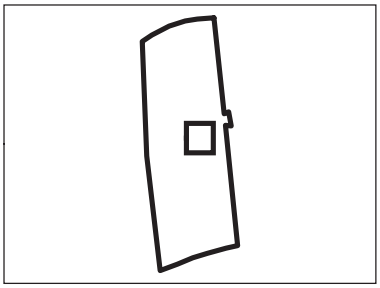
A generalized fee schedule to complete the work as detailed in this ISCO Pilot Test Work Plan is detailed below.

Description	Qty.	Unit Cost	Total Cost
Permitting	1	$2,000	$2,000
Well Installation	1	$42,500	$42,500
Bio/Chemical Injection	1	$115,000	$115,000
Subsurface Investigation (post-injection borings)	1	$7,200	$7,200
Post Remediation Sampling (3 Quarters of post-ISCO monitoring)	3	$7,500	$22,500
Reporting	1	$6,000	$6,000
		Total Cost:	**$195,200**

FIGURES



G:\Projects\State&Local\NYSDEC - D007624\D007624 - Work Assignments\14907.31 - Owego Heat Treat, Inc\GIS\Projects\RSOReport\Figure4-1 ISCODesign.mxd



0 12.5 25 50
Feet

1 inch = 40 feet

N

Legend

- ISCO Pilot Test Well
- ISCO Injection Point
- ISCO Monitoring Well
- 10 by 10-ft Injection Grid
- Suspected Source Area
- Former Pit Location
- Building-2 Original Limit
- Former Building Footprint

Note:
Modified from EA 2015, all locations approximate.
ISCO = In-situ chemical oxidation
bgs = Below ground surface
mV = Microvolts

Figure 1
ISCO Pilot Test Well Map
Owego Heat Treat (Site No. 754011)
Apalachin, New York

APPENDIX A

SAFETY DATA SHEET

1. Identification

Product identifier	**RemOx® L-D ISCO Reagent**
Other means of identification	Not available.
Recommended use	Liquid oxidant recommended for applications that require a concentrated permanganate solution.
Recommended restrictions	Use in accordance with supplier's recommendations.

Manufacturer / Importer / Supplier / Distributor information

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	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	Oxidizing liquids	Category 2
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 1B
	Serious eye damage/eye irritation	Category 1
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	May intensify fire; oxidizer. Harmful if swallowed. Causes severe skin burns and eye damage. May cause respiratory irritation.

Precautionary statement

Prevention	Keep away from heat. Take any precaution to avoid mixing with combustibles. Keep/Store away from clothing//combustible materials. Use only outdoors or in a well-ventilated area. Do not breathe mist or vapor. Wear protective gloves/protective clothing/eye protection/face protection. Do not eat, drink or smoke when using this product. Wash thoroughly after handling.
Response	In case of fire: Use water for extinction. 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): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. If swallowed: Rinse mouth. Do NOT induce vomiting. If inhaled: Remove person to fresh air and keep comfortable for breathing.
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.

Hazard(s) not otherwise classified (HNOC) Not a PBT or vPvB substance or mixture.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Sodium permanganate	10101-50-5	19.5 - 21

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

Inhalation If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Remove victim to fresh air and keep at rest in a position comfortable for breathing. Move to fresh air. For breathing difficulties, oxygen may be necessary. Call a physician or poison control center immediately. Get medical attention immediately. Call a physician if symptoms develop or persist. Get medical attention if symptoms persist.

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.

Before using, read Material Safety Data Sheet (MSDS) for this product. Rinse container at least three times to an absence of pink color before disposing.

Most important symptoms/effects, acute and delayed Contact with this material will cause burns to the skin, eyes and mucous membranes. Corrosive effects. Irritation of eyes and mucous membranes. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. May cause temporary blindness and severe eye damage. Permanent eye damage including blindness could result. Show this safety data sheet to the doctor in attendance.

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 In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. For personal protection, see Section 8 of the SDS. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before reuse.

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 intensify fire; oxidizer. 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 vapors/gases may be formed.

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 intensify fire; oxidizer. 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.

Large Spills: 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. Cover with reducing agent (e.g. sodium bisulphite/thiosulphate or a ferrous salt plus 2M H2SO4). Transfer to container with water and neutralize with soda ash. Otherwise, absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Do not use sawdust or other combustible material. Following product recovery, flush area with water. Prevent product from entering drains.

Small Spills: Cover with reducing agent (e.g. sodium bisulphite/thiosulphate or a ferrous salt plus 2M H2SO4). Transfer to container with water and neutralize with soda ash. Clean surface thoroughly to remove residual contamination.

Never return spills in original containers for re-use. Never return spills in original containers for re-use.

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. 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). Follow applicable local/national/international recommendations on storage of oxidizers. Store in accordance with NFPA 430 requirements for Class II oxidizers.

8. Exposure controls/personal protection

Occupational exposure limits

No exposure limits noted for ingredient(s).

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.

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. Suitable gloves can be recommended by the glove supplier.
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	Dark purple liquid.
Physical state	Liquid.
Form	Aqueous solution.
Color	Dark purple.
Odor	Odorless.
Odor threshold	Not available.
pH	5 - 9
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Does not flash.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
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.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	1.15 - 1.17 (25 °C)
Solubility(ies)	
Solubility (water)	Completely soluble in water.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive. Can explode in contact with sulfuric acid, peroxides and metal powders.
Oxidizing properties	Strong oxidizing agent.

10. Stability and reactivity

Reactivity	Not available.
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

Ingestion	Causes digestive tract burns. Harmful if swallowed. Ingestion causes burns of the upper digestive and respiratory tracts.
Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
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.

Information on toxicological effects

Acute toxicity	Causes severe skin burns and eye damage. Causes burns. Harmful if swallowed. Health injuries are not known or expected under normal use. Harmful if swallowed.
Skin corrosion/irritation	Causes severe skin burns.
Serious eye damage/eye irritation	Causes serious eye damage.
Respiratory or skin sensitization	
Respiratory sensitization	Not classified.
Skin sensitization	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

Ecotoxicity	Very toxic to aquatic life with long lasting effects.
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	Rinse container at least three times to an absence of pink color before disposing.
Hazardous waste code	D001: Ignitable waste 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	UN3214
UN proper shipping name	Permanganates, inorganic, aqueous solution, n.o.s. (Sodium permanganate)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-

Packing group	II
Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	26, 353, IB2, T4, TP1
Packaging exceptions	152
Packaging non bulk	202
Packaging bulk	242

IATA

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

IMDG

UN number	UN3214
UN proper shipping name	PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S. (Sodium permanganate)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
Packing group	II
Environmental hazards	
Marine pollutant	Yes
EmS	F-H, S-Q
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 available.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

Drug Enforcement Administration (DEA) (21 CFR 1310.02 (b) 8: List II chemical.

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

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Sodium permanganate (CAS 10101-50-5) LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Sodium permanganate	10101-50-5	19.5 - 21

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 This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US. Massachusetts RTK - Substance List

Not regulated.

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

Sodium permanganate (CAS 10101-50-5)

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

Not listed.

US. Rhode Island RTK

Sodium permanganate (CAS 10101-50-5)

US. California Proposition 65

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

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 25-January-2014

Revision date -

Version # 01

NFPA Ratings

References

HSDB® - Hazardous Substances Data Bank
Registry of Toxic Effects of Chemical Substances (RTECS)
EPA: AQUIRE database
NLM: Hazardous Substances Data Base
US. IARC Monographs on Occupational Exposures to Chemical Agents
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

This safety data sheet was prepared in accordance with the Safety Data Sheet for Chemical Products (JIS Z 7250:2005). 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.

SAFETY DATA SHEET

1. IDENTIFICATION

Product Name:	**Sodium Thiosulfate 30%**
Synonyms:	Sodium hyposulfite, $Na_2S_2O_3$
CAS Number:	Mixture
Product Use:	Industrial water dechlorination

Manufacturer/Supplier:

Slack Chemical Co., Inc
465 South Clinton St.
Carthage, NY 13619
800.479.0430

www.slackchem.com
sds_request@slackchem.com

Transportation Emergency Number: CHEMTREC: 800.424.9300

2. HAZARDS IDENTIFICATION

GHS Classification

Not classified.

GHS Label Elements

Signal Word: None.

Hazard Statements None.

Precautionary Statements None.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS Number	Weight %
Sodium Thiosulfate Pentahydrate	10102-17-7	30

4. FIRST AID MEASURES

Inhalation: Remove to fresh air. Get medical attention for any breathing difficulty.

Eye: Wash thoroughly with running water. Get medical advice if irritation develops.

Skin: Wash exposed area with soap and water. Get medical advice if irritation develops.

Ingestion: Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media: Material is not flammable. Use extinguishing media appropriate for material in surrounding fire.

Fire Fighting Procedures: Wear NIOSH-approved self-contained breathing apparatus to protect against any release of toxic and/or irritating fumes. Skin and eye protection should also be provided. Use water-spray to keep fire-exposed containers cool, and to knock down vapors and gases.

Unusual Fire and Explosion Hazards: None known.

Combustion Products: Sodium oxides, hydrogen sulfide.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Wear appropriate personal protective equipment.

Environmental Precautions: Spills and releases may have to be reported to Federal and/or local authorities.

Methods and Materials for Containment and Cleaning Up: Promptly sweep up material with minimum dusting and shovel into an empty container with a cover. Clean spill area with plenty of water.

7. HANDLING AND STORAGE

Precautions for Safe Handling: Avoid contact with skin, eyes and clothing. Do not breathe dust or mist. Use with adequate ventilation. Wash thoroughly after handling.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a cool, dry, well-ventilated area away from acids and oxidizing agents. Keep container closed when not in use and protect from physical damage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters:

Component	OSHA PEL-TWA	ACGIH TLV-TWA
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7)		Not established

Engineering Controls: Local exhaust if dust or mist conditions exist or if there is a release of sulfur dioxide gas. Do not use in unventilated spaces or confined spaces.

Personal Protective Equipment (PPE)

Eye/Face Protection: Use safety glasses (with side shields) or chemical safety goggles.

Skin Protection: For handling dry material, wear rubber gloves and full work clothing, including long-sleeved shirt and trousers. When handling solutions, wear impervious gloves and an apron. If contact with the solution is repeated and/or prolonged, wear full impervious clothing.

Respiratory Protection: Where required, use a NIOSH-approved respirator for dust, mist, sulfur dioxide and/or hydrogen sulfide gas, as conditions indicate. If sulfur dioxide and/or hydrogen sulfide gas should be released, use a NIOSH-approved self-contained breathing apparatus or supplied-air respirator. Equipment selection depends on contaminant type and concentration.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Liquid, clear, colorless

Odor	None
Odor threshold	Not available
pH	8.5 – 9.0
Melting/freezing point	~ 0°C
Boiling point	> 100°C
Flash point	Not available
Evaporation rate	Not available
Flammability	Not available
Upper/lower flammability limits	Not available
Vapor pressure	Not available
Vapor density	Not available
Relative density	1.27
Solubility	100% (water)
Partition coefficient: n-octanol/water	Not available
Auto-ignition temperature	Not available
Viscosity	Not available

10. STABILITY AND REACTIVITY

Reactivity: Stable under recommended storage conditions.

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: Hazardous polymerization will not occur.

Conditions to Avoid: Some components of this product can decompose at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems.

Incompatible Materials: Strong acids, strong bases, strong oxidizers.

Hazardous Decomposition Products: Sulfur oxides, hydrogen sulfide.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity Values:

Component	Route	Species	Value
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7)	Oral LD_{50}	Mouse	2,700 mg/kg

Skin Corrosion/Irritation: Not classified.

Serious Eye Damage/Irritation: Not classified.

Respiratory or Skin Sensitization: Not classified.

Germ Cell Mutagenicity: Not classified.

Carcinogenicity: Not classified.

Reproductive Toxicity: Not classified.

Specific Target Organ Toxicity (STOT) – Single Exposure: Not classified.

Specific Target Organ Toxicity (STOT) – Repeated Exposure: Not classified.

Aspiration Hazard: Not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity:

Component	Species	Value	
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7)	Mosquitofish *(Gambusia affinis)*	24,000 mg/L	(LC_{50}-96 hr)
	Water flea *(Daphnia magna)*	520 mg/L	(LC_{50}-48 hr)

Persistence/Degradability: Not available.

Bioaccumulation: Not available.

Soil Mobility: Not available.

Other Adverse Affects: Not available.

13. DISPOSAL CONSIDERATIONS

Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container may need to be disposed of as hazardous waste. Do not allow this material to drain into sewers or water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents and container in accordance with local, regional, national and/or international regulations. Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. TRANSPORT INFORMATION

U.S. Department of Transportation (DOT)
Not regulated.

15. REGULATORY INFORMATION

This product is NOT a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants:
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention 40 CFR 68.130:
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

Clean Water Act (CWA) 40 CFR 401.15:
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 40 CFR 302.4:
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

SARA Section 302 Extremely Hazardous Substance 40 CFR 355:
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

SARA Section 311/312 40 CFR 370:
Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

SARA Section 313 40 CFR 372:

Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

Toxic Substances Control Act (TSCA):

Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – Yes

Canadian Environmental Protection Act, Domestic Substance List (CEPA-DSL):

Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – Yes

California Proposition 65:

Sodium Thiosulfate Pentahydrate (CAS 10102-17-7) – No

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA):

Not applicable

16. OTHER INFORMATION

HMIS RATINGS		NFPA RATINGS	
Health	1	Health	1
Flammability	0	Flammability	0
Reactivity	0	Reactivity	0

Disclaimer

Slack Chemical Company Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material for a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. SLACK CHEMICAL COMPANY INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, SLACK CHEMICAL COMPANY INC. WILL NOT BE REPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.