
In-Situ Chemical Oxidation Remedial Design

for

Enclave on 241st Street Development

**714 East 241st Street
Block 5087, Lot 1
Bronx, New York
NYSDEC BCP Site Number: C203077**

Prepared For:

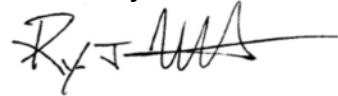
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LANGAN

**25 May 2021
Langan Project No. 140115301**

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1.0 BACKGROUND

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan) has prepared this In-Situ Chemical Oxidation (ISCO) Remedial Design for the Enclave on 241st Street Development Brownfield Cleanup Program (BCP) site located at 714 East 241st Street in the Bronx, New York (the "Site") (see Figure 1).

The BCP site encompasses 26,690 square feet and includes approximately 100 feet of frontage along White Plains Road, 185 feet of frontage along 241st Street, and 171 feet of frontage along Furman Avenue. The New York City Transit Authority (NYCTA) #2 rail corridor and station platform are located above grade along the northwestern property line. Prior to demolition activities (completed in 2018), the site contained four buildings including an approximate 1,086-square-foot one-story office building with basement, an approximate 3,375-square foot one-story former auto body shop building, an approximate 1,500-square foot one-story former auto body shop building, and an approximate 2,400-square foot, two-story residential building with a basement.

The general stratigraphy at the site consists of uncontrolled fill ranging in depth from about 6 to 15 feet below grade surface (bgs), underlain by a layer of sand interbedded with silt, clay and boulders, overlying bedrock. The depth to groundwater is about 9 to 12 feet bgs and flows to the south.

The proposed development will consist of a new 11-story residential building, with a below-grade parking garage, and retail on the first floor. The parking garage and cellar space will extend to approximately 15 feet bgs over almost the entire footprint of the Site. Site development activities are expected to begin within the next year. Volatile organic compounds (VOCs¹) have been detected at the site at concentrations exceeding NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) for Class GA groundwater. VOC concentrations in groundwater are greatest in the northern and western portions of the site (in the vicinity of the former gasoline filling station and automobile repair shop), and decrease to the south and east. Based on analytical results, the source of onsite VOC contamination is likely petroleum releases from the former (now removed) on-site underground storage tank (USTs).

2.0 IN-SITU CHEMICAL OXIDATION REMEDIAL DESIGN

The ISCO remedial design is based on the treatability study results and recommendations documented in Langan's Draft Treatability Study Report submitted to NYSDEC on 27 October 2020. The treatability study report was approved by NYSDEC in a letter on 4 January 2021 and a finalized report is being submitted concurrently with this report.

¹ VOC exceeding NYSDEC TOGS 1.1.1 AWQS for class GA groundwater include benzene, toluene, ethyl benzene, xylenes, 1,2,4- and 1,3,5-trimethylbenzene, p-isopropylbenzene, n-propylbenzene, sec-butylbenzene, p-isopropyltoluene, and methyl tert-butyl ether (MTBE)

2.1 Remedial Approach

The remedial objective for the ISCO remedy is to achieve reduction in groundwater concentrations of VOCs, namely benzene, toluene, ethyl benzene, xylenes, 1,2,4- and 1,3,5-trimethylbenzene, p-isopropylbenzene, n-propylbenzene, sec-butylbenzene, p-isopropyltoluene, and methyl tert-butyl ether (MTBE).

ISCO using alkaline-activated sodium persulfate will be performed to achieve reduction in groundwater concentrations of VOCs. Alkaline pH (>10.5) will be achieved by adding sodium hydroxide (see Appendix A for safety data sheets). The ISCO reagents will be delivered into the subsurface using temporary injection points established using direct push technology (DPT).

ISCO application will be performed in areas that have VOC impacts, and will be focused in zones below the zone that will be excavated during the proposed site redevelopment activities, currently targeted to begin within a year.

2.2 Treatment Zones

Treatment zones for the application of ISCO were determined based on the soil and groundwater concentrations of the petroleum-related VOCs detected at the site. In addition, photoionization detector (PID) readings used to field screen soil for VOCs were also considered to refine vertical treatment intervals. Further it was considered that as a part of the future development, excavation for a below grade parking garage will occur to a depth of 15 feet bgs. The proposed ISCO treatment zones are shown on Figure 2 and are defined as below:

- Treatment Zone 1 is approximately 1,400 square feet and 8 feet thick (from 15 to 23 feet bgs).
- Treatment Zone 2 is approximately 1,100 square feet and 8 feet thick (from 15 to 23 feet bgs)

The vertical extent of the treatment by ISCO will be from 15 to 23 feet bgs, so that contamination below the proposed excavation zone (approximately 15 feet bgs) is addressed. This extended depth of treatment is intended to allow for an effective decrease in groundwater concentration within and below the treatment area.

2.3 Injection Reagents and Dosages

To implement ISCO, a solution of sodium persulfate (oxidant) and sodium hydroxide (alkaline) will be injected into both Treatment Zones 1 and 2. The reagent demand and injection volumes for the ISCO application are summarized in Table 1. The criteria and rationale used for design dosage include the following:

- Based on Langan's treatability study, within the excavation zone, sodium persulfate oxidant demand was derived to be 41.2 and 29 g/kg of wet soil, from soil samples

collected from above 15 ft. in Treatment Zone 1 and Treatment Zone 2, respectively. Below the excavation zone, i.e., greater than 15 ft. bgs, sodium persulfate oxidant demand was lower, estimated to be 9.9 and 12.3 g/kg of wet soil, for soil from Treatment Zone 1 and Treatment Zone 2, respectively. Soil samples were collected from zones of relatively higher PID response, indicating that the soils tested were reasonable worst case levels of contamination for each soil horizon tested.

- While injecting sodium persulfate solutions, a maximum sodium persulfate injection concentration of 300 g/L is typically feasible. Sodium persulfate concentrations above this level can lead to precipitation of sodium persulfate due to common ion effect (levels of sodium ions increase due to application of sodium persulfate and sodium hydroxide). Therefore the amount of sodium persulfate that can be delivered in an injection event is limited by maximum concentration of sodium persulfate that can be injected and the total volume of fluids that can be injected as compared to total pore volume.
- Typically about 10-20% pore volume is injected for ISCO applications. Higher pore volumes can potentially displace the plume. In tight soils (with silt and clay) as those observed in the site boring logs, injections can prove to be challenging, higher injection pressures may be necessary.
- Based on the above considerations, an ISCO injection event is planned between 15 to 23 feet in Treatment Zones 1 and 2. The dosage for the injection event is provided in Table 1. The injection event is designed with the goal of delivering the maximum feasible amount of oxidant into the treatment zones, with a schedule that will allow post-injection monitoring to assess the effectiveness.
- Injection in the shallower zone (above 15 feet) would be challenging, as the derived SOD values would result in dosages oxidant that would require multiple ISCO events. Performing multiple injection events can present a negative risk for this site. The initial event could release excess contaminant, potentially worsening the groundwater contamination via desorption of contaminant from the soil. Therefore, it would appear prudent to forego ISCO in the shallow zone and rely on excavation for this more contaminated zone, which could occur as early as late 2021.
- A total of 9,520 pounds of sodium persulfate and 20,303 pounds of 25% sodium hydroxide will be applied in Treatment Zone 1 between 15 to 20 feet bgs. A total of 5,712 pounds of sodium persulfate and 12,182 pounds of 25% sodium hydroxide will be applied in Treatment Zone 2 between 15 to 20 feet bgs.
- A total of 7,480 pounds of sodium persulfate and 17,060 pounds of 25% sodium hydroxide will be applied in Treatment Zone 1 between 20 to 23 feet bgs. A total of 4,488 pounds of sodium persulfate and 10,236 pounds of 25% sodium hydroxide will be applied in Treatment Zone 2 between 20 to 23 feet bgs.
- With the completion of the injection event to 20 feet bgs, 25%, and over 100% of the oxidant demand will be met in Treatment Zone 1 and 2, respectively. It is expected that

a minimum of approximately 33% to 45% reduction in groundwater VOC mass and up to 30% reduction in soil VOC mass can be achieved in Treatment Zone 1 and 2, respectively. Between 20 and 23 feet bgs, with the completion of the injection event, over 100% and 81% of the oxidant demand will be met in Treatment Zone 1 and 2, respectively. This would significantly reduce the potential for these soils to be a continuing source of groundwater contamination to lower zones. Again, note that soils to 15 ft. bgs will be excavated as part of the development activities.

3.0 ISCO IMPLEMENTATION

The following tasks will be completed as a part of ISCO implementation:

- Health and Safety Requirements
- Monitoring well installation;
- Baseline groundwater monitoring event;
- Permit and Notifications;
- Mobilization;
- Injection event;
- Community Air Monitoring; and
- Post-injection groundwater monitoring events.

3.1 Health and Safety Requirements

A site-specific construction health and safety plan (CHASP) was developed as part of the NYSDEC-approved Remedial Action Work Plan (RAWP), dated March 2016, and will be enforced to protect on-site workers during the implementation of the ISCO remedy. The existing CHASP will be revised to include ISCO reagent and chemical substance handling and storage guidelines, first aid and spill control measures, and exposure limits for all additives to be used in the field. Personal protective equipment to be used while handling of dry ISCO reagents will include full-face respirators, chemical resistant coveralls and booties, rubber or vinyl covered gauntlets, with nitrile gloves, steel toed shoes, and hard hats. PPE to be used during handling of liquid ISCO reagents will include protective glasses, face shield, protective coveralls and booties, rubber or vinyl gauntlets with nitrile gloves, steel toed shoes and hard hat. A job safety analysis will be prepared before all field activities.

Appropriate storage, handling, and spill cleanup guidelines will be followed to minimize the potential for accidental release and exposure to injection reagents. Injection area and surroundings will be continuously monitored for surfacing and leaks during the injection process when the likelihood of surfacing and leaks is highest. In an event of surfacing or leak, the injections will be immediately stopped and the leaked or surfaced materials will be removed and

contained in drums. At the end of each work day, once application of injection pressure is ceased, injection area and surroundings will be monitored for additional half hour to identify any potential surfacing or leaks. During this time the pressure at the injection points is expected to subside to ambient conditions, reducing potential for surfacing. Considering that the underground utilities at the site have been abandoned, inadvertent release of the injection reagents outside the site is unlikely.

As a precautionary measure, every batch of injection solution prepared each day will be injected into the ground, and injection mixtures will not be stored at the site overnight. All injection reagents will be stored onsite inside a fenced area within secondary containment with appropriate labeling and warning signs.

3.2 Monitoring Well Installation

Three monitoring wells, MW-40D, MW-41D and MW-42D will be installed adjacent to existing wells MW40, MW-41 and MW-42 using a direct-push Geoprobe drill rig. The wells will be screened between 15 to 23 feet bgs. The wells will be constructed with 2-inch polyvinyl chloride (PVC) casing and 0.01-inch slotted screen. The wells will be finished to grade and will be developed (purged at least three well volumes) until groundwater is clear. A Langan field engineer will screen the soil cores with a PID and will classify the soil type, grain size and soil texture observed during well construction. Drill cuttings and purge water generated during well installation will be collected in 55-gallons drums. The waste drums will be staged pending characterization and off-site disposal at the site after the well installation activities are completed. It is estimated that two investigation-derived waste (IDW) drums will be generated during the well installation activities

3.3 Baseline Ground Water Monitoring

Groundwater samples will be collected to establish baseline conditions within and downgradient of the treatment zones. Baseline groundwater monitoring samples will be collected from MW-07B, MW-08B, MW-40 & MW-40D, MW-41 & MW-41D, MW-42 & MW-42D, MW-43, and MW-29, (Figure 2). Groundwater samples will be collected using low-flow method and will be analyzed for VOCs, SVOCs, metals (filtered and unfiltered), alkalinity, and sulfate. The analytical monitoring plan is provided in Table 2. Depth to water measurements and groundwater quality parameters (pH, temperature, oxidation reduction potential (ORP), dissolved oxygen (DO), turbidity, and specific conductivity) will also be collected during the baseline groundwater sampling event. Purged groundwater collected during the sampling event will be contained in 55-gallon drums and properly disposed of off-site. Baseline analytical sampling will be completed in two to three days.

3.4 Permits and Notifications

An underground control notification letter along with Inventory of Injection wells form (USEPA form 7520-16) and a copy of approved the in-Situ Chemical Oxidation Remedial Design will be submitted to the United States EPA before field activities for injections are started.

A permit for access to City fire hydrant will be requested from the Department of Environmental Protection. Hydrant water will be used to provide dilution water for injection activities.

3.5 Mobilization

Prior to starting the injection activities, Langan and its subcontractors will mobilize the necessary equipment and reagents to the site. Mobilization will be completed over the course of a single week. Reagents and equipment mobilized to the site for the pilot test will be staged adjacent to the treatment areas (Figure 2). Equipment needed for the injection includes the following: air compressor, generator, injection mixing totes, electric mixer, injection hoses, injection pumps, injection manifold, injection trailer, well head fittings, groundwater sampling/monitoring equipment, work zone and perimeter air monitoring equipment, and 55-gallon steel drums. Reagents, including sodium persulfate bags/super sacks and 25% sodium hydroxide (totes/pails), will be delivered to the site. All mixing and injection equipment will be staged within secondary containment in the treatment areas. Water for dilution of injection reagents will be sourced directly from a nearby fire hydrant or will be sourced from off-site. Equipment left overnight at the site will be secured as appropriate locked inside the field trailer(s).

The proposed injection locations and monitoring wells are located in an open area without access restrictions. The proposed injection locations will be marked with cones and will be surveyed by a ground penetrating radar (GPR) prior to initiating DPT. Injection locations will be finalized based on field observations made during the GPR survey and DPT injections.

3.6 Injections

The injection event will include preparation of injection mix and injection of the reagents at the temporary injection points.

Injection Mix: A solution of reagents in water will be prepared in small batches (about 100 gallons) and will be continuously mixed to avoid settling of solids. Injection reagent concentrations are provided in Table 1. Dilution water for injection activities will be provided from the hydrant located on Furman Avenue.

Injections: Injection mix will be applied within the treatment zones using temporary injection locations established using DPT. Proposed injection locations are shown on Figure 2. Injections at each locations will be performed using bottom up injections, using 1 to 4-foot lifts between 15 to 23 feet bgs. The injection reagent will be pumped from the mixing tank to the well head through an injection manifold. The injection manifold will be equipped with ball valves, gate vales,

and flow totalizers to regulate and monitor the injection flow. Each injection location will be fitted with a well head that will be equipped with a pressure gauge and a threaded adaptor to connect to the injection location and Camlock fittings to connect with similarly fitted hoses. Target injection volumes for each treatment zone are provided in Table 1.

Each temporary injection location will be flushed with 50 to 100 gallons of water (chase water) after reagents are injected, to rinse the injection hoses and push out reagents within the ground away from the injection location. The borings will be abandoned by backfilling with bentonite chips. NYSDEC will be notified at least 7 days prior to performing any in-situ treatment. Each injection event will be completed in three weeks.

3.6 Community Air Monitoring

Pursuant to the NYSDEC-approved RAWP, dated March 2016, air monitoring will be conducted for particulates (i.e., dust) and VOCs during intrusive activities. Dust and/or vapor suppression techniques will be employed to limit potential for off-site migration of soil and vapors. The air monitoring will include continuous perimeter monitoring of dust and organic vapor utilizing DustTrak aerosol monitors and PIDs capable of recording data and calculating 15-minute averages. A field engineer, scientist, or geologist will also monitor Site perimeters for visible dust and odors.

3.7 Injection Monitoring

Field monitoring will consist of water quality and process monitoring and is summarized in Table 3.

Field monitoring: Water quality parameters (pH, temperature, ORP, dissolved oxygen, turbidity, and conductivity) will be measured at each monitoring location (including MW-07B, MW-08B, MW-29, MW-40 & MW-40D, MW-41 & MW-41D, MW-42 & MW-42D, and MW-43) during injection activities. A field monitoring plan is provided in Table 3. Field monitoring will be used to assess the radius of influence of injections. In addition, monitoring will be performed to identify leaks and surfacing of injection fluid at the injection wells heads, and within and around the treatment zone. Any injection fluid that surfaces will be contained in 55-gallon plastic drums and disposed of off-site.

Process Monitoring: During ISCO injections, process parameters (injection pressure, flow rate, and volume) will be monitored. A process monitoring plan is provided in Table 3. The process monitoring will be performed to assess if injection process is being implemented as planned.

Preparation of batches of injection solutions, the injection process parameters, and field monitoring will be recorded in field logs.

3.8 Post-Injection Performance Monitoring

Post-injection monitoring will consist of groundwater sampling and water quality monitoring. Three monthly groundwater monitoring events will be completed for three months after the ISCO injections are completed. During each sampling round of ground monitoring, samples will be collected from MW-7B, MW-08B, MW-40 & MW-40D, MW-41 & MW-41D, MW-42 & MW-42D, MW-43 and MW-29. Groundwater samples will be collected by low-flow method and will be analyzed for VOCs, SVOCs, metals (filtered and unfiltered), alkalinity, and sulfate. The analytical monitoring plan is provided in Table 2. Depth to water measurements, and groundwater quality parameters (pH, temperature, ORP, DO, turbidity, and conductivity) will be collected during each round of groundwater monitoring event. Purged groundwater collected during the sampling event will be contained in 55-gallon drums and properly disposed of off-site. Each groundwater sampling event will be completed in two to three days.

Quarterly groundwater monitoring would be continued after the 3-month post-injection monitoring is completed, and would be continued until the site development activities are initiated. Monitoring locations and parameters for the quarterly monitoring events would be determined on results of the post-injection monitoring.

4.0 REPORTING

Following the injection event, the injection volumes, reagent dosage, injection and field monitoring data will be presented in a letter report for discussion with NYSDEC. Additionally, the results of the post-injection performance monitoring will be presented to NYSDEC in Langan's monthly progress reports. Plan for post development groundwater monitoring will be prepared for NYSDEC review.

5.0 SCHEDULE

Following approval from NYSDEC, implementation of the remediation activities proposed herein is expected to progress under the following schedule:

Task		Duration
1	Installation of new monitoring wells	1 day
2	Baseline groundwater sampling	3 Days (performed at least 1 week after new well installation).
3	Mobilization, ISCO injections, and injection monitoring	3 to 4 weeks
4	Post-injection performance monitoring	Three events, each lasting 3 days, will be performed for three months after injections; then quarterly until the site undergoes remedial excavation.

5	Reporting	Final injection report will be submitted in six months after injections.
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Once post-injection monitoring is completed, groundwater monitoring will be conducted on a quarterly basis till site development is initiated.

CERTIFICATION

I, Stewart Abrams, P.E., certify that I am currently a NYS registered professional engineer and that the In-Situ Chemical Oxidation Remedial Design was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).



NYS Professional Engineer 078833

05/25/2021

Date

Signature

TABLES

Table 1- Reagent Demand and Injection Volume
ISCO Remedial Design
714 East 241 Street
Bronx, New York
Langan Project No. 140115301
May 2021

		Zone between 15 to 20 feet bgs		Zone between 20 to 23 feet bgs	
Treatment Zone		Treatment Zone 1	Treatment Zone 2	Treatment Zone 1	Treatment Zone 2
Area	sq feet	1,400	1,100	1,400	1,100
Depth to water	feet bgs	11	11	11	11
Top of the treatment zone	feet bgs	15	15	20	20
Bottom of the treatment zone	feet bgs	20	20	23	23
Treatment thickness	feet	5	5	3	3
Treatment volume	cu feet	7,000	5,500	4,200	3,300
Soil wet density	lb/cu feet	136	136	136	136
Treatment soil mass	lb	952,000	748,000	571,200	448,800
Reagents and Injection Volume Per Injection Event					
Sodium persulfate dose	g/kg	10	10	10	10
Sodium persulfate demand	lb	9,520	7,480	5,712	4,488
25% Sodium hydroxide dose for soil buffering capacity	lb/lb soil	0.008	0.009	0.008	0.009
25% Sodium hydroxide dose to counter the acid production	lb/lb of oxidant	1.34	1.34	1.34	1.34
25% Sodium hydroxide demand	lb	20,303	17,060	12,182	10,236
25% Sodium hydroxide demand	gallons	1,901	1,597	1,141	958
Soil porosity	fraction	0.3	0.3	0.3	0.3
Plume volume	gallon	15,708	12,342	9,425	7,405
Injection volume (% of pore volume)	%	25%	25%	25%	25%
Injection volume (including reagents)	gallons	3,927	3,086	2,356	1,851
Sodium persulfate solution	gallons	2,026	1,488	1,216	893
Sodium persulfate solution	g/L	565	604	565	604
Sodium persulfate solution theoretical density*	g/ml	1.34	1.36	1.34	1.36
Sodium persulfate solution	pounds	22,613	16,903	13,568	10,142
Weight of Injection Mixture	lb	42,916	33,963	25,750	20,378
Sodium persulfate injection concentration	wt/wt	22%	22%	22%	22%
Sodium persulfate injection concentration	g/L	292	292	292	292
Sodium hydroxide injection concentration	wt/wt	12%	13%	12%	13%
Dilution Water	pounds	13,093	9,423	7,856	5,654
Dilution Water	gallons	1,569	1,129	941	678
Radius of Influence (ROI)	feet	5	3	5	3
Injection Point (5 foot ROI with 15% overlap)	DPTs	20	45	20	45
Injection volume per injection point	gallon	192	69	115	41

Notes:

sq feet - square feet

bgs - below ground surface

lb - pound

cu - cubic

g/kg - gram per kilogram

wt/wt- weight per weight

lb/lb - pound per pound

- Bottom of the treatment depth is based on the impacts observed in the soil borings.

- Approximately 50 to 100 gallons of chase water will be injected at each temporary injection point.

* Sodium persulfate theoretical density is estimated using density (grams per milliliter) and concentration (grams per liter) linear regression equation ($y = 0.0006x + 0.9985$). Data supplied by vendor PeroxyChem LLC, Philadelphia, PA.

Table 2 - Groundwater Analytical Monitoring Plan
ISCO Remedial Design
714 East 241 Street
Bronx, New York
Langan Project No. 140115301
May 2021

Well ID	Analytical Parameters				
	VOCs EPA 8260	SVOCs EPA 8270	TAL Metals ^a EPA 200	Alkalinity SM 2320	Sulfate EPA 300
MW-08	X	X	X	X	X
MW-29			X	X	X
MW-40	X	X	X	X	X
MW-40D	X	X	X	X	X
MW-41	X	X	X	X	X
MW-41D	X	X	X	X	X
MW-42	X	X	X	X	X
MW-42D	X	X	X	X	X
MW-43			X	X	X
MW-7B			X	X	X

Notes:

feet bgs - feet below ground surface

VOCs - Volatile organic compounds

SVOC - Semivolatile organic compounds

^a - Metals will be analyzed using filtered and unfiltered samples and will include analysis of iron, manganese and sodium and other metals in the Target Analyte List.

- Groundwater samples will be collected using low flow techniques.
- Duplicates, field blanks and trip blanks will be collected as part of the sampling events for quality assurance and quality control.
- Water quality parameters include pH, temperature, dissolved oxygen, specific conductivity, oxidation reduction potential, and turbidity will be measured using a Horiba water quality meter, or equivalent.
- Baseline samples and three rounds of post-injection groundwater monitoring samples will be collected from each well listed above.

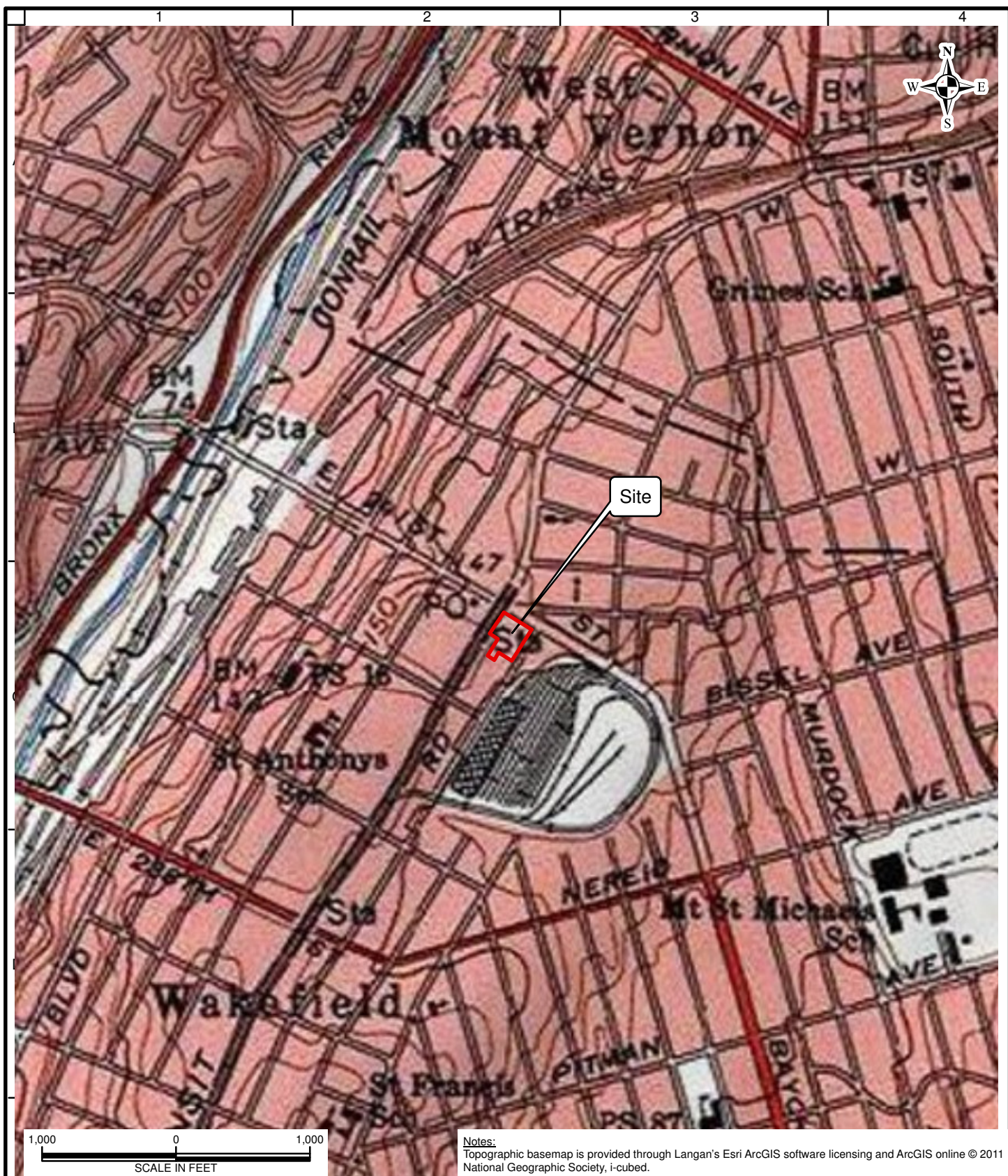
Table 3 - Injection Process and Field Monitoring Plan
ISCO Remedial Design
714 East 241 Street
Bronx, New York
Langan Project No. 140115301
May 2021

Injection Monitoring			
Parameters	Equipment	Monitoring Location	Frequency of Monitoring
Groundwater quality	Horiba-22 or 52	Monitoring wells	Before injection event begins and before daily injections.
Depth to groundwater	Water level meter	Monitoring wells	Before daily injections and periodically during injections
Process Monitoring			
Parameters	Equipment	Monitoring Location	Frequency of Monitoring
Pressure	Pressure gauge	At the injection well head	Every hour
Total flow	Totalizer	Injection skid	
Surfacing/Leaks	-	All wells within each treatment area	
Injection Batch Monitoring			
Parameters	Equipment	Monitoring Location	Frequency of Monitoring
Mixing ratios	Level markings on totes and pails	Injection mix tote	During each batch preparation

Notes:

- Groundwater quality parameters: pH, temperature, dissolved oxygen, specific conductivity, oxidation reduction potential, and turbidity will be measured using a Horiba U-22 water quality meter, or equivalent.
- Note color and sample odor

FIGURES



Notes:
Topographic basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online © 2011 National Geographic Society, i-cubed.

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Project

**ENCLAVE ON
241ST STREET**
BLOCK No. 5087, LOT Nos. 1 & 9

Bronx

New York

Drawing Title

**SITE
LOCATION MAP**

Project No.

140115301

Date

JANUARY 2016

Scale

1"=1,000'

Drawn By

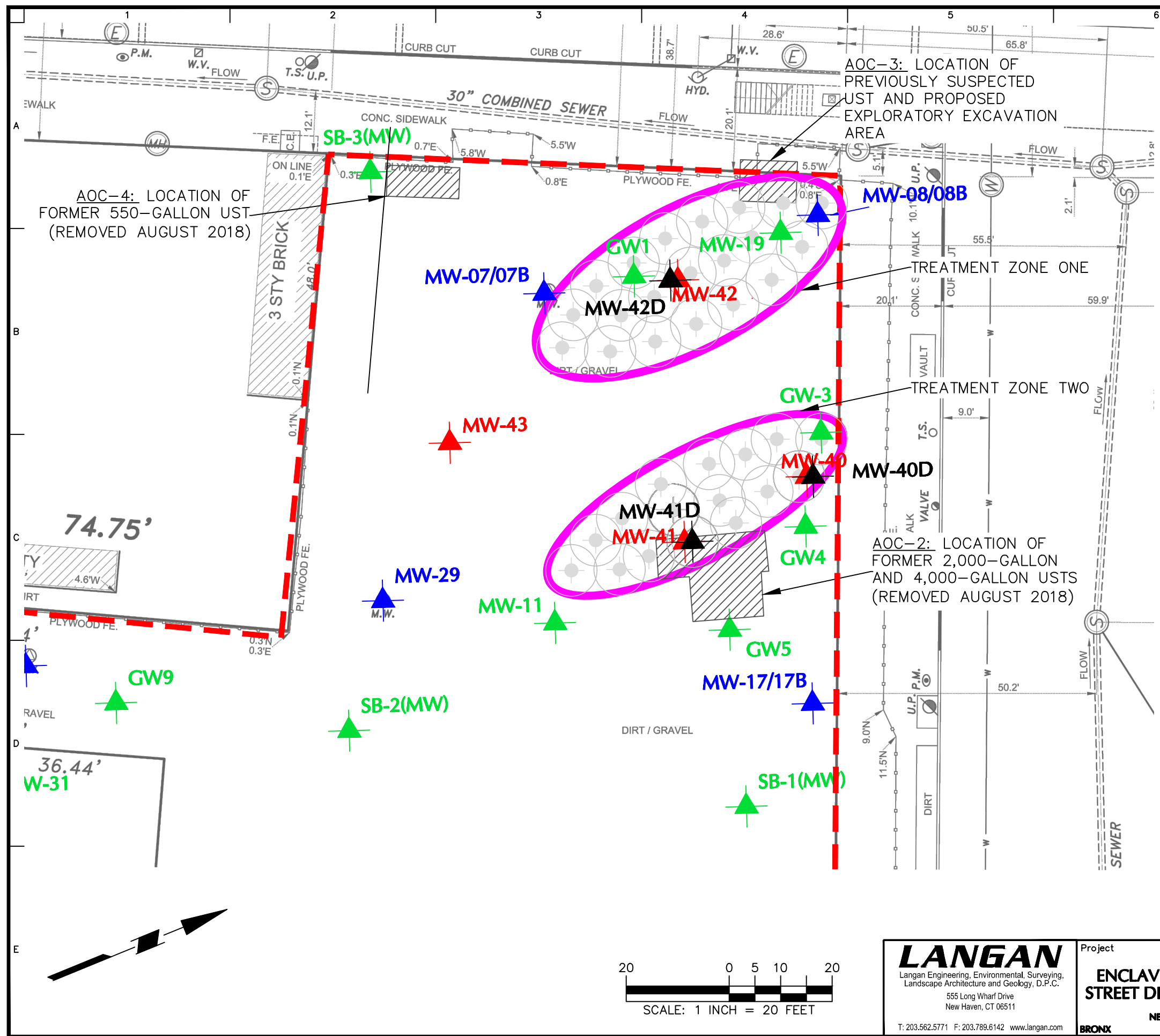
JPH

Submission Date

JANUARY 2016

Figure

1



NOTES

1. BASE MAP PROVIDED BY PERFECT POINT LAND SURVEYING RT (DATED 4 APRIL 2019).
2. THIS PLAN SHOULD BE VIEWED AS A COLOR COPY AS THE BORING LOCATIONS AND BOUNDARIES ARE COLOR COORDINATED.
3. AOC - AREA OF CONCERN
4. THE TOTAL TREATMENT AREA IS APPROXIMATELY 2500 SQUARE FEET: TREATMENT AREA 1 IS ~1400 SQUARE FEET, AND AREA 2 IS ~1100 SQUARE FEET.
5. PROPOSED GROUNDWATER MONITORING WELLS WILL BE SCREENED BETWEEN 15 TO 23 FEET BELOW GROUND SURFACE.

LEGEND

- SITE BOUNDARY
- EXISTING GROUNDWATER MONITORING WELL
- HISTORICAL GROUNDWATER MONITORING WELL (REMOVED)
- GROUNDWATER MONITORING WELLS INSTALLED IN 2020
- PROPOSED GROUNDWATER MONITORING WELLS
- APPROXIMATE EXTENTS OF TARGET TREATMENT AREA
- APPROXIMATE LOCATION OF PROPOSED INJECTION POINT WITH ASSUMED RADIUS OF INFLUENCE (ROI) OF 5 FEET.

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Project

**ENCLAVE ON 241ST
STREET DEVELOPMENT**

NEW YORK

BRONX

NEW YORK

Drawing Title

**PROPOSED ISCO
TREATMENT AREA AND
INJECTION LOCATIONS**

Project No.

140115301

Date

February 2021

Drawn By

JRF

Checked By

RJW

Drawing No.

2

Sheet 3 of 3

APPENDIX

SAFETY DATA SHEET

Klozur® Caustic

SDS # : 1310-73-2--25
Revision date: 2015-05-22
Format: NA
Version 1



1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name Klozur® Caustic

Other means of identification

Synonyms Caustic Soda Solution; Lye Solution; Sodium Hydrate Solution, White Caustic Solution

Recommended use of the chemical and restrictions on use

Recommended Use: Activating agent for Klozur® Persulfate

Restrictions on Use: Use as recommended by the label.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone number

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 1 Sub-category A
Serious eye damage/eye irritation	Category 1
Corrosive to Metals	Category 1

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Danger**Hazard Statements**

H314 - Causes severe skin burns and eye damage
H302 - Harmful if swallowed
H290 - May be corrosive to metals

**Precautionary Statements - Prevention**

P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection
P260 - Do not breathe mist, vapours or spray.
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P234 - Keep only in original container

Precautionary Statements - Response

P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor
P303 + P361 + P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower
P363 - Wash contaminated clothing before reuse
P315 - Get immediate medical advice/ attention
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor
P330 - Rinse mouth
P390 - Absorb spillage to prevent material damage

Precautionary Statements - Storage

P406 - Store in corrosive resistant polyethylene container with a resistant inner liner

Precautionary Statements - Disposal

P501 - Dispose of contents/ container according to local regulation

Hazards not otherwise classified (HNOC)

No hazards not otherwise classified were identified.

Other Information None known.

Unknown acute toxicity

0% of the mixture consists of ingredient(s) of unknown toxicity

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS-No	Weight %
Water	7732-18-5	75
Sodium Hydroxide	1310-73-2	25

Synonyms are provided in Section 1.

4. FIRST AID MEASURES

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. See a medical doctor or ophthalmologist immediately.
Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Wash off with soap and water. Seek immediate medical attention/advice.
Inhalation	Remove person to fresh air. If signs/symptoms continue, get medical attention.
Ingestion	Rinse mouth with water and afterwards drink plenty of water or milk. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.
Most important symptoms and effects, both acute and delayed	Liquid and mist are corrosive (causing burns); direct contact could cause irreversible damage to eyes including blindness and/or irreversible destruction of skin tissue. Vapor/mist will irritate nose, throat and lungs but will usually subside when exposure ceases
Indication of immediate medical attention and special treatment needed, if necessary	Sodium hydroxide at this concentration is corrosive. Prolonged dilution with water is required. Neutralization of eye burns is absolutely contraindicated; for skin, 2% acetic acid has been recommended, but washing with water is effective. Ingestion requires milk or water dilution, consideration of esophagoscopy and management for possible esophageal structure

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Use extinguishing agent suitable for type of surrounding fire. Cool containers / tanks with water spray.
Specific Hazards Arising from the Chemical	The product causes burns of eyes, skin and mucous membranes. Not flammable
<u>Explosion data</u>	
Sensitivity to Mechanical Impact	Not sensitive.
Sensitivity to Static Discharge	Not sensitive.
Protective equipment and precautions for firefighters	Use water spray to cool fire exposed surfaces and protect personnel.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Use personal protective equipment. For personal protection see Section 8.
Other	For further clean-up instructions, call PeroxyChem Emergency Hotline number listed in Section 1 "Product and Company Identification" above.
Environmental Precautions	Prevent material from entering into soil, ditches, sewers, waterways, and/or groundwater. See Section 12, Ecological Information for more detailed information.
Methods for Containment	Absorb spill with inert material (e.g. dry sand or earth), then place in a chemical waste container.
Methods for cleaning up	After cleaning, flush away traces with water. Dispose of waste as indicated in Section 13.

7. HANDLING AND STORAGE

Handling	Avoid contact by using personal protective equipment. Refer to Section 8. Use only in area provided with appropriate exhaust ventilation.
Storage	Keep tightly closed in a dry and cool place. Keep away from incompatible products (acids).

Incompatible products

Acids, flammable liquids, organic halogen compounds, nitro compounds, and amphoteric metals, such as aluminum, magnesium and zinc

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters**Exposure Guidelines**

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Sodium Hydroxide 1310-73-2	Ceiling: 2 mg/m ³	TWA: 2 mg/m ³	IDLH: 10 mg/m ³ Ceiling: 2 mg/m ³	Mexico: Ceiling 2 mg/m ³
Chemical name	British Columbia	Quebec	Ontario TWAEV	Alberta
Sodium Hydroxide 1310-73-2	Ceiling: 2 mg/m ³	Ceiling: 2 mg/m ³	CEV: 2 mg/m ³	Ceiling: 2 mg/m ³

Appropriate engineering controls**Engineering measures**

Adequate engineering controls and/or personal protective equipment must be used to prevent contact with skin and eyes. Engineering controls and/or respirators may be necessary when the generation of airborne mists or fog are possible.

Individual protection measures, such as personal protective equipment**Eye/Face Protection**

For dust, splash, mist or spray exposure, wear chemical protective goggles. Face-shield.

Skin and Body Protection

Rubber or vinyl apron. Rubber or plastic boots.

Hand Protection

Rubber or vinyl gloved with gauntlets. Wash the outside of gloves with soap and water prior to removal. Inspect regularly for leaks.

Respiratory Protection

When exposure above the established standard is likely, a respiratory protection program that complies with OSHA General Industry Standard 1910.134 should be implemented. Wear full face-piece respirators approved by MSHA/NIOSH if mists are expected.

Hygiene measures

Prevent contact with skin eyes and clothing. Clean water should be available for washing in case of eye or skin contamination.

General information

Clean water should be available for washing in case of eye or skin contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Clear, Colorless
Physical State	Liquid
Color	No information available
Odor	odorless
Odor threshold	No information available
pH	14 (7.4 % solution)
Melting point/freezing point	-16 to -20 °C
Boiling Point/Range	112 - 122 °C
Flash point	Not applicable
Evaporation Rate	No information available
Flammability (solid, gas)	Not flammable
Flammability Limit in Air	Not applicable
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	10 - 18 hPa @ 30 °C
Vapor density	No information available
Density	No information available
Specific gravity	1.28 - 1.38 @ 15.5 °C

Water solubility	completely soluble
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	Not combustible
Decomposition temperature	No information available
Viscosity, kinematic	5.2 cP @ 30 °C
Viscosity, dynamic	No information available
Explosive properties	No information available
Oxidizing properties	No information available
Molecular weight	40
Bulk density	Not applicable

10. STABILITY AND REACTIVITY

Reactivity

Chemical Stability	Stable under recommended storage conditions.
Possibility of Hazardous Reactions	None under normal processing.
Hazardous polymerization	Hazardous polymerization does not occur.
Conditions to avoid	Heat; Incompatible products; Exposure to water.
Incompatible materials	Acids, flammable liquids, organic halogen compounds, nitro compounds, and amphoteric metals, such as aluminum, magnesium and zinc.
Hazardous Decomposition Products	Sodium oxides.

11. TOXICOLOGICAL INFORMATION

Product Information

Unknown acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity
LD50 Oral	400 mg/kg (rabbit) (37 % solution)
LD50 Dermal	corrosive
LC50 Inhalation	Corrosive
Serious eye damage/eye irritation	Corrosive. Corneal lesions and irreversible damage if contact with the eyes.
Skin corrosion/irritation	Corrosive to skin. Causes severe burns.

Information on toxicological effects

Symptoms	Liquid and mist are corrosive and can cause burns, direct contact could cause irreversible damage to eyes including blindness and/or irreversible destruction of skin tissue. Vapor/mist will irritate the nose, throat and lungs, but will usually subside when exposure ceases. The severity of the effects depends in the concentration and dose.
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Delayed and immediate effects as well as chronic effects from short and long-term exposure

Chronic toxicity	Sodium hydroxide may produce inflammation of the eyes, skin, and mucous membranes. Esophageal carcinoma at the site of a chronic lye stricture has been reported. [Gosselin , Smith & Hodge 1984].
Carcinogenicity	Not recognized as carcinogenic by Research Agencies (IARC, NTP, OSHA, ACGIH).
Mutagenicity	This product is not recognized as mutagenic by Research Agencies

Reproductive toxicity	This product is not recognized as reprotox by Research Agencies.
STOT - single exposure	Not classified.
STOT - repeated exposure	Not classified.
Target organ effects	Skin, Eyes, Mucous membrane.
Aspiration hazard	Aspiration risk: may cause lung damage if swallowed.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects	Large amounts will affect pH and harm aquatic organisms
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Chemical name	Toxicity to algae	Toxicity to fish	Toxicity to Microorganisms	Toxicity to daphnia and other aquatic invertebrates
Sodium Hydroxide		96 h LC50: = 45.4 mg/L (Oncorhynchus mykiss) static		

Persistence and degradability	There is no degradation of sodium hydroxide in waters, only loss by absorption or through chemical neutralization.
Bioaccumulation	Bioaccumulation is unlikely.
Mobility	Will likely be mobile in the environment due to its water solubility.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods	Dispose of in accordance with local regulations. Check the pH of waste to be disposed. If it is greater than 12.5 it must be handled as a RCRA hazardous waste. Can be disposed as waste water, when in compliance with local regulations.
US EPA Waste Number	D002
Contaminated Packaging	Clean container with water. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. TRANSPORT INFORMATION

DOT

UN/ID no	1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II
Reportable Quantity (RQ)	1000 lbs.

TDG

UN/ID no	1824
Proper Shipping Name	Sodium hydroxide solution
Hazard class	8
Packing Group	II

ICAO/IATA

UN/ID no	1824
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Proper Shipping Name Sodium hydroxide solution
 Hazard class 8
 Packing Group II

IMDG/IMO

UN/ID no 1824
 Proper Shipping Name Sodium hydroxide solution
 Hazard class 8
 Packing Group II

15. REGULATORY INFORMATION

U.S. Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic health hazard	NO
Fire hazard	NO
Sudden release of pressure hazard	NO
Reactive Hazard	NO

Clean Water Act

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42):

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Sodium Hydroxide 1310-73-2	1000 lb			X

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302):

Chemical name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	SARA RQ
Sodium Hydroxide 1310-73-2	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/EL INCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Sodium Hydroxide 1310-73-2 (25)	X	X	X	X	X	X	X	X	X

Mexico - Grade

Serious risk, Grade 3

CANADA**WHMIS Statement**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the

MSDS contains all the information required by the CPR.

WHMIS Hazard ClassD2B - Toxic materials
E - Corrosive material**16. OTHER INFORMATION**

NFPA	Health Hazards 3	Flammability 0	Stability 1	Special Hazards -
HMIS	Health Hazards 3	Flammability 0	Physical hazard 1	Special precautions H

NFPA/HMIS Ratings LegendSevere = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0
Protection = H (Safety goggles, gloves, apron, the use of supplied air or SCBA respirator is required in lieu of a vapor cartridge respirator)**Revision date:**

2015-05-22

Revision note

Initial Release

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End of Safety Data Sheet

SAFETY DATA SHEET

Klozur® SP

SDS # : 7775-27-1-12
Revision date: 2018-07-13
Format: NA
Version 1.04



1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name Klozur® SP

CAS-No 7775-27-1

Synonyms Sodium Persulfate; Sodium Peroxydisulfate; Disodium Peroxydisulfate; Peroxydisulfuric acid, disodium salt; Peroxydisulfuric acid, sodium salt.

Alternate Commercial Name Klozur® Persulfate

Recommended use of the chemical and restrictions on use

Recommended Use: In situ and ex situ chemical oxidation of contaminants and compounds of concern for environmental remediation applications

Restrictions on Use No uses to be advised against were identified.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone numbers

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2B
Respiratory sensitization	Category 1
Skin sensitization	Category 1
Specific target organ toxicity (single exposure)	Category 3
Oxidizing Solids	Category 3

GHS Label elements, including precautionary statements**EMERGENCY OVERVIEW****Danger****Hazard Statements**

H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335 - May cause respiratory irritation
H319 - Causes serious eye irritation
H315 - Causes skin irritation
H317 - May cause an allergic skin reaction
H302 - Harmful if swallowed
H272 - May intensify fire; oxidizer

**Precautionary Statements - Prevention**

P261 - Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray
P285 - In case of inadequate ventilation wear respiratory protection
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves/ protective clothing
P264 - Wash face, hands and any exposed skin thoroughly after handling
P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P220 - Keep/Store away from clothing/combustible materials
P221 - Take any precaution to avoid mixing with combustibles

Precautionary Statements - Response

P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/ attention
P302 + P352 - IF ON SKIN: Wash with plenty of water.
P333 + P313 - If skin irritation or rash occurs: Get medical advice/ attention
P362 - Take off contaminated clothing and wash before reuse
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor
P301 + P312 - IF SWALLOWED: Call a POISON CENTER or doctor if you feel unwell
P330 - Rinse mouth
P370 + P378 - In case of fire: Use water for extinction

Precautionary Statements - Storage

P403 + P233 - Store in a well-ventilated place. Keep container tightly closed

Hazards not otherwise classified (HNOC)

No hazards not otherwise classified were identified.

Other Information

Risk of decomposition by heat or by contact with incompatible materials

Unknown acute toxicity

0% of the mixture consists of ingredient(s) of unknown toxicity

3. COMPOSITION/INFORMATION ON INGREDIENTSFormula Na₂O₈S₂

Chemical name	CAS-No	Weight %
Sodium Persulfate	7775-27-1	> 99
Sodium sulfate	7757-82-6	< 2

4. FIRST AID MEASURES

General Advice	May produce an allergic reaction.
Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids intermittently. Consult a physician. If symptoms persist, call a physician.
Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Get medical attention if irritation develops and persists.
Inhalation	Remove from exposure, lie down. If breathing is irregular or stopped, administer artificial respiration. Call a physician immediately.
Ingestion	Do NOT induce vomiting. Call a physician or poison control center immediately. Rinse mouth. Drink 1 or 2 glasses of water.
Most important symptoms and effects, both acute and delayed	Itching; Redness; Coughing and/ or wheezing.
Indication of immediate medical attention and special treatment needed, if necessary	Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media	Water. Cool containers with flooding quantities of water until well after fire is out.
Unsuitable extinguishing media	Do not use carbon dioxide or other gas filled fire extinguishers; they will have little effect on decomposing persulfate.
Specific Hazards Arising from the Chemical	Decomposes under fire conditions to release oxygen that intensifies the fire.
Flammable properties	Contact with combustible material may cause fire
Explosion data	
Sensitivity to Mechanical Impact	Not sensitive.
Sensitivity to Static Discharge	Not sensitive.
Protective equipment and precautions for firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Keep off any unprotected persons. Avoid contact with the skin and the eyes. Avoid breathing dust. Wear personal protective equipment.
Other	Never add other substances or combustible waste to product residues.

Environmental Precautions	Prevent material from entering into soil, ditches, sewers, waterways, and/or groundwater. See Section 12, Ecological Information for more detailed information.
Methods for Containment	Vacuum, shovel or pump waste into a drum and label contents for disposal. Avoid dust formation. Store in closed container.
Methods for cleaning up	Clean up spill area and treat as special waste. Dispose of waste as indicated in Section 13.

7. HANDLING AND STORAGE

Handling	Wear personal protective equipment. Use only in area provided with appropriate exhaust ventilation. Avoid dust formation. Handle product only in closed system or provide appropriate exhaust ventilation at machinery. Avoid contact with skin and eyes. Avoid breathing dust. Remove and wash contaminated clothing before re-use. Reference to other sections.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat. Do not store near combustible materials. Avoid contamination of opened product. Keep away from food, drink and animal feedingstuffs. Avoid formation and deposition of dust.
Incompatible products	Acids, Alkalies, Halides, Combustible materials, Organic material, Reducing agents. Acids, alkalis, halides (fluorides, chlorides, bromides), combustible materials, reducing agents and organic compounds.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Sodium Persulfate 7775-27-1	TWA: 0.1 mg/m ³	-	-	-
Chemical name	British Columbia	Quebec	Ontario TWAEV	Alberta
Sodium Persulfate 7775-27-1	TWA: 0.1 mg/m ³	-	TWA: 0.1 mg/m ³	TWA: 0.1 mg/m ³

Appropriate engineering controls

Engineering measures	Provide local exhaust or general ventilation adequate to maintain exposures below permissible exposure limits.
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Individual protection measures, such as personal protective equipment

Eye/Face Protection	Eye protection recommended. Chemical goggles consistent with EN 166 or equivalent.
Skin and Body Protection	Wear long-sleeved shirt, long pants, socks, and shoes.
Hand Protection	Protective gloves: Neoprene gloves, Polyvinylchloride, Natural Rubber.
Respiratory Protection	If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn: particulate filtering facepiece respirators.
Hygiene measures	Keep away from food, drink and animal feeding stuffs. Do not eat, drink or smoke when using this product. Wash hands before breaks and after shifts. Keep work clothes separate, remove contaminated clothing - launder after open handling of product.
General information	Protective engineering solutions should be implemented and in use before personal protective equipment is considered.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Crystalline solid
Physical State	Solid
Color	White
Odor	odorless
Odor threshold	Not applicable
pH	6.0 (1% solution)
Melting point/freezing point	180 °C (Decomposes)
Boiling Point/Range	Decomposes upon heating
Flash point	Not flammable
Evaporation Rate	No information available
Flammability (solid, gas)	Not flammable
Flammability Limit in Air	Not applicable
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	6.07E-30 mm Hg at 25°C
Vapor density	No information available
Density	2.59 g/cm ³ (crystal density)
Specific gravity	No information available
Water solubility	42 % @ 25 °C
Solubility in other solvents	No information available
Partition coefficient	No information available (inorganic)
Autoignition temperature	No evidence of combustion up to 600°C No evidence of combustion up to 600 °C
Decomposition temperature	> 100 °C (assume)
Viscosity, kinematic	No information available (Solid)
Viscosity, dynamic	No information available
Explosive properties	Not explosive
Oxidizing properties	oxidizer
Molecular weight	238.1
VOC content (%)	Not applicable
Bulk density	1.12 g/cm ³ (loose)

10. STABILITY AND REACTIVITY

Reactivity	None under normal use condtions. Oxidizer. Contact with other material may cause fire.
Chemical Stability	Stable.
Possibility of Hazardous Reactions	None under normal processing.
Hazardous polymerization	Hazardous polymerization does not occur.
Conditions to avoid	Heat. Moisture.
Incompatible materials	Acids, alkalis, halides (fluorides, chlorides, bromides), combustible materials, reducing agents and organic compounds. . Acids, Alkalis, Halides, Combustible materials, Organic material, Reducing agents.

Hazardous Decomposition Products Oxygen which supports combustion.

11. TOXICOLOGICAL INFORMATION

Product Information

Unknown acute toxicity	0% of the mixture consists of ingredient(s) of unknown toxicity
LD50 Oral	Sodium Persulfate: 895 mg/kg (rat)
LD50 Dermal	Sodium Persulfate: > 10 g/kg
LC50 Inhalation	Sodium Persulfate: >5.10 mg/L (4h) (rat)

Serious eye damage/eye irritation Irritating to eyes.
Skin corrosion/irritation Minimally irritating.

Sensitization Sodium Persulfate: May cause sensitization by inhalation and skin contact.

Component Information

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation	NOAEL Oral Value
Sodium Persulfate (7775-27-1)	895 mg/kg (Rat)	> 10000 mg/kg (Rabbit)	> 21.6 mg/L (Rat) 4 h	
Sodium sulfate (7757-82-6)	> 10000 mg/kg (Rat)			

Information on toxicological effects

Symptoms Symptoms of allergic reaction may include rash, itching, swelling and trouble breathing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin.
corrosivity None.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity Did not show mutagenic effects in animal experiments

Neurological effects Not neurotoxic

Reproductive toxicity This product is not recognized as reprotox by Research Agencies.
Developmental toxicity None known.
Teratogenicity Not teratogenic in animal studies.

STOT - single exposure May cause respiratory irritation.
STOT - repeated exposure Not classified.

Target organ effects Eyes, Lungs.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects

Sodium Persulfate (7775-27-1)				
Active Ingredient(s)	Duration	Species	Value	Units
Sodium Persulfate	96 h LC50	Rainbow trout	163	mg/L
Sodium Persulfate	48 h LC50	Daphnia magna	133	mg/L
Sodium Persulfate	96 h LC50	Grass shrimp	519	mg/L
Sodium Persulfate	72 h EC50	Algae Selenastrum capricornutum	116	mg/L

Persistence and degradability Biodegradability does not pertain to inorganic substances.

Bioaccumulation Does not bioaccumulate.

Mobility Dissociates into ions.

Other Adverse Effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261). It must undergo special treatment, e.g. at suitable disposal site, to comply with local regulations.

Contaminated Packaging Empty remaining contents. Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

TDG

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

MEX

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

ICAO

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

ICAO/IATA

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1

Packing Group III

IMDG/IMO

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

ADR/RID

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

ADN

Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

15. REGULATORY INFORMATION

U.S. Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

This product is not subject to reporting under the Emergency Planning and Community Right-to-Know rule.

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA/EPCRA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations**U.S. State Right-to-Know Regulations**

This product contains the following substances regulated under state Right-to-Know laws:

Chemical name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sodium Persulfate		X			
Sodium sulfate	X		X		

California Proposition 65

This product does not contain any Proposition 65 chemicals

CANADA**Environmental Emergencies**

This product contains no substances listed under Canada's Environmental Emergency regulations.

Canadian National Pollutant Release Inventory

This product contains no substances reportable under Canada's National Pollutant Release Inventory regulations.

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/EL INCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Sodium Persulfate 7775-27-1 (> 99)	X	X	X	X	X	X	X	X	X
Sodium sulfate 7757-82-6 (< 2)	X	X	X	X	X	X	X	X	X

Mexico

Mexico - Grade

Slight risk, Grade 1

16. OTHER INFORMATION

NFPA	Health Hazards 1	Flammability 0	Stability 1	Special Hazards OX
HMIS	Health Hazards 1	Flammability 0	Physical hazard 1	Special precautions J

NFPA/HMIS Ratings Legend

Special Hazards: OX = Oxidizer
Protection=J (Safety goggles, gloves, apron, combination dust and vapor respirator)

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End of Safety Data Sheet