

TECHNICAL MEMORANDUM

TO: Mike Warfel, Washington State Department of Ecology
FROM: Jenny Green, PE, and Clint Jacob, PE, LG
DATE: September 5, 2024
RE: Addendum No. 2
Work Plan, Enhanced Biotic and Abiotic Trichloroethene Degradation
Beckwith & Kuffel, Inc. Site
1313 South 96th Street
Seattle, Washington
Landau Project No. 1645001.040

INTRODUCTION

At the request of Beckwith & Kuffel, Inc. (B&K), Landau Associates, Inc. (Landau) prepared this technical memorandum, which provides a second work plan addendum for additional remediation activities to be conducted at the B&K property located at 1313 South 96th Street in Seattle, Washington (Site; Figure 1). Groundwater monitoring will continue on a semiannual basis to evaluate the treatment performance. All activities will be conducted as part of the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP). The Site VCP project number is NW3119. Additional remedial action will focus *in situ* treatment in the vicinity of monitoring wells with trichloroethene (TCE) concentrations in groundwater that still exceed the Model Toxics Control Act (MTCA) Method C cleanup level of 5 micrograms per liter ($\mu\text{g/L}$). Both biotic (biological) and abiotic (chemical) degradation of TCE and its degradation products will be stimulated through direct-push injection of a slurry of combined treatment reagents consisting of:

- EHC[®] Reagent (a proprietary product from Evonik Active Oxygens, LLC)
- LactOil[™] (vegetable oil and ethyl lactate product, JRW Bioremediation, LLC)
- Ferrous Sulfate heptahydrate (Cascade Columbia Distribution).

The detailed discussion of treatment approach, groundwater monitoring, and a health and safety plan (HASp), which were provided in the Enhanced Biotic and Abiotic Trichloroethene Degradation Work Plan (Work Plan; Landau 2020), are incorporated by reference.

PREVIOUS REMEDIAL ACTIVITIES

Previous remedial activities have been conducted at the Site to address TCE contamination in groundwater, as described below and shown on Figure 2.

- **November 2013:** Remedial excavation to remove contaminated soil near the suspected source.

- **January 2018:** Bioremediation injection of electron donor substrate LactOil to monitoring well MW-7, located within the backfilled excavation.
- **October 2020:** Direct-push injection of substrate slurry to 36 locations on the Wooldridge Boats (WB) property and adjacent Sea Mar property. The slurry consisted of EHC, LactOil, and water.
- **September and October 2022:** Larger-scale treatment involving direct-push injection of substrate slurry to locations on the Sea Mar property (9 locations), B&K property (34 locations), and WB property (25 locations). The slurry consisted of EHC, Newman Zone HRO™ (fine droplet vegetable oil product, RNAS Remediation Products), ferrous sulfate solution, and water.

IMPLEMENTATION OF ADDITIONAL FOCUSED TREATMENT

Additional focused treatment will involve injection in the northern portion of the WB property and adjacent Sea Mar locations. This focused treatment will target the vicinity of monitoring wells where TCE concentrations in groundwater still exceed the MTCA Method C cleanup level of 5 µg/L as of the April 2024 groundwater monitoring event (MW-6, MW-11, SM-MW-8, and SM-MW-18). Eighteen injection points will be located on the WB property and five injection points will be located on the Sea Mar property (Figure 3). As with prior injection events, injection points will generally be spaced approximately 8 feet apart in offset rows resulting in a reduced effective spacing along the northerly groundwater flow path. Because these areas were injected previously in 2020 and 2022, the new injection locations will be placed between previous injection points, as evidenced by patches in the asphalt, allowing for adequate distance from underground utilities.

To overcome the difficulty of injecting liquid amendments at this Site, *in situ* treatment will continue to be stimulated through direct-push injection of a slurried substrate that will stimulate both biotic and abiotic degradation of TCE and its breakdown products. The degradation and injection processes are explained in detail in the Work Plan (Landau 2020) and Work Plan Addendum No. 1 (Landau 2022). Similar to the two prior direct-push injections, the injected substrate will consist primarily of EHC, supplemented by LactOil and ferrous sulfate, described as follows:

- EHC contains micro-scale zero-valent iron (ZVI), controlled-release food-grade organic carbon, nutrients, and a food-grade binding agent. The organic carbon and ZVI stimulate concurrent and complementary biotic and abiotic degradation of TCE and its breakdown products to non-toxic end products.
- LactOil provides additional electron donor for biotic degradation in the form of soluble ethyl lactate and insoluble vegetable oil emulsion. The combined use of soluble and insoluble donors is intended to enhance the downgradient extent of treatment due to movement of ethyl lactate with groundwater flow and to enhance treatment longevity within the injection grid due to the less mobile and longer-lasting emulsified vegetable oil.
- Ferrous sulfate will further stimulate abiotic degradation. The amount of ferrous sulfate heptahydrate (25 percent by weight $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 5 percent by weight iron) solution will be approximately 1.5 times the mass of the prior injection to further enhance the downgradient extent of abiotic degradation. While the particulate ZVI contained in the EHC will not move beyond the injection emplacement, the soluble ferrous sulfate will move further downgradient

with groundwater flow until sulfate becomes reduced, resulting in precipitation of reactive iron sulfide minerals within the aquifer matrix. ZVI and precipitated iron sulfides result in the abiotic degradation of TCE and cis-1,2-dichloroethene by the same reductive elimination pathway. The estimated quantity of ferrous sulfate solution for this injection (below) approximately replaces the tap water previously used for mixing the injection slurry; small amounts of potable water will be added, as needed, to create a slurry of the desired consistency for injection.

The injection slurry for the 23 injection points will be prepared using a total of 6,250 pounds (lbs) of EHC powder, 500 gallons of LactOil, and 1,750 gallons of ferrous sulfate solution, resulting in approximately 2,700 gallons of slurry with a solids concentration of 25 percent by weight. A summary of the injection design is provided in the table below.

Design Parameter	Units	WB Property	Sea Mar Property
Injection points	pts	18	5
Treatment interval	ft bgs	8-25	8-25
Total slurry per area	gal	2,400	300
Slurry volume per point	gal/pt	135	66
Slurry volume per foot	gal/ft	8	4
EHC mass per point	lbs/pt	306	150
LactOil volume per point	gal/pt	22	22
Ferrous sulfate volume per point	gal/pt	88	32

Notes: bgs = below ground surface lbs = pound/pounds
 ft = feet/foot pts = points
 gal = gallons

The application rates shown above are lower than used in previous injections, due to challenges with slurry surfacing during the previous injection event in September/October 2022. The WB property injection area (Figure 3) was able to accept the entire target slurry volume in 2022, but as this is the third injection in the same area, the injection volume is reduced by approximately 20 percent. The Sea Mar injection area (Figure 3) was able to accept only 40 percent of the target slurry volume in 2022, so the design volume for the third injection is a reduction of approximately 60 percent from the prior design.

Drilling and injection procedures are detailed in the Work Plan (Landau 2020) and Work Plan Addendum No. 1 (Landau 2022). All work will be conducted in accordance with the HASP included in the Work Plan. The EHC, LactOil, and ferrous sulfate safety data sheets (Attachment 1) have been reviewed and appropriate procedures for safety, handling, storage, and disposal will be followed.

The injection is scheduled to begin **September 23, 2024** and is anticipated to be completed in 2 weeks. Prior to drilling, both public and private utility locates will be completed to identify all underground utilities present at the Site, where possible. Locating non-conductible utilities is not part of this scope. Therefore, Landau is not responsible for repair costs associated with damage caused to non-conductible utilities for which the owner does not provide accurate location information.

MONITORING AND REPORTING

Groundwater monitoring will continue on a semiannual basis at the Site to evaluate treatment progress following the 2024 injection. Analytical methods, procedures, and sampling locations will continue as specified in the Work Plan (Landau 2020). Semiannual groundwater monitoring is anticipated to occur in April and October.

Annual reporting to Ecology will consist of both informal email summaries providing evaluation of performance data and more formal progress reports documenting injection activities and monitoring results. A progress report is anticipated in the first half of 2025 to document this third injection and monitoring results. The next report will include monitoring data since the previous report in October 2023 (Landau 2023) and a summary of the April 2025 monitoring event.

USE OF THIS TECHNICAL MEMORANDUM

This technical memorandum has been prepared for the exclusive use of Beckwith & Kuffel, Inc. and applicable regulatory agencies for specific application to this project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau, shall be at the user's sole risk. Landau warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. Landau makes no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.



Jenny Green, PE
Senior Project Engineer



Clint Jacob, PE, LG
Principal Engineer

JKG/CLJ/ccy

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References

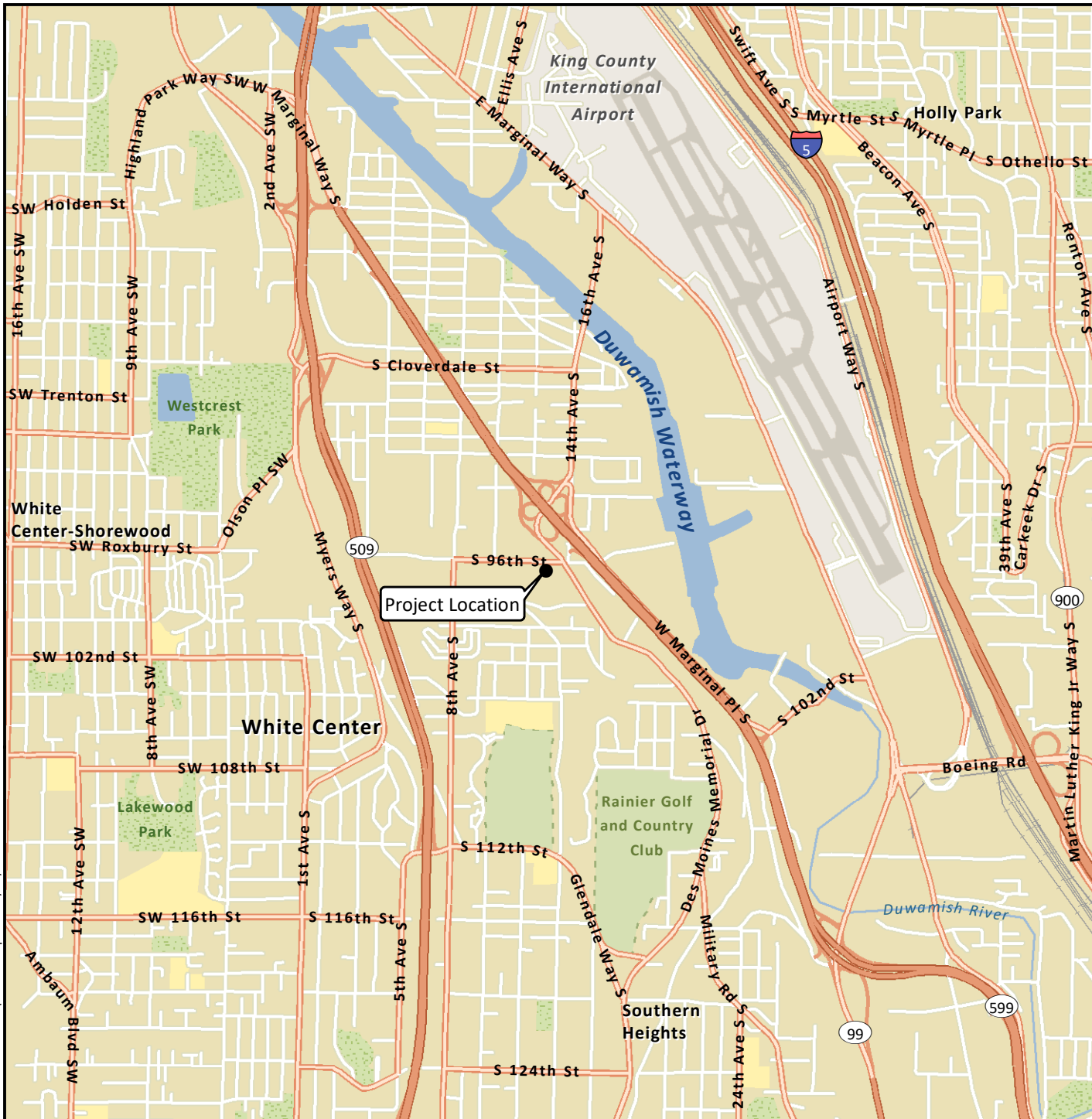
- Landau. 2020. Work Plan: Enhanced Biotic and Abiotic Trichloroethene Degradation, Beckwith & Kuffel, Inc. Site, 1313 South 96th Street, Seattle, Washington. Landau Associates, Inc. January 29.
- Landau. 2022. Technical Memorandum: Addendum No. 1, Work Plan, Enhanced Biotic and Abiotic Trichloroethene Degradation, Beckwith & Kuffel, Inc. Site, 1313 South 96th Street, Seattle, Washington. Landau Associates, Inc. July 22.
- Landau. 2023. Technical Memorandum: Progress Report – Data through July 2023, Beckwith & Kuffel, Inc. Property, 1313 South 96th Street, Seattle, Washington, VCP Project No. NW3119. Landau Associates, Inc. October 20.

Attachments

- Figure 1: Vicinity Map
Figure 2: Site Plan
Figure 3: Proposed EHC Treatment Areas

Attachment 1: Safety Data Sheets

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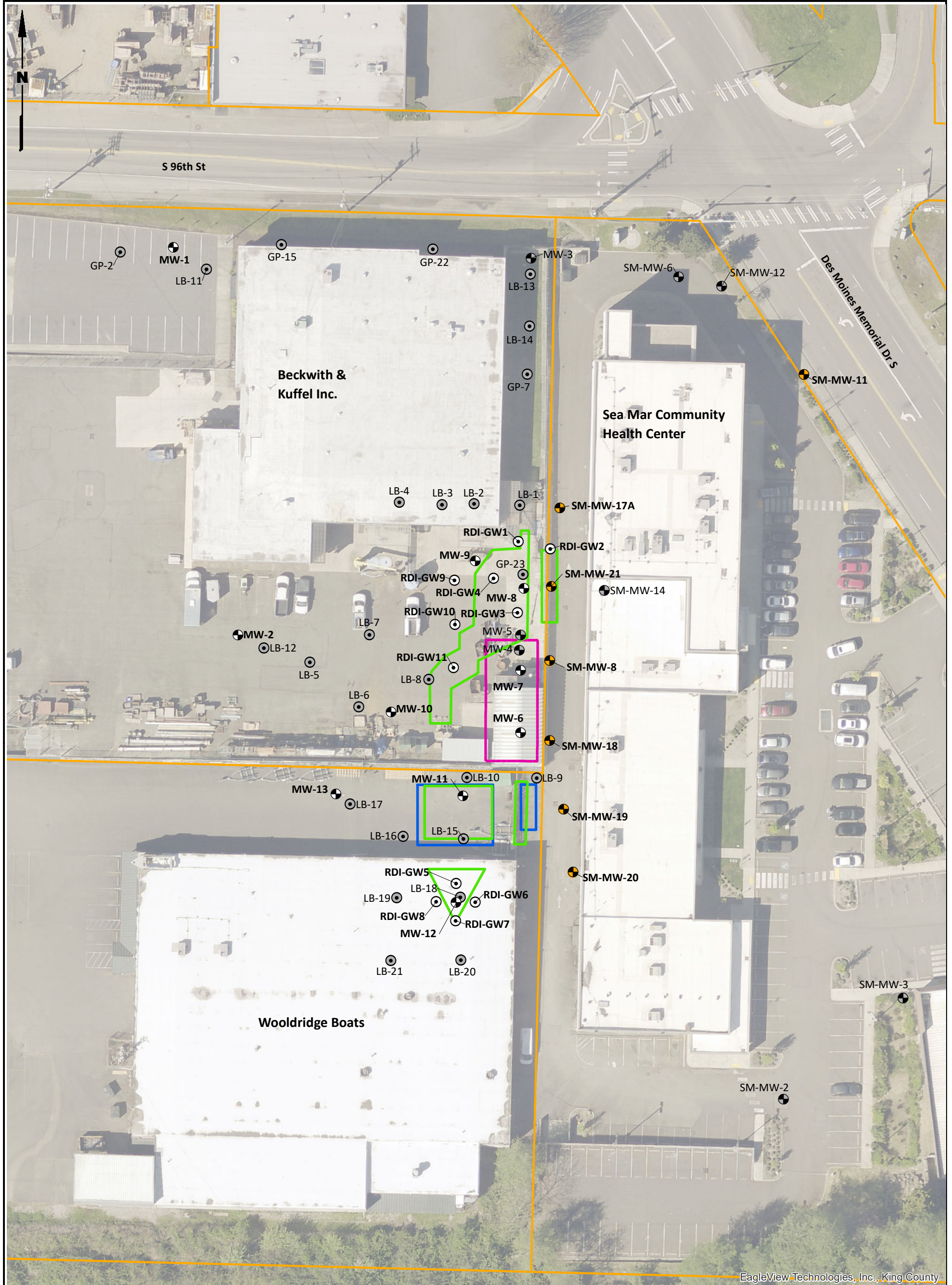
Data Source: Esri.

Beckwith & Kuffel, Inc.
Seattle, Washington

Vicinity Map

Figure
1





EagleView Technologies, Inc., King County

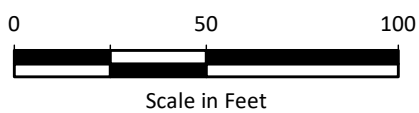
Legend

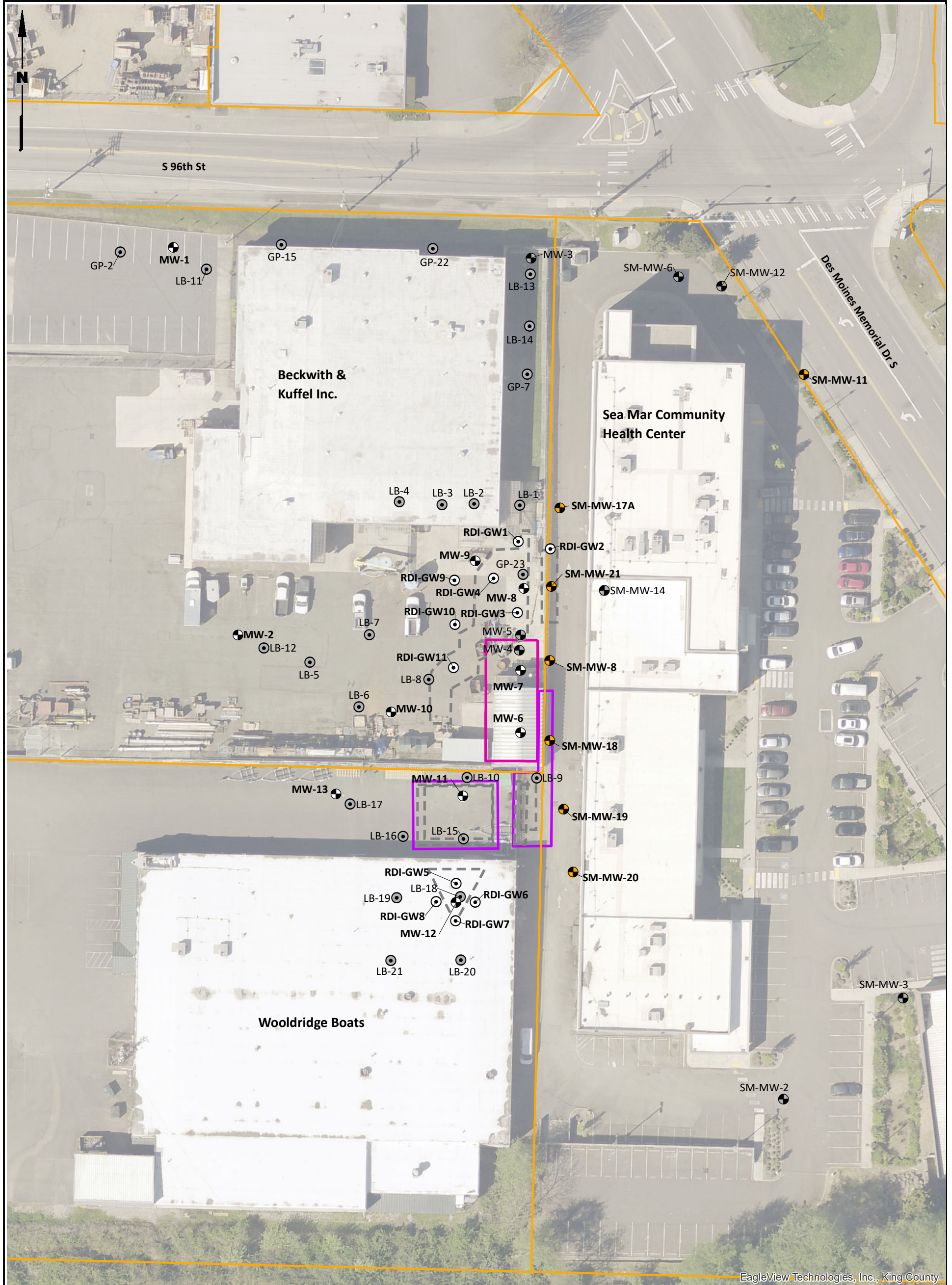
- MW-12 Monitoring Well (Landau)
- SM-MW-11 Monitoring Well (Sea Mar)
- MW-4 Former Monitoring Well
- LB-1 Former Direct-Push Boring
- Approximate 2022 EHC Injection Area
- Approximate 2020 EHC Injection Area
- Approximate Extent of 2013 Remedial Excavation
- Parcels

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Sea Mar; Google Earth Imagery.





EagleView Technologies, Inc., King County

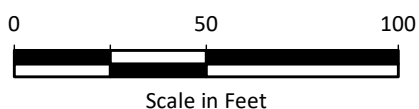
Legend

- MW-12 Monitoring Well (Landau)
- SM-MW-11 Monitoring Well (Sea Mar)
- MW-4 Former Monitoring Well
- LB-1 Former Direct-Push Boring
- Proposed EHC Injection Area
- Previous EHC Injection Area
- Approximate Extent of 2013 Remedial Excavation
- Parcels

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Sea Mar; Google Earth Imagery.



ATTACHMENT 1

Safety Data Sheets

SAFETY DATA SHEET
EHC® Reagent

SDS # : EHC-C
Revision date: 2020-10-14
Format: NA
Version 2.02



1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name EHC® Reagent
Alternate Commercial Name EHC® Fine, EHC®-F, EHC® Granular, EHC® 50%

Recommended use of the chemical and restrictions on use

Recommended Use: For the remediation of contaminated groundwater
Restrictions on Use No uses to be advised against were identified.

Manufacturer Address
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)
Korea: +82 2 567 0810

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

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

Combustible dust

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Warning

Hazard Statements

May form combustible dust concentrations in air

Precautionary Statements - Prevention

Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtures that are ignitable or explosive. Minimize airborne dust generation and eliminate sources of ignition.

Hazards not otherwise classified (HNOC)

No hazards not otherwise classified were identified.

Other Information

CONTAINMENT HAZARD: Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS-No	Weight %
Iron	7439-89-6	25 - 50
Organic amendment	Proprietary	50 - 75
Soybean oil	8001-22-7	2
Viscosity modifier	Proprietary	0 - 4

4. FIRST AID MEASURES

Eye Contact

In case of contact, immediately flush eyes with plenty of water. If irritation persists, call a physician.

Skin Contact

Wash skin with soap and water.

Inhalation

Remove person to fresh air. If breathing is difficult or if discomfort occurs and persists, obtain medical attention.

Ingestion

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water and afterwards drink plenty of water or milk. Call a poison control center or doctor immediately for treatment advice.

Most important symptoms and effects, both acute and delayed Asthma-like and/ or skin allergy-like symptoms.

Indication of immediate medical attention and special treatment needed, if necessary Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media Dry chemical, CO₂, sand, earth, water spray or regular foam.

Unsuitable extinguishing media Do not use a solid water stream as it may scatter and spread fire.

Specific Hazards Arising from the Chemical Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Flammable properties Combustible material

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 Avoid dust formation. Avoid dispersal of dust in the air (i.e., cleaning dust surfaces with compressed air.). For personal protection see Section 8.

Other Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Use only non-sparking tools.

Environmental Precautions Recover the product in solid form, if possible. Do not flush into surface water or sanitary sewer system.

Methods for Containment Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.

Methods for cleaning up Sweep or vacuum up spillage and return to container. The waste may be recovered and recycled.

7. HANDLING AND STORAGE

Handling Minimize dust generation and accumulation. Use only non-sparking tools. Remove all sources of ignition. Refer to Section 8.

Storage Keep in a dry, cool and well-ventilated place. Keep away from open flames, hot surfaces and sources of ignition. Any vessel that contains wet EHC® must be vented due to potential pressure build up from fermentation gases.

Incompatible products Strong acids. Oxidizing agents

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies. Local nuisance dust standards apply.

Appropriate engineering controls

Engineering measures It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in the handling of this product contain explosion relief vents or an explosion suppression or an oxygen-deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Safety glasses with side-shields.

Skin and Body Protection Wear suitable protective clothing. Protective shoes or boots.

Hand Protection Use gloves if extended exposure is anticipated Neoprene gloves

Respiratory Protection Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable organization to protect against airborne dust.

Hygiene measures Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Bulk density
Bulk density 0.50 - 0.80 mg/l

Information on basic physical and chemical properties

Appearance	Flakes
Physical State	Solid
Color	Brown, Tan
Odor	odorless
Odor threshold	Not applicable
pH	5.6 (as aqueous solution)
Melting point/freezing point	Decomposes
Boiling Point/Range	Not applicable
Flash point	Not applicable
Evaporation Rate	No information available
Flammability (solid, gas)	Combustible material
Flammability Limit in Air	
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	No information available
Vapor density	No information available
Density	No information available
Specific gravity	No information available
Water solubility	practically insoluble
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Viscosity, kinematic	No information available (Solid)
Viscosity, dynamic	No information available
Explosive properties	Low level dust explosion hazard
K_{st}	19 bar-m/sec: St1 Class dust
Oxidizing properties	No information available
<u>Other Information</u>	

Molecular weight No information available
Bulk density 0.50 - 0.80 mg/l 31.2 - 49.9 lb/cu ft

10. STABILITY AND REACTIVITY

Reactivity None under normal use conditions.

Chemical Stability Stable.

Possibility of Hazardous Reactions May react with water to release flammable hydrogen gas.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Heat, flames and sparks.

Incompatible materials Strong acids. Oxidizing agents.

Hazardous Decomposition Products Burning produces obnoxious and toxic fumes.

11. TOXICOLOGICAL INFORMATION

Product Information

LD50 Oral Iron: 98.6 g/kg (rat)
LD50 Dermal No information available
LC50 Inhalation Iron: > 100 mg/m³ 6 hr (rat)

Serious eye damage/eye irritation May cause slight irritation.
Skin corrosion/irritation May cause slight irritation.

Sensitization May cause sensitization by inhalation.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation	NOAEL Oral Value
Iron (7439-89-6)	98600 mg/kg (Rat)			
Viscosity modifier ()	6770 mg/kg (Rat)			

Information on toxicological effects

Symptoms Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

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

Irritation May cause irritation.
Chronic toxicity No known chronic effects of components present at greater than 1%.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity No known mutagenic or teratogenic effects.

Neurological effects Not neurotoxic

Reproductive toxicity This product does not contain any known or suspected reproductive hazards.

Developmental toxicity	Not a reproductive hazard.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration hazard	No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

Chemical name	Toxicity to algae	Toxicity to fish	Toxicity to Microorganisms	Toxicity to daphnia and other aquatic invertebrates
Iron		96 h LC50: = 13.6 mg/L (Morone saxatilis) static		48 h Daphnia magna EC50 = 8934.78 mg/l

Persistence and degradability	No data is available on the product itself. The organic components are biodegradable and can be expected to contribute to BOD.
Bioaccumulation	Does not bioaccumulate.
Mobility	Is not likely mobile in the environment due its low water solubility.
Other Adverse Effects	None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods	Recovery/recycling recommended. Dispose of in accordance with local regulations.
Contaminated Packaging	Empty remaining contents. Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT NOT REGULATED

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 has the following hazards that are reportable under The Emergency Planning and Community Right-to-Know rule (EPCRA Tier II):

- Combustible dust

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

CWC (Chemical Weapons Convention) - Annex on Chemicals Not applicable

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
Soybean oil			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

Chemical name	TSCA (United States)	DSL (Canada)	EINECS/EL INCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Iron 7439-89-6	X	X	231-096-4	X	X	X	X	X	X
Organic amendment		X	281-689-7		X		X	X	X
Viscosity modifier	X	X	232-536-8	X	X	X	X	X	X

All ingredients are directly listed on the active TSCA Inventory

Mexico

Mexico - Grade Slight risk, Grade 1

16. OTHER INFORMATION

NFPA	Health Hazards 1	Flammability 1	Stability 0	Special Hazards -
HMIS	Health Hazards 1	Flammability 1	Physical hazard 0	Personal Protection -

NFPA/HMIS Ratings Legend Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

References Refer to NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, for safe handling.

Revision date: 2020-10-14
Revision note SDS sections updated: 1.

Issuing Date: 2018-02-02

Disclaimer

PeroxyChem believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. **NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN.** The information provided herein relates only to the specified product designated and may not be applicable where such product is used in combination with any other materials or in any process. Further, since the conditions and methods of use are beyond the control of PeroxyChem, PeroxyChem expressly disclaims any and all liability as to any results obtained or arising from any use of the products or reliance on such information.

Prepared By:

PeroxyChem
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End of Safety Data Sheet

SAFETY DATA SHEET



1. IDENTIFICATION OF MATERIAL AND SUPPLIER

Product Identifier:	LactOil [®] Soy Microemulsion
Other Name(s):	none known
Recommended Use:	In-situ Bioremediation
Recommended Restrictions:	none known
Supplier Name:	JRW Bioremediation, LLC
Address:	14321 W. 96 th Terrace Lenexa, KS 66215
Telephone:	913-438-5544
EMERGENCY Telephone:	800-779-5545 x 116 (Mon-Fri 9am-5pm CST) 913-961-6644 (afterhours)

2. HAZARD IDENTIFICATION

Health & Physical Hazards:

This product is not expected to cause adverse health effects while used as intended. Prolonged exposure may cause slight irritation to skin, eyes, respiratory system, headache, nausea, drowsiness. May cause abdominal discomfort, nausea, and diarrhea.

Flammability Hazards:

This is a Non-Flammable liquid with a closed cup flash point >75C via Pensky-Martens Closed Cup Test (ASTM std D93)

Reactivity Hazards:

This product is considered stable. Hydrolysis may occur in the presence of strong acids and may react with strong oxidizing agents. There are no known hazardous decomposition or byproducts.

OSHA Hazards: L

This material is not considered hazardous by OSHA. No labels or signage are known to be required.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Components	CAS #	% by Weight	Hazard Classification
LactOil®	Proprietary blend	100%	none

4. FIRST-AID MEASURES

Inhalation:

Inhalation of vapors or mist may cause mild irritation of respiratory system. If symptoms are experienced, remove source of contamination or move to fresh air. If affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen.

Skin Contact:

In case of contact with skin, immediately wash with plenty of soap and water while removing contaminated clothing. Seek medical attention if skin Irritation develops or persists.

Eye Contact:

In case of contact with eyes, immediately flush eyes with water for at least 15 minutes, lifting eyelids to facilitate irrigation. Get medical attention if necessary.

Ingestion:

If swallowed, get medical attention. Do NOT induce vomiting.

Signs and symptoms of exposure:

May cause slight irritation to skin, eyes, respiratory system, headache, nausea, drowsiness. May cause abdominal discomfort, nausea, and diarrhea. Treat symptomatically.

Medical Conditions aggravated by exposure:

Soybean derived product. Avoid if sensitive to soy products.

Indication of immediate medical attention or special treatment needed:

If medical advice is needed, have product SDS and/or label available to medical personnel.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:	Dry chemical, foam, carbon dioxide, or water fog.
Unsuitable Extinguishing Media:	Do not use heavy water stream as it may spread burning oil
Specific hazards from substance/mixture:	May react with strong oxidizing agents. Hydrolysis may occur in the presence of strong acids or bases.
General fire hazards:	No unusual fire or explosion hazards noted

Special protective equipment / precautions for fire-fighters:

Wear full protective clothing and positive pressure breathing apparatus. If possible, prevent/minimize material from entering waterways.

6. ACCIDENTAL RELEASE MEASURES

Methods and Materials for containment and clean up:

Contain spill with absorbent materials such as clay or soil; shovel and place material in drum for disposal. Surfaces may become slippery after spillage. Dispose of according to all local, state, and federal regulations at an approved waste treatment facility.

Personal precautions / Protective equipment:

Use personal protective equipment. Prevent spills, contamination, and leakage.

Environmental precautions:

Prevent material from entering waterways. If contamination of local sewer or waterway has occurred advise local emergency services.

7. HANDLING AND STORAGE

Precautions for safe handling:

Observe good work and industrial hygiene practices. Use personal protective equipment. Prevent spills, contamination, and leakage.

Conditions for safe storage, including any incompatibilities:

Keep container tightly closed. Keep in properly labeled containers. Store in a well ventilated, cool, dry area. Avoid freezing or excessive heat or sources of ignition.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters:	No exposure or biological limits noted for ingredients(s).
Appropriate engineering controls:	General ventilation and local exhaust are recommended.
Individual protection measures, such as Personal Protective Equipment (PPE):	
Eye/Face protection:	Chemical goggles recommended.
Skin / hand / body protection:	Chemical resistant gloves recommended. Suitable protective clothing as defined by employer.
Respiratory protection:	May be required if used in poorly ventilated area or if material is sprayed or heated. OSHA respiratory regulations found in 29 CFR 1910.134. Use NIOSH approved respirator when necessary.
General considerations:	Avoid contact with skin. When using material, do not eat, drink, or smoke. Remove and wash any contaminated clothing before storage or re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Thick, brown to yellowish liquid
Odor:	Sweet, mild alcohol-like scent
Odor threshold:	not applicable
pH:	7.5
Melting point/freezing point:	not applicable
Initial boiling point and boiling range:	not determined
Closed cup Flash point:	>75C vis Pensky-Martens Closed Cup Test (ASTM std D93)
Evaporation rate:	not determined
Flammability (solid, gas):	not determined
Upper/lower flammability or explosive limits:	not determined
Vapor pressure (Mg Hg):	not determined
Vapor density (air = 1):	not determined
Density:	1.05
Solubility in water:	soluable
Auto-ignition temperature:	not determined
Decomposition temperature:	not determined
Specific Gravity (H₂O = 1):	not determined

10. STABILITY AND REACTIVITY

Reactivity:	Non-reactive under conditions of normal use, storage & transport.
Chemical stability:	Stable under conditions of normal use, storage and transport.
Possibility of hazardous reactions:	
Conditions to avoid:	Hydrolysis may occur in the presence of strong acids or bases.
Incompatible materials:	May react with strong oxidizing agents.
Hazardous decomposition products:	None known

11. TOXICOLOGICAL INFORMATION

No adverse health effects are expected if the product is used as intended and in accordance with this Safety Data Sheet.

Inhalation:	Inhalation of vapors or mist may cause mild irritation of respiratory system. If symptoms are experienced, remove source of contamination or move to fresh air. If affected person is not breathing, apply artificial respiration. If breathing is difficult, give oxygen.
Ingestion:	If swallowed, get medical attention. Soybean derived product. Avoid if sensitive to soy products.
Skin:	In case of contact with skin, immediately wash with plenty of soap and water while removing contaminated clothing. Seek medical attention if skin irritation develops or persists.
Eye contact:	In case of contact with eyes, immediately flush eyes with water for at least 15 minutes, lifting eyelids to facilitate irrigation. Get medical attention if necessary.
Signs & symptoms of exposure:	Slight irritation to skin, eyes, respiratory system, headache, nausea, drowsiness. May cause abdominal discomfort, nausea, and diarrhea. No chronic effects from short and long term exposure expected.
Carcinogenicity:	Not determined.
Mutagenicity:	Not determined.
Reproductive Toxicity:	Not determined.

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Product is not considered environmentally hazardous and is not expected to cause significant harm to aquatic, animal, or plant life however it is generally recommended to prevent material from entering waterways.
Persistence/degradability:	Readily biodegradable.
Bioaccumulative potential:	Not expected to bioconcentrate or bioaccumulate.
Mobility in soil:	No specific information available.

13. DISPOSAL CONSIDERATIONS

Disposal Methods:

Contain spill with absorbent materials such as clay or soil and shovel and place material in drum for disposal. Surfaces may become slippery after spillage. Dispose of according to all local, state, and federal regulations at an approved waste treatment facility.

14. TRANSPORTATION INFORMATION

DOT hazard class:	Not Applicable, non-regulated
Labeling:	Not Applicable
Proper Shipping Name:	LactOil® Soy Microemulsion
NMFC#:	144920
Class	65

15. REGULATORY INFORMATION

Restrictions on use:	None.
Other regulations:	No information available.

16. OTHER INFORMATION

The information in this SDS summarizes to the best of our knowledge at the date of issue, the chemical health and safety hazards of this material and general guidance for safe handling, use, processing, storage, transportation, disposal, and release. This information is not intended to be considered a warranty or quality specifications. The information contained relates only to the specific material designated and may not be valid if used in conjunction with other materials or in any other processes other than intended use. If further clarification or information is required, please contact JRW Bioremediation.

SAFETY DATA SHEET

Version 6.10
Revision Date 08/06/2024
Print Date 08/07/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Iron(II) sulfate heptahydrate

Product Number : 215422
Brand : SIGALD
Index-No. : 026-003-01-4
CAS-No. : 7782-63-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word

Warning

Hazard Statements

H302

Harmful if swallowed.

H315

Causes skin irritation.

H319

Causes serious eye irritation.

Precautionary Statements

P264

Wash skin thoroughly after handling.

P270

Do not eat, drink or smoke when using this product.

P280

Wear protective gloves/ eye protection/ face protection.

P301 + P312 + P330

IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.

P302 + P352

IF ON SKIN: Wash with plenty of soap and water.

P305 + P351 + P338

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P332 + P313

If skin irritation occurs: Get medical advice/ attention.

P337 + P313

If eye irritation persists: Get medical advice/ attention.

P362

Take off contaminated clothing and wash before reuse.

P501

Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : Ferrous sulfateheptahydrate

Formula : $\text{FeO}_4\text{S} \cdot 7\text{H}_2\text{O}$

Molecular weight : 278.01 g/mol

CAS-No. : 7782-63-0

EC-No. : 231-753-5

Index-No. : 026-003-01-4

Component	Classification	Concentration
Ferrous sulfate heptahydrate	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; H302, H315, H319	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

No data available

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

No data available

5.2 Special hazards arising from the substance or mixture

Sulfur oxides

Iron oxides

Not combustible.

5.3 Advice for firefighters

No data available

5.4 Further information

No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For personal protection see section 8.

6.2 Environmental precautions

No data available

6.3 Methods and materials for containment and cleaning up

No data available

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Air sensitive. Store under inert gas. hygroscopic

Storage class

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Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Ferrous sulfate heptahydrate	7782-63-0	TWA	1 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
		TWA	1 mg/m ³	USA. NIOSH Recommended Exposure Limits
		PEL	1 mg/m ³	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

8.2 Exposure controls

Personal protective equipment

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:KCL 741 Dermatril® L

Respiratory protection

Recommended Filter type: Filter B-(P2)

The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented. required when dusts are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Prevent product from entering drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance	Form: solid
b) Odor	No data available
c) Odor Threshold	No data available
d) pH	3.0 - 4.0 at 50 g/l at 25 °C (77 °F)
e) Melting point/freezing point	Melting point/ range: 64 °C (147 °F)
f) Initial boiling point and boiling range	No data available
g) Flash point	()Not applicable
h) Evaporation rate	No data available
i) Flammability (solid, gas)	No data available
j) Upper/lower flammability or explosive limits	No data available
k) Vapor pressure	14.6 hPa at 25 °C (77 °F)
l) Vapor density	No data available
m) Density	1.898 g/cm ³ at 25 °C (77 °F) - lit.
Relative density	No data available
n) Water solubility	soluble
o) Partition coefficient: n-octanol/water	Not applicable for inorganic substances
p) Autoignition temperature	No data available
q) Decomposition temperature	No data available
r) Viscosity	No data available
s) Explosive properties	No data available

t) Oxidizing properties none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

No data available

10.3 Possibility of hazardous reactions

increased reactivity with:

Bases

Oxidizing agents

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Mouse - 1,520 mg/kg

Remarks: (RTECS)

Oral: absorption

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

Skin - Rabbit

Result: Irritating to skin. - 4 h

(OECD Test Guideline 404)

Remarks: The value is given in analogy to the following substances: Iron(II) sulphate

Serious eye damage/eye irritation

Eyes - Rabbit

Result: Causes serious eye irritation.

(OECD Test Guideline 405)

Remarks: The value is given in analogy to the following substances: iron dichloride

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

Test Type: Ames test

Result: negative

Remarks: (Lit.)

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

11.2 Additional Information

RTECS: NO8510000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After swallowing of large amounts:

Bloody vomiting

Diarrhea

drop in blood pressure

Handle in accordance with good industrial hygiene and safety practice.

Other dangerous properties can not be excluded.

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information**12.1 Toxicity**

No data available

12.2 Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

No data available

SECTION 14: Transport information

DOT (US)

UN number: 3077 Class: 9

Packing group: III

Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Ferrous sulfate heptahydrate)

Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

IATA

Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

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Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Ferrous sulfate heptahydrate	7782-63-0	1000	1000

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know

Ferrous sulfate heptahydrate 7782-63-0

Pennsylvania Right To Know

Ferrous sulfate heptahydrate 7782-63-0

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

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