In-Situ Bioremediation Injections
Batch Mixing and Injections
Field Guidance Document
Nevada Environmental Response Trust Site
Henderson, Nevada

PREPARED FOR

Nevada Environmental Response Trust
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PRESENTED BY

Tetra Tech, Inc.
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Henderson, NV 89015

November 11, 2019

CERTIFICATION

In-Situ Bioremediation Injections
Batch Mixing and Injections
Field Guidance Document

Nevada Environmental Response Trust Site
(Former Tronox LLC Site)
Henderson, Nevada

Nevada Environmental Response Trust (NERT) Representative Certification
I certify that this document and all attachments submitted to the Division were prepared at the request of, or under the direction or supervision of NERT. Based on my own involvement and/or my inquiry of the person or persons who manage the systems(s) or those directly responsible for gathering the information or preparing the document, or the immediate supervisor of such person(s), the information submitted and provided herein is, to the best of my knowledge and belief, true, accurate, and complete in all material respects.

Office of the Nevada Environmental Response Trust

Le Petomane XXVII, not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Signature: Jay A Steinberg Not Individually, but Solely as President of the Trustee, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Name: Jay A. Steinberg, not individually, but solely in his representative capacity as President of the Nevada Environmental Response Trust Trustee

Title: Solely as President and not individually

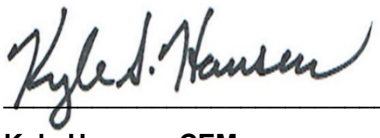
Company: Le Petomane XXVII, Inc., not individually, but solely in its representative capacity as the Nevada Environmental Response Trust Trustee

Date: 11/11/19

CERTIFICATION

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been prepared in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.

Description of Services Provided: **In-Situ Bioremediation Injections, Batch Mixing and Injections, Field Guidance Document**



November 11, 2019

Kyle Hansen, CEM
Field Operations Manager/Geologist
Tetra Tech, Inc.

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2020

Summary: This Field Guidance Document (FGD) describes the general equipment and methodology to be used for batch mixing and injection of carbon substrate, amendments, and distribution water to ensure mixture consistency and appropriate subsurface distribution to promote in-situ bioremediation (ISB).

This FGD has been customized for injections into the alluvium based on previous injection experience conducting in-situ bioremediation programs for the Nevada Environmental Response Trust (NERT). Because this is a treatability study (i.e. not final remedy), this FGD may be periodically updated based on the lessons learned during injections. General procedures and equipment sizing/specifications may require modification depending on the targeted lithology (i.e., alluvium, Upper Muddy Creek formation [UMCf], or UMCf-coarse grained), total injectate quantities, and targeted injection rates. It should be noted that this FGD follows general guidance and concurrence from EOS® Remediation, the inventor and distributor of the emulsified vegetable oil (EVO) product called EOS®, which is currently be used as the primary carbon substrate. Should a different carbon substrate be implemented, different mixing and injection procedures may be required.

Procedure:

1.0 INJECTION PROCEDURES

1.1 PERSONAL PROTECTIVE EQUIPMENT

At a minimum, the following personal protection equipment (PPE) is required for this task:

- Level D PPE consisting of: Hard hat (if overhead hazards are present), safety glasses, high visibility traffic vest, nitrile gloves, steel toe safety boots, and hearing protection (if noise hazards are present); and
- Additional PPE required during mixing operations should consist of long-sleeve shirts, cut proof gloves, face shields, dust masks, and spoggles (combined safety glass and goggle).

1.2 SITE PREPARATION

Before beginning any injection operations, the following preparations must take place:

- All personnel working at or in the immediate vicinity of the injection system are fitted with appropriate PPE;
- Combustible materials including (but not limited to) fuels, lubricants, and coated rags are kept away from the work area; and

- All personnel review the safety data sheets (SDSs) for chemicals to be injected provided in Attachment A.

1.3 SYSTEM SPECIFICATIONS

The contractor will mobilize all equipment required for the injection system platform and associated equipment, which includes the following:

- Minimum of two double-walled frac tanks, typically each with a minimum working volume of 16,400 gallons, but may slightly vary depending on tank vendor;
- Generator to power injection trailer, typically a 150kva portable generator (Tier 4 rated);
- Injection/extraction hosing consisting of 1-inch injection hose inserted into 2-inch lay-flat polyvinyl chloride (PVC) hose that is free of holes with water tight couplings securely fitted such that the 2-inch hose serves as secondary containment for the injection lines;
- Manifolds with flow meters for each injection line (capacity to connect to multiple injection wells simultaneously, depending on application);
- Flow meters with flow rate and totalizing capabilities placed using cam lock or quick connect fittings to insure quick and efficient replacement or cleaning, as needed;
- Glycerin-filled pressure gauges to be connected at each injection wellhead with a maximum range of 0 to 60 pounds per square inch (psi) to monitor back pressure during injections;
- Portable centrifugal pumps (typically a 75-horsepower system with up to 240 gallons per minute [gpm] nominal flow capacity) with 100% capacity recirculation line for injection of injectate solution and distribution water; Note: two pumps shall be mobilized so that there is one pump for injections and an additional pump as back up;
- Air operated double diaphragm pump(s) (typically 2-inch pumps with an approximate 140 gpm nominal flow capacity; diesel air compressor with approximately 175 to 195 cubic feet per minute) complete with a flow meter/totalizer to add chemicals to frac tanks;

- Submersible pump (typically a 6-inch pump with a 70 gpm flow capacity) and recirculation hose to recirculate injectate solution within the frac tank to ensure proper mixing;
- Submersible well pumps equipped for placement in 4-inch extraction wells (typically 4-inch pumps with 22 – 35 gpm nominal flow capacity installed with throttling valves and 1.5" Schedule 40 PVC pipe down well and 1.5" hose at surface) for extraction of groundwater;
- Portable generators (typically 7 kilowatts) to power submersible well pumps installed in extraction wells;
- Drip pans for potential seepage collection and containment at hose joints;
- Portable drip containment system with berms for injection system and oil tankers;
- Spill kits and portable vacuums; and
- 275-gallon plastic totes to containerize rinse water.

1.4 PROCEDURES FOR INJECTIONS OF CARBON SUBSTATE AND AMENDMENTS

This section provides an overview of the injection process and assumed that all injection wells and amendments have been pre-approved by the Nevada Division of Environmental Protection – Underground Injection Control.

1.4.1 INJECTION SYSTEM SET-UP

1. Set up portable drip containment for EVO tankers, amendments, and injection system platform and associated equipment.
2. Receive shipments of EVO (periodically delivered via 5,000-gallon tanker trucks as needed to minimize EVO on-site storage), chemical amendments (stored in original tightly closed containers until use), and frac tanks and place inside containment berms. Ensure all chemical containers are properly labeled. Record chemical name, supplier, delivery date and time, and quantity received for all injectate chemicals received on the Chemical Tracking Log field form provided in Attachment B. If required, provide notification to local fire department based on the quantity of chemicals that are ordered and stored on-site.

3. Place spill kits and portable vacuums within the work area for immediate deployment (as necessary).

4. Connect selected injection wells to the injection system via injection well connectors with pressure gauge.

5. Run injection hose from each injection well to a manifold system. The injection manifolds should be placed to minimize injection hose length required to reach each of the injection wells. Install flow meters on each outgoing injection line at the manifold to monitor injection flow rate and total gallons injected at each injection well. Install influent flow meter to monitor overall input into the manifold system.

6. Run 2-inch injection hose from each injection manifold to a centrifugal pump on the injection system platform. Connect centrifugal pump to frac tank discharge. Run 100% capacity recirculation line from the centrifugal pump to the frac tank.

7. Keep all injection line valves closed and centrifugal pumps off until injectate solution is properly mixed.

8. Install drip pans as secondary containment at connection points for injection hoses.

1.4.2 Extraction System Set-Up

This section provides an overview of the groundwater extraction process, which must be permitted by the Nevada Division of Water Resources and include a permit for each individual well used for extraction prior to extraction activities. This section is not applicable if the water source selected for injections is not extracted groundwater (i.e., City of Henderson municipal water, stabilized Lake Mead water, or other water source).

1. Measure depth to water and total well depth at each extraction well. Deploy submersible well pumps at each extraction point to specified depths. The groundwater is extracted using a submersible pump that is set at an appropriate depth in the required number of extraction wells. Install throttling valves to reduce flow to match yields as needed.

2. Set up portable generators to power extraction pumps. Run dual-walled hose from each extraction point to one of the frac tanks onsite. Install a flow meter on each extraction line to monitor flow rate and total gallons extracted from each extraction well. Mark each extraction point with traffic cones or similar high-visibility demarcation to alert vehicle traffic of uncovered well box and pump equipment.

3. If applicable based on field conditions encountered, install bag filters with basket strainers in parallel arrangement to filter extracted groundwater.

4. Turn on submersible pumps to start groundwater extraction system operation to begin accumulating extracted groundwater for batch mixing of injectate solution. Monitor and record extraction rates, extraction time periods, total volume extracted for each extraction well, and level of extracted groundwater that has accumulated in the frac tank in the Groundwater Extraction Log field form provided in Attachment B. Adjust throttling valves based on periodic well depth to water measurements to maintain steady and sustainable extraction rates.

1.4.3 BATCH MIXING

The injectate solution is to be mixed in the double-walled frac tanks in accordance with the batch formula specified for each injection event. Prior to implementing an injection event, all injectate solution quantities will be reviewed with the Nevada Division of Environmental Protection (NDEP). In general, the injectate solution will consist of EVO diluted with extracted groundwater or other approved water source (likely in a 1:4 [1 part EVO to 4 parts water] ratio, but may vary depending on the study application and objectives). Other amendments, such as phosphate solution, glycerin, and/or sodium sulfite (SDSs provided in Attachment A) will be added to each batch mixture in accordance with the batch formula. If extracted groundwater is used as the water source, the extraction wells will be sampled prior to the injection event to document the chemistry of the extracted groundwater.

Each batch of injectate solution will be prepared following a series of steps to ensure consistency in the mixing of the injectate solution.

1. Allow extracted groundwater pumped into the frac tank as described in Section 1.4.2 to accumulate until the desired volume of water for the injectate batch is achieved. The volume of extracted groundwater shall be determined based on the data obtained from the flow meters connected to each extraction well and by gauging the height to which the water has filled the frac tank. The height of the water in the frac tank is then compared to a chart provided by the frac tank vendor to confirm the volume in each tank. Record the time and volume of extracted groundwater addition on the Batch Mixing Log provided in Attachment B.

2. After the required volume of extracted groundwater for the individual batch has accumulated in the first frac tank in which the injectate

solution will be mixed, move extraction lines to second frac tank to continue to accumulate groundwater for the next batch to be mixed.

3. After confirmation of the required extracted groundwater volume, all amendments will be prepared for transfer into the mixing frac tank. Personnel should don required PPE for chemical mixing (described in Section 1.1) prior to adding amendments to the mixing frac tank.

4. Prior to amendment addition, install a submersible pump (typically a 6-inch pump with a 70 gpm flow capacity) at one end of the tank, slowly lowering the pump using a stainless steel safety wire until the pump rests on the bottom of the tank. The pump is attached to a 2-inch recirculation hose that runs to the opposite end of the tank and then discharges to the top of the tank, recirculating the contents at a rate of approximately 70 gpm. The return recirculation hose shall be submerged to avoid cascading and aeration of injection solution. Recirculation will continue during the entire batch preparation process.

5. Continue operation of the submersible pump for continuous recirculation during the batch mixing process. Add the designed quantity of sodium sulfite, which is the first amendment to be added, directly into the top/front of the frac tank above the recirculation pump. Record the time and mass of sodium sulfite addition on the Batch Mixing Log provided in Attachment B.

6. Continue operation of the submersible pump for continuous recirculation during the batch mixing process. Using a 2-inch air diaphragm pump complete with 2-inch flow meter/totalizer to track the volume, add target volume of EVO, transferring the EVO from its delivery tanker to the front/top of mixing frac tank above the recirculation pump. The amount transferred is also confirmed by measuring the increase in tank volume (see Step 1 above). Record the time and volume of EVO addition on the Batch Mixing Log provided in Attachment B.

7. Continue operation of the submersible pump for continuous recirculation during the batch mixing process. Once the full volume of EVO transferred to the mixing frac tank has been confirmed and recorded, transfer the required volume of glycerin (second amendment to be added) to the front/top of the mixing frac tank, via an air diaphragm pump complete with flow meter/totalizer to track the volume of glycerin being added to the mixture. Record the time and volume of glycerin and addition on the Batch Mixing Log provided in Attachment B.

8. Repeat the process described in Step 5 to add phosphate solution, which is the third and final amendment) to the mixing frac tank.

9. After all amendments have been added to the mixing frac tank, continue running the submersible recirculation pump during the injection process while ensuring that the submersible recirculation pump remains adequately submerged. As the tank gets close to empty, turn off the recirculation pump before the submersible recirculation pump is no longer adequately submerged.

10. Record batch number, total volume, quantities and concentration of amendments, mixing equipment, and mixing time interval on the Batch Mixing Log field form provided in Attachment B.

11. Collect field readings for specific gravity and temperature of the injectate solution following mixing operations of each batch. Record readings on the Specific Gravity Log provided in Attachment B. Sample of injectate solution should be collected at the injectate solution sampling port (as indicated on the process flow diagram, Attachment C). Additionally, a stock injectate solution should be prepared using the EVO from each tanker truck delivered, extracted groundwater, and associated amendments. Measure and record temperature and specific gravity of the stock injectate solution on the Specific Gravity Log provided in Attachment B. The specific gravity measurement of the stock injectate solution will be used for comparison purposes to the regular measurements collected during the injection process to ensure mixture consistency (described in Section 1.4.4, Step 6).

1.4.4 Injection Operation

1. After the batch of injectate solution has been mixed in accordance with Section 1.4.3, reconfirm injection wells selected for injection are properly connected to manifold and injection system with valves closed in accordance with Section 1.4.1, Steps 4 through 7.

2. Turn on centrifugal pump to begin injection process. At each manifold, slowly open valves for each injection line, carefully monitoring flow rate and back pressure. Use pressure relief valve at each injection well head to purge air from each injection line with pressure relief tubing directed with tubing directing the sputtered injection solution into a bucket. Record injection start time, initial pressure, and flow rate data on the Daily Injection Log provided in Attachment B. Ensure that no more than 35 psi is observed at any injection well (maximum permissible pressure as stated in the Underground Injection Control Permit). If at any point, a pressure reading exceeds 35 psi, immediately

close valve to terminate injections at that injection well. Flow rates should be maximized to the extent possible while not exceeding the injection pressure limit of 35 psi.

3. During operation of the injection system, monitor and record flow rate and pressure readings at each injection well on an hourly basis on the Injection Pressure and Flow Rate Log provided in Attachment B.

4. Monitor total targeted volume prescribed for each injection well. When total volume injected for an injection well nears the target volume, closely monitor flow rate and volume. Upon reaching the targeted volume of injectate solution for an injection well, terminate injections at that injection well. Record time at which injections were terminated on the Daily Injection Log provided in Attachment B. Connect additional injection wells to manifold (as described in Section 1.4.1) and begin injections, as needed.

5. Monitor level of injectate solution in frac tank. Record injectate solution level and volume remaining in the frac tank on the Daily Injection Log provided in Attachment B.

6. Collect periodic samples from the injectate solution sampling port for field analysis of specific gravity and temperature to demonstrate injectate solution remains sufficiently mixed. Sample frequency may vary depending on application (batch size and injection rates). At a minimum, an initial specific gravity sample will be collected prior to initiating the injection of a new batch, followed by three subsequent samples throughout injection of each batch to ensure mixture consistency. Record readings on the Specific Gravity Log provided in Attachment B. Sample of injectate solution should be collected at the injectate solution sampling port (as indicated on the process flow diagram, Attachment C).

7. As extracted groundwater accumulates in additional frac tank(s), mix additional batches of injectate solution as described in Section 1.4.3, which includes resampling the batch solution for specific gravity and temperature to ensure consistency of injectate mixture in each batch. The mixing of additional batches should be performed concurrently while injecting the previously mixed batch from the other frac tank to minimize downtime. Injection rates should be considered in the timing of mixing additional batches so as to minimize the residence time of a batch solution within a tank prior to injection. After initial batch of injectate solution is depleted, connect centrifugal pumps to frac tank in

which the next batch of injectate solution has been mixed. Resume injections as described in Step 2 of this section.

8. Fill 275-gallon tote(s) with potable City of Henderson water from nearby hydrant. As amendment drums are emptied during batch mixing, rinse empty drums with a small amount (approximately 1 gallon per drum) of potable water in preparation for return to chemical supplier(s). Pour drum rinsate into mixing tank, and record addition of drum rinsate on Batch Mixing Log provided in Attachment B.

9. During the injection process, flow meters should be visually inspected during hourly field recordings (Section 1.4.4, Step 3). All flow meters should be calibrated (performing a controlled test from one graduated tank to another) prior to use and periodically recalibrated during off-days to ensure proper operation. Additional calibrated flow meters should be present at the site at all times to replace a malfunctioning flow meter as required.

10. After injection wells have received the target volume of injectate solution, begin injection of distribution water (extracted groundwater or other water source). Continue distribution water injection until injection wells have reached their target distribution water volume. Monitor extraction and injection rates of the system. Depending on extraction rates achieved, injection of distribution water may be temporarily suspended to allow extracted ground water to accumulate. Effort should be made to maximize extraction time each day to increase injection efficiency and maximize injection rates.

11. At the end of each day, record time at which injections are terminated and the total volume injected into each injection well on the Daily Injection Log. After injection system has been shut down, turn off submersible pumps at each extraction well and record the total volume extracted from each well on the Groundwater Extraction Log. At the beginning of each day, turn on submersible pumps at each extraction well and resume injections as described in Section 1.4.4, Step 2.

12. The contractor is to perform daily inspections of all equipment and regular inspections of secondary containment.

13. The site is located in an open, unsecured area so overnight and weekend security will be provided.

14. All pumps and hoses are to be purged at the end of each working day by gravity feeding the injectate solution into the injection wells so that injectate solution does not remain in the lines overnight.

1.4.5 DEMOBILIZATION

1. Following completion of injection activities, flush injection and extraction lines into the connected injection wells using City of Henderson hydrant water contained in 275-gallon totes.

2. Oversee EVO tanker and amendment drum removal and demobilization of injection and extraction system equipment. Record date and time of amendment drum and EVO tanker pick up on the Chemical Tracking Log field form provided in Attachment B.

3. Contractor shall perform frac tank clean out using high-pressure steam in accordance with an approved Tetra Tech confined space entry permit and oversight.

Documentation:

Attachment A – Chemical Safety Data Sheets

Attachment B – Injection Field Forms

Attachment C – Process Flow Diagram

Notes:

TETRA TECH	**IN-SITU BIOREMEDIATION INJECTIONS BATCH MIXING AND INJECTIONS FIELD GUIDANCE DOCUMENT**	
		Rev. 0.0
Seep Well Field Area Bioremediation Treatability Study	**Nevada Environmental Response Trust**	Date: November 2019
		Reviewed/Approved

Summary:	Attachment A – Chemical Safety Data Sheets
Documentation:	1. Emulsified Vegetable Oil – EOS PRO 2. Phosphate Solution – AQUAPURE® 3601 NSF 3. Glycerin – GLYCERINE 99.7% USP KOSH MUSIM GSO 4. Sodium Sulfite Technical Grade

EOS Remediation, LLC

EOS PRO

SAFETY DATA SHEET

Section 1: Identification	
Product Name:	**EOS Pro**
Chemical Description:	Mixture; vegetable oil emulsion
Manufacturer:	EOS Remediation PO Box 14266 Research Triangle Park NC 27709 (P): 919-873-2204 www.eosremediation.com
Recommended Use:	Groundwater bioremediation (environmental applications)
Restricted Use:	Not for human consumption.
24-Hour Emergency Contact:	ChemTel: United States (P): 800-255-3924 ChemTel: International (P): 813-248-0585

Section 2: Hazard(s) Identification	
Hazard Classification:	Irritant (skin and eye)
Signal Word:	Warning
Hazard Statement(s):	Potential eye and skin irritant.
Pictograms:	
Precautionary Statement(s):	Not for human consumption. Do not store near excessive heat or oxidizers. Avoid contact with eyes and skin. Wear protective gloves and eye protection.

Section 3: Composition/Information on Ingredients		
Common Name(s)	**CAS NO.**	**% by Weight**
Soybean Oil	8001-22-7	60
Food Grade Emulsifiers Trade Secret[1,2]	111-03-5	10
Soluble Substrates (glycerol) Trade Secret[1,2]	56-81-5	4
Water	7732-18-5	26

1 – The precise composition of this product is proprietary information. A more complete disclosure will be provided to a physician in the event of a medical emergency.
2 – The soluble substrates and emulsifiers are generally recognized as safe for food contact.

Section 4: First-Aid Measures	
Routes of Exposure	**Emergency First-Aid Procedures**
Inhalation	Remove to fresh air.
Eye Contact	Flush with water for 15 minutes; if irritation persists see a physician.
Skin Contact	Wash with mild soap and water.
Ingestion	Product is non-toxic. If nausea occurs, induce vomiting and seek medical attention.

Section 5: Fire-Fighting Measures	
Extinguishing Media:	CO_2, foam, dry chemical Note: Water, fog and foam may cause frothing and spattering.
Special Fire Fighting Procedures:	Wear self-contained breathing apparatus and chemical resistant clothing. Use water spray to cool fire exposed containers.
Fire Hazard(s):	Burning will cause oxides of carbon.

Section 6: Accidental Release Measures	
Personal Precautions:	Avoid contact with eyes and skin. Do not consume.
Emergency Procedures:	N/A
Methods & Materials used for Containment:	Compatible granular absorbent
Cleanup Procedures:	Spread compatible granular absorbent over spill area and sweep using broom and pan; dispose in appropriate receptacle. Clean area with water.

Section 7: Handling and Storage	
Safe Handling & Storage:	Do not store near excessive heat or oxidizers.
Other Precautions:	Consumption of food and beverages should be prevented in work area where product is being used. After handling product, always wash hands and face thoroughly with soap and water before eating, drinking, or smoking.

Section 8: Exposure Controls/Personal Protection		
Exposure Limits		
OSHA PEL:	NE	
ACGIH TLV:	NE	
NIOSH REL:	NE	
Personal Protective Measures		
Respiratory Protection:	Not normally required. P95 respirator if aerosols might be generated.	
Hand Protection:	Protective gloves are recommended	
Eye Protection:	Recommended	
Engineering Measures:	Local exhaust ventilation if aerosols are generated	
Hygiene Measures:	Wash promptly with soap & water if skin becomes irritated from contact.	
Other Protection:	Wear appropriate clothing to prevent skin contact.	

Section 9: Physical and Chemical Properties			
Appearance:	White Liquid	Explosive Limits:	NE
Odor:	Vegetable Oil	Vapor Pressure:	NE
Odor Threshold:	NE	Vapor Density:	Heavier than air
pH:	6.0-7.0 (su)	Relative Density:	0.96-0.98
Melting Point/Freezing Point:	Liquid at room temperature	Solubility:	Dispersible
Boiling Point:	212°F (100°C)	Partition coefficient:	NE
Flash Point:	>300°F (149°C)	Auto-ignition Temperature:	NE
Evaporation Rate:	NE	Decomposition Temperature:	N/A
Flammability (solid, gas):	NE	Viscosity:	500-1500 cP

NE – Not Established

Section 10: Stability and Reactivity	
Stability:	Stable
Incompatibility:	Strong acids and oxidizers
Hazardous Decomposition Products:	Thermal decomposition may produce oxides of carbon
Hazardous Reactions/Polymerization:	Will not occur
Conditions to Avoid:	None known

Section 11: Toxicological Information		
Likely Routes of Exposure:		Ingestion, dermal and eye contact
Signs and Symptoms of Exposure:		None known
Health Hazards		
	Acute:	Potential eye and skin irritant
	Chronic:	None known
Carcinogenicity		
	NTP:	No
	IARC:	No
	OSHA:	No

Section 12: Ecological Information (non-mandatory)
There is no data on the ecotoxicity of this product.

Section 13: Disposal Considerations (non-mandatory)	
Waste Disposal Methods:	Dispose of according to Federal and local regulations for non-hazardous waste. Recycle, if practical.

Section 14: Transport Information (non-mandatory)
The product is not covered by international regulation on the transport of dangerous goods.
No transport warning required.

Section 15: Regulatory Information (non-mandatory)
N/A

Section 16: Other Information	
Date of Preparation:	29 May 2014
Last Modified Date:	27 June 2019
The information contained herein is based on available data and is believed to be correct. However, EOS Remediation, LLC makes no warranty, expressed or implied, regarding the accuracy of this data or the results to be obtained thereof. This information and product are furnished on the condition that the person receiving them shall make his/her own determination as to the suitability of the product for his/her particular purpose.	

BRENNTAG

SAFETY DATA SHEET

1. Identification

Product identifier **AQUAPURE® 3601 NSF (25 MG/L MAX)**

Other means of identification None.

Recommended use ALL PROPER AND LEGAL PURPOSES

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name Brenntag Pacific Inc.

Address 10747 Patterson Place
Santa Fe Springs, CA 90670

Telephone 562-903-9626

E-mail Not available.

Emergency phone number 800-424-9300 CHEMTREC

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards

Acute toxicity, dermal	Category 4
Skin corrosion/irritation	Category 1A
Serious eye damage/eye irritation	Category 1

Environmental hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Signal word Danger

Hazard statement Harmful in contact with skin. Causes severe skin burns and eye damage. Causes serious eye damage.

Precautionary statement

Prevention Do not breathe mist or vapor. Wash thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection.

Response If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Take off contaminated clothing and wash before reuse.

Storage Store locked up.

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

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information 100% of the mixture consists of component(s) of unknown acute oral toxicity. 86.67% of the mixture consists of component(s) of unknown acute inhalation toxicity.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
PHOSPHORIC ACID		7664-38-2	32.67
SODIUM HYDROXIDE (NA(OH))		1310-73-2	13.335
Other components below reportable levels			53.995

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Do not breathe mist or vapor. Do not get in eyes, on skin, or on clothing. When using, do not eat, drink or smoke. Avoid prolonged exposure. Provide adequate ventilation. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices. Wash contaminated clothing before reuse.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS). Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

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

Components	Type	Value
PHOSPHORIC ACID (CAS 7664-38-2)	PEL	1 mg/m3
SODIUM HYDROXIDE (NA(OH)) (CAS 1310-73-2)	PEL	2 mg/m3

US. ACGIH Threshold Limit Values

Components	Type	Value
PHOSPHORIC ACID (CAS 7664-38-2)	STEL	3 mg/m3
	TWA	1 mg/m3
SODIUM HYDROXIDE (NA(OH)) (CAS 1310-73-2)	Ceiling	2 mg/m3

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
PHOSPHORIC ACID (CAS 7664-38-2)	STEL	3 mg/m3
	TWA	1 mg/m3
SODIUM HYDROXIDE (NA(OH)) (CAS 1310-73-2)	Ceiling	2 mg/m3

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

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

The following are recommendations for Personnel Protective Equipment (PPE). The employer/user of this product must perform a Hazard Assessment of the workplace according to OSHA regulations 29 CFR 1910.132 to determine the appropriate PPE for use while performing any task involving potential exposure to this product.

Eye/face protection Wear safety glasses with side shields (or goggles) and a face shield. Face shield is recommended.

Skin protection

Hand protection For prolonged or repeated skin contact use suitable protective gloves.

Other Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.

Respiratory protection In case of insufficient ventilation, wear suitable respiratory equipment.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form Liquid.

Color CLEAR COLORLESS

Odor NONE

Odor threshold Not available.

pH Not available.

Melting point/freezing point Not available.

Initial boiling point and boiling range 587.61 °F (308.67 °C) estimated

Flash point Not available.

Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	11.76 lbs/gal
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
Percent volatile	54 % estimated
Specific gravity	1.41

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong acids.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system. Prolonged inhalation may be harmful.
Skin contact	Causes severe skin burns. Harmful in contact with skin.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns.
Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.

Information on toxicological effects

Acute toxicity	Harmful in contact with skin.
Skin corrosion/irritation	Causes severe skin burns and eye damage.
Serious eye damage/eye irritation	Causes serious eye damage.
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not an aspiration hazard.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		Species	Test Results
SODIUM HYDROXIDE (NA(OH)) (CAS 1310-73-2)			
Aquatic			
Crustacea	EC50	Water flea (Ceriodaphnia dubia)	34.59 - 47.13 mg/l, 48 hours
Fish	LC50	Western mosquitofish (Gambusia affinis)	125 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

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

Waste from residues / unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

DOT information on packaging may be different from that listed.

15. Regulatory information

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

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

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

PHOSPHORIC ACID (CAS 7664-38-2)	Listed.
SODIUM HYDROXIDE (NA(OH)) (CAS 1310-73-2)	Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

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

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

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

Not regulated.

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

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

PHOSPHORIC ACID (CAS 7664-38-2)	High priority

US state regulations California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

PHOSPHORIC ACID (CAS 7664-38-2)
SODIUM HYDROXIDE (NA(OH)) (CAS 1310-73-2)

International Inventories

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

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

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

Issue date 06-12-2017

Revision date	08-22-2017
Version #	02
HMIS® ratings	Health: 3 Flammability: 0 Physical hazard: 0
NFPA ratings	Health: 3 Flammability: 0 Instability: 1
Disclaimer	While Brenntag believes the information contained herein to be accurate, Brenntag makes no representation or warranty, express or implied, regarding, and assumes no liability for, the accuracy or completeness of the information. The Buyer assumes all responsibility for handling, using and/or reselling the Product in accordance with applicable federal, state, and local law. This SDS shall not in any way limit or preclude the operation and effect of any of the provisions of Brenntag's terms and conditions of sale.
Revision information	Hazard(s) identification: Response Hazard(s) identification: Supplemental information Accidental release measures: Personal precautions, protective equipment and emergency procedures Accidental release measures: Methods and materials for containment and cleaning up Handling and storage: Conditions for safe storage, including any incompatibilities Exposure controls/personal protection: Eye/face protection Exposure controls/personal protection: Hand protection Exposure controls/personal protection: Other Exposure controls/personal protection: PPE Symbols Toxicological information: Carcinogenicity Ecological information: Persistence / degradability

BRENNTAG

SAFETY DATA SHEET

1. Identification

Product identifier **GLYCERINE 99.7% USP KOSH MUSIM RSPO (FIBER) GSO**

Other means of identification

CAS number 56-81-5

Recommended use ALL PROPER AND LEGAL PURPOSES

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name Brenntag Pacific Inc.

Address 10747 Patterson Place
Santa Fe Springs, CA 90670

Telephone 562-903-9626

E-mail Not available.

Emergency phone number 800-424-9300 CHEMTREC

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Not classified.

Environmental hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word None.

Hazard statement The substance does not meet the criteria for classification.

Precautionary statement

Prevention Observe good industrial hygiene practices.

Response Wash hands after handling.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information 100% of the mixture consists of component(s) of unknown acute oral toxicity. 100% of the mixture consists of component(s) of unknown acute dermal toxicity. 100% of the mixture consists of component(s) of unknown acute inhalation toxicity.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
GLYCEROL		56-81-5	100

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact Rinse with water. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed Headache. Nausea, vomiting.

Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Alcohol resistant foam. Dry powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Use water spray to reduce vapors or divert vapor cloud drift. This product is miscible in water. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS). Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

The following are recommendations for Personnel Protective Equipment (PPE). The employer/user of this product must perform a Hazard Assessment of the workplace according to OSHA regulations 29 CFR 1910.132 to determine the appropriate PPE for use while performing any task involving potential exposure to this product.

Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.
Other	Wear appropriate chemical resistant clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Liquid.
Form	Liquid.
Color	CLEAR
Odor	ODORLESS
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	65 °F (18.33 °C)
Initial boiling point and boiling range	554 °F (290 °C) 101.325 kPa
Flash point	390.0 °F (198.9 °C)
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	3.17
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Miscible
Partition coefficient (n-octanol/water)	-1.76
Auto-ignition temperature	739 °F (392.78 °C)
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	10.51 lbs/gal 1.26 g/ml
Dynamic viscosity	17 mPa.s (77 °F (25 °C))
Explosive properties	Not explosive.
Flammability class	Combustible IIIB estimated
Molecular formula	C3-H8-O3
Molecular weight	92.09 g/mol
Oxidizing properties	Not oxidizing.
Percent volatile	100 %
Specific gravity	1.26
VOC	100 % 100 % EPA estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.

Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	No adverse effects due to inhalation are expected.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Headache. Nausea, vomiting.

Information on toxicological effects

Acute toxicity	Not known.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Product		Species	Test Results
GLYCEROL (CAS 56-81-5)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	51000 - 57000 mg/l, 96 hours

Persistence and degradability No data is available on the degradability of this substance.

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

-1.76

Mobility in soil	No data available.
Other adverse effects	The product contains volatile organic compounds which have a photochemical ozone creation potential.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

Transportation information on packaging may be different from that listed.

15. Regulatory information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

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

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1052)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

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

Not regulated.

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

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

GLYCEROL (CAS 56-81-5) Other Flavoring Substances with OSHA PEL's

US state regulations

California Proposition 65

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

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Toxic Chemical Substances (TCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

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

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

Issue date 09-23-2019

Revision date 09-23-2019

Version # 02

HMIS® ratings Health: 0
Flammability: 0
Physical hazard: 0

NFPA ratings Health: 1
Flammability: 1
Instability: 0

Disclaimer While Brenntag believes the information contained herein to be accurate, Brenntag makes no representation or warranty, express or implied, regarding, and assumes no liability for, the accuracy or completeness of the information. The Buyer assumes all responsibility for handling, using and/or reselling the Product in accordance with applicable federal, state, and local law. This SDS shall not in any way limit or preclude the operation and effect of any of the provisions of Brenntag's terms and conditions of sale.

SAFETY DATA SHEET

SODIUM SULFITE Technical Grade

Revision Date 04/02/2015

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

1.1 Product identifier

- Trade name SODIUM SULFITE Technical Grade

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

Uses of the Substance / Mixture

- Manufacture of pulp, paper and paper products
- photographic chemical
- Water treatment
- Reducing agents
- Dyes
- Bleaching agents
- Food additive

1.3 Details of the supplier of the safety data sheet

Company

SOLVAY CHEMICALS, INC.
3333 RICHMOND AVENUE
77098-3099, HOUSTON
USA
Tel: +1-800-7658292; +1-713-5256800
Fax: +1-713-5257804

1.4 Emergency telephone

FOR EMERGENCIES INVOLVING A SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT CONTACT: CHEMTREC 800-424-9300 within the United States and Canada, or 703-527-3887 for international collect calls.

SECTION 2: Hazards identification

Although OSHA has not adopted the environmental portion of the GHS regulations, this document may include information on environmental effects.

2.1 Classification of the substance or mixture

HCS 2012 (29 CFR 1910.1200)

Eye irritation, Category 2A H319: Causes serious eye irritation.

2.2 Label elements

HCS 2012 (29 CFR 1910.1200)

Pictogram

Signal Word

- Warning

Hazard Statements

- H319 Causes serious eye irritation.

Precautionary Statements

Prevention

- P264 Wash skin thoroughly after handling.
- P280 Wear eye protection/ face protection.

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.

2.3 Other hazards which do not result in classification

- H402: Harmful to aquatic life.

- Harmful if swallowed.
- Irritating to eyes.
- Hazardous decomposition products formed under fire conditions.
- May cause sensitization by inhalation.

SECTION 3: Composition/information on ingredients

3.1 Substance

- Not applicable, this product is a mixture.

3.2 Mixture

Hazardous Ingredients and Impurities

- No ingredients are hazardous.

Non Hazardous Ingredients and Impurities

Chemical Name	Identification number CAS-No.	Concentration [%]
Sulfurous acid, sodium salt (1:2)	7757-83-7	>= 98.5

SECTION 4: First aid measures

4.1 Description of first-aid measures

In case of inhalation

- Call a doctor immediately if allergic signs, particularly in the respiratory tract, are observed.
- Oxygen or artificial respiration if needed.
- Remove to fresh air.

Exposure to decomposition products

- If inhaled
- Remove to fresh air.
- Immediate medical attention is required.

In case of eye contact

- Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
- In the case of difficulty of opening the lids, administer an analgesic eye wash (oxybuprocaine).
- Immediate medical attention is required.

In case of ingestion

- If victim is unconscious:
- Never give anything by mouth to an unconscious person.

4.2 Most important symptoms and effects, both acute and delayed

In case of inhalation

Symptoms

- Headache
- Breathing difficulties
- Cardiac irregularities
- loss of consciousness and cardiopulmonary arrest

Effects

- Mild respiratory irritant
- May cause severe allergic respiratory reaction.
- Breathing of dust may aggravate asthma or other pulmonary diseases.

In case of eye contact

Effects

- Moderate eye irritation

4.3 Indication of any immediate medical attention and special treatment needed

- no data available

SECTION 5: Firefighting measures

Flash point	Not applicable
Autoignition temperature	no data available
Flammability / Explosive limit	no data available

5.1 Extinguishing media

Suitable extinguishing media

- Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media

- Water may be ineffective.

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting

- Not combustible.
- Contact with water liberates hazardous gas.
- Sulphur dioxide

Hazardous combustion products:

- Sulphur dioxide
- Sulfur oxides

5.3 Advice for firefighters

Special protective equipment for fire-fighters

- Wear self-contained breathing apparatus and protective suit.
- Use NIOSH approved respiratory protection.

Further information

- Approach from upwind.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel

- Avoid dust formation.

Advice for emergency responders

- Keep away from water.

6.2 Environmental precautions

- The product should not be allowed to enter drains, water courses or the soil.
- In case of accidental release or spill, immediately notify the appropriate authorities if required by Federal, State/Provincial and local laws and regulations.
- Should not be released into the environment.
- Do not flush into surface water or sanitary sewer system.

6.3 Methods and materials for containment and cleaning up

- Collect the product with suitable means.
- Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

- no data available

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- Persons with a history of skin sensitization problems or asthma, allergies, chronic or recurrent respiratory disease should not be employed in any process in which this mixture is being used.
- Use only in well-ventilated areas.
- Avoid dust formation.
- Protect from moisture.
- Avoid prolonged or repeated contact with skin.

Hygiene measures

- Wash contaminated clothing before re-use.
- Eye wash bottle with pure water
- Use only in an area equipped with a safety shower.
- Handle in accordance with good industrial hygiene and safety practice.
- When using do not eat, drink or smoke.

7.2 Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions

- Keep away from heat/sparks/open flames/hot surfaces. No smoking.
- For personal protection see section 8.

7.3 Specific end use(s)

- Sulfite-sensitive individuals may experience a severe allergic reaction. This product in contact with heat, water, ice, acids, or oxidizing agents releases sulfur dioxide gas which may be harmful or deadly when inhaled. Do not use in a dry form in the holds of fishing boats or walk-in coolers.
- Contact your supplier for additional information

SECTION 8: Exposure controls/personal protection

Introductory Remarks: These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

8.1 Control parameters

- Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Control measures

Engineering measures

- Ensure adequate ventilation.
- Provide appropriate exhaust ventilation at machinery and at places where dust can be generated.

Individual protection measures

Respiratory protection

- When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
- In the case of vapor formation use a respirator with an approved filter.
- Use NIOSH approved respiratory protection.
- In the case of dust or aerosol formation use respirator with an approved filter.

Hand protection

- Protective gloves

Eye protection

- Chemical resistant goggles must be worn.

Skin and body protection

- Preventive skin protection
- Wear suitable protective clothing.

Hygiene measures

- Wash contaminated clothing before re-use.
- Eye wash bottle with pure water
- Use only in an area equipped with a safety shower.
- Handle in accordance with good industrial hygiene and safety practice.
- When using do not eat, drink or smoke.

SECTION 9: Physical and chemical properties

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product information phone number in Section 1 for its exact specifications.

9.1 Information on basic physical and chemical properties

Appearance	Form: granular Physical state: solid solid Color: white white
Odor	odorless
Odor Threshold	no data available
pH	9.6 - 9.8 (10 g/l)
Boiling point/boiling range	Not applicable
Flash point	Not applicable
Evaporation rate (Butylacetate = 1)	no data available
Flammability (solid, gas)	The product is not flammable.
Flammability / Explosive limit	Explosiveness: Not applicable
Autoignition temperature	no data available
Vapor pressure	no data available
Vapor density	no data available
Density	Bulk density: 1.5 - 1.6 kg/m3
Solubility	Water solubility : 250 g/l (68 °F (20 °C))
Partition coefficient: n-octanol/water	log Pow: -4 (77 °F (25 °C))
Thermal decomposition	>= 1112 °F (>= 600 °C)
Viscosity	no data available
Explosive properties	no data available
Oxidizing properties	Not considered as oxidizing., oxygen scavenger

9.2 Other information

Molecular weight	126.04 g/mol

SECTION 10: Stability and reactivity

10.1 Reactivity

- no data available

10.2 Chemical stability

- Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

- no data available

10.4 Conditions to avoid

- Heat.
- Exposure to moisture.

10.5 Incompatible materials

- Water
- Acids
- Oxidizing agents

10.6 Hazardous decomposition products

- Sulphur dioxide
- Sulfur oxides

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute oral toxicity	LD50 : 820 mg/kg - Mouse LD50 : > 2,000 mg/kg - Rat
Acute inhalation toxicity	no data available
Acute dermal toxicity	no data available
Acute toxicity (other routes of administration)	no data available
Skin corrosion/irritation	Rabbit No skin irritation
Serious eye damage/eye irritation	Rabbit Eye irritation

Respiratory or skin sensitization no data available

Mutagenicity

Genotoxicity in vitro In vitro tests showed mutagenic effects

Genotoxicity in vivo no data available

Carcinogenicity no data available

This product does not contain any ingredient designated as probable or suspected human carcinogens by:
NTP
IARC
OSHA
ACGIH

Toxicity for reproduction and development

Toxicity to reproduction / fertility no data available

Developmental Toxicity/Teratogenicity no data available

STOT

STOT-single exposure no data available

STOT-repeated exposure no data available

Aspiration toxicity no data available

Further information Harmful if swallowed.
Moderate eye irritation
May cause sensitization of susceptible persons by inhalation of aerosol or dust.

SECTION 12: Ecological information

12.1 Toxicity

Aquatic Compartment

Acute toxicity to fish LC50 - 96 h : 100 mg/l - Carassius auratus (goldfish)

12.2 Persistence and degradability

Biodegradation

Biodegradability Method: Biochemical Oxygen Demand (BOD)
instantaneous reaction

12.3 Bioaccumulative potential

Bioconcentration factor (BCF)	Bioaccumulative potential
12.4 Mobility in soil	no data available
12.5 Results of PBT and vPvB assessment	no data available
12.6 Other adverse effects	no data available
Remarks	oxygen scavenger, Ecological injuries are not known or expected under normal use.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product Disposal

- Respect local/federal and national regulations for:
- Hazardous waste
- Contact waste disposal services.

Advice on cleaning and disposal of packaging

- To avoid treatments, as far as possible, use dedicated containers.
- Containers that cannot be cleaned must be treated as waste.
- In accordance with local and national regulations.

SECTION 14: Transport information

DOT
not regulated

TDG
not regulated

NOM
no data available

IMDG
not regulated

IATA
not regulated

Note: The above regulatory prescriptions are those valid on the date of publication of this sheet. Given the possible evolution of transportation regulations for hazardous materials, it would be advisable to check their validity with your sales office.

SECTION 15: Regulatory information

15.1 Notification status

Inventory Information	Status
United States TSCA Inventory	Listed on Inventory
New Zealand. Inventory of Chemical Substances	In compliance with the inventory
Canadian Domestic Substances List (DSL)	Listed on Inventory
Australia Inventory of Chemical Substances (AICS)	Listed on Inventory
Japan. CSCL - Inventory of Existing and New Chemical Substances	Listed on Inventory
Korea. Korean Existing Chemicals Inventory (KECI)	Listed on Inventory
China. Inventory of Existing Chemical Substances in China (IECSC)	Listed on Inventory
Philippines Inventory of Chemicals and Chemical Substances (PICCS)	Listed on Inventory

15.2 Federal Regulations

US. EPA EPCRA SARA Title III

SARA Hazard Designation Sections 311/312 (40 CFR 370)

Fire Hazard	no
Reactivity Hazard	no
Sudden Release of Pressure Hazard	no
Acute Health Hazard	yes
Chronic Health Hazard	yes

Section 313 Toxic Chemicals (40 CFR 372.65)

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.

Section 302 Emergency Planning Extremely Hazardous Substance Threshold Planning Quantity (40 CFR 355)

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

Section 302 Emergency Planning Extremely Hazardous Substance Reportable Quantity (40 CFR 355)

This material does not contain any components with a SARA 302 RQ.

Section 304 Emergency Release Notification Reportable Quantity (40 CFR 355)

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

US. EPA CERCLA Hazardous Substances and Reportable Quantities (40 CFR 302.4)

This material does not contain any components with a CERCLA RQ.

15.3 State Regulations

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

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

SECTION 16: Other information

NFPA (National Fire Protection Association) - Classification

Health	2 moderate
Flammability	0 minimal
Instability or Reactivity	1 slight
Special Notices	None

HMIS (Hazardous Materials Identification System (Paint & Coating)) - Classification

Health	2 moderate
Flammability	0 minimal
Reactivity	1 slight
PPE	Determined by User; dependent on local conditions

Further information

- Product evaluated under the US GHS format.

Date Prepared: 04/02/2015

- ACGIH	American Conference of Governmental Industrial Hygienists
- OSHA	Occupational Safety and Health Administration
- NTP	National Toxicology Program
- IARC	International Agency for Research on Cancer
- NIOSH	National Institute for Occupational Safety and Health

TETRA TECH	**IN-SITU BIOREMEDIATION INJECTIONS BATCH MIXING AND INJECTIONS FIELD GUIDANCE DOCUMENT**	
		Rev. 0.0
Seep Well Field Area Bioremediation Treatability Study	**Nevada Environmental Response Trust**	Date: November 2019
		Reviewed/Approved

Summary:	Attachment B – Injection Field Forms
Documentation:	1. Chemical Tracking Log 2. Groundwater Extraction Log 3. Batch Mixing Log 4. Daily Injection Log 5. Injection Pressure and Flow Rate Log 6. Specific Gravity Log

TETRA TECH

CHEMICAL TRACKING LOG

Task Name:	Task No:	Date:
Injection Event:	Task Manager:	Recorded by:

Chemical	Supplier	Date Received	Time Received	Quantity	Date of Container Pick-up	Time of Container Pick-Up	Comments

gpm - gallons per minute psi- pounds per square inch

TETRA TECH

GROUNDWATER EXTRACTION LOG

Task Name:	Task No:	Date:
Task Manager:	Injection Event:	Recorded by:

Date	Start Time	Stop Time	Extraction Well ID	Current Flow Rate	Total Volume Extracted (Totalizer)	Average Flow Rate (Total/Time)	Cumulative Event Total Volume	Comments
				gpm	gal	gpm	gal	
					Summary			
					Summary			
					Summary			

Date	Time	Tank Number	Current Tank Level	Current Tank Volume	Comments
			feet	gal	

Notes/Comments:

gal - gallons gpm - gallons per minute

TETRA TECH

BATCH MIXING LOG

Page ___ of ___

Task Name:	Task No:	Date:
Task Manager:	Injection Event:	Recorded by:

Date: ***Batch Number:*** ***Tank Number:***

Batch Formula

Chemical Name	Density	Mass	Volume	Concentration	Comments
	lbs/gal	lbs	gal	wt.%	
TOTAL					

Addition of Injectate Solution Chemicals

Chemical Name	Addition Start Time	Addition Stop Time	Addition Method and Equipment	Comments

Batch Mixing

Method	Equipment	Start Time	Stop Time

Notes/Comments:

lbs/gal - pounds per gallon gal - gallons lbs - pounds wt.% - weight percent

TETRA TECH

DAILY INJECTION LOG

Task Name:	Task No:	Date:
Injection Event:	Task Manager:	Recorded by:

Injectate: ***Tank Number:*** ***Batch Number:***

Injection Well ID	Start Time	Previous Total	Initial Pressure	Initial Flow Rate	Stop Time	Daily Volume Injected	Cumulative Volume Injected	Comments
		gal	psi	gpm		gal	gal	
					Summary			

Frac Tank Level			
Tank Number	Time	Level (ft)	Volume (gal)

Daily Comments/Notes:

gal - gallons gpm - gallons per minute psi- pounds per square inch ft - feet

TETRA TECH

INJECTION PRESSURE AND FLOW RATE LOG

Task Name:	Task No:	Date:
Injection Event:	Task Manager:	Recorded by:

Injectate: ***Tank Number:*** ***Batch Number:***

Injection Well ID	Date	Time	Pressure	Flow Rate	Comments
			psi	gpm	

gpm - gallons per minute psi- pounds per square inch

TETRA TECH

SPECIFIC GRAVITY LOG

NERT, Henderson, Nevada

Task Name:	Task No:	Date:
Sample Collection Method:	Field Parameters Equipment and SN:	Task Manager:
Specific Gravity Test Equipment S/N:		Recorded by:

Date	Time	BATCH			Atmospheric Temperature (°C)	Hydrometer Calibration Temperature (°C)	Sample Duplicate ID	Sample Temperature (°C)	Specific Gravity	Comments
		Batch Number	Initial	Remaining at Sample Time						
			Tank Level: Volume:	Tank Level: Volume:			a			
							b			
							c			
							d			
							e			
			Tank Level: Volume:	Tank Level: Volume:			a			
							b			
							c			
							d			
							e			
			Tank Level: Volume:	Tank Level: Volume:			a			
							b			
							c			
							d			
							e			

Notes/Comments:

TETRA TECH	**IN-SITU BIOREMEDIATION INJECTIONS BATCH MIXING AND INJECTIONS FIELD GUIDANCE DOCUMENT**	
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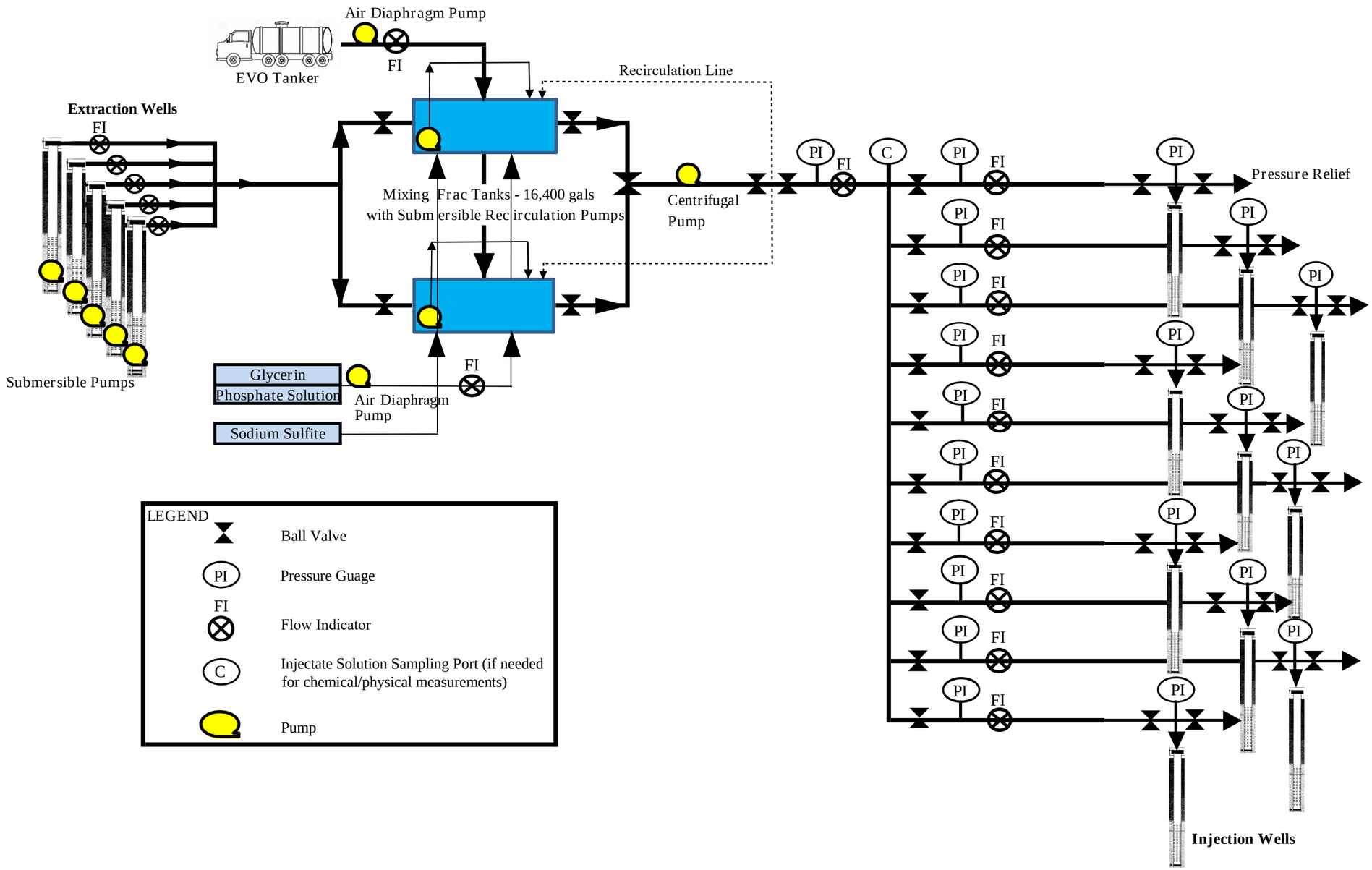
Summary:	Attachment C – Process Flow Diagram
Documentation:	1. Process Flow Diagram

Cascade Technical Services
Typical Process Flow Diagram for NERT Seep Well Field Area Bioremediation Treatability Study, Henderson, Nevada



Note: Because this Field Guidance Document process flow diagram is for a treatability study, it may be periodically updated based on lessons learned during injections.