Safety Data Sheet

1. Identification

Product Identifier: Produced Water (Sour, Non-flammable)

Other Means of Identification: Formation water, Produced Brine

Product use: For disposal

Restrictions on use: Do not use for purposes other than those listed above

Manufacturer: Keyera and Affiliates

Address: Suite 200, The Ampersand, West Tower
144 – 4th Avenue SW
Calgary, AB, T2P 3N4

Main Phone Number: (403) 205-8300 / 1 (888) 699-4853 (Mon. - Fri. 8 AM - 5 PM)

Transportation Emergencies Only: CANUTEC (CAN) Ph:1-888-CAN-UTEC(226-8832) Cell*666 (24 hr)
CHEMTREC (US) Ph: 1-800-424-9300 (24 hr)

2. Hazards Identification

GHS Hazards

Pictogram	Classification	Hazard Statements
No Pictogram	Flammable Liquid – Category 4	Combustible liquid
	Acute Toxicity – Inhalation – Category 2	Fatal if inhaled.

Other Hazards

- The quantity of dissolved hydrogen sulphide H_2S is much less than the solubility (~0.4 wt.% at 20°C water), there is still slight chance H_2S may degas resulting in exposure by inhalation.

  There are no visible warning signs of its presence because it is colorless. Although it typically has a "rotten-egg" odor even at very low concentrations (<1 ppm), it becomes odorless at high concentrations (approx. >50 ppm) due to the loss of olfactory function (sense of smell).
- Harmful to aquatic life with long lasting effects.

Signal Word: Danger

Precautionary Statements:

Prevention

- Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
- Do not breathe gas or vapour.
- Use only outdoors or in a well-ventilated area.
- Wear protective gloves/protective clothing/eye protection/face protection.

Response

- In case of fire: use appropriate media to extinguish.
- If inhaled: Remove person to fresh air and keep comfortable for breathing.
- Immediately call a doctor or physician.

Storage

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

Disposal

- Dispose of contents/container in accordance with applicable local, provincial/state, and federal regulations place.

3. Composition/Information on Ingredients

Chemical Name: Produced Water

Common Name/Synonyms: Formation Water, Produced Brine

Ingredient Name	Weight %	CAS No.
Water	95 - 98	7732-18-5
Minerals salts Cations: sodium, potassium, calcium Anions: chlorides, carbonate, sulphate	2 - 5	Not applicable
Hydrogen Sulphide	0.001 - 0.05	7783-06-4
Crude oil and hydrocarbons	0 - Trace	8002-05-9
Benzene	0 - 0.01	71-43-2
Toluene	0 - 0.01	108-88-3
Xylene (all isomers)	0 - 0.001	1330-20-7
Ethylbenzene	0 - 0.001	100-41-4

Dissolved hydrogen sulphide may degas into the atmosphere, resulting in exposure by inhalation. An engineering simulation with (worst case) 500 wppm H_2S in water at 0°C, and assuming a tank at atm pressure with only 5 volume% air headspaces: when the enclosed tank is heated to 35°C, the H_2S concentration may be as high as 1180 vppm in the headspace.

4. First Aid Measures

Immediate Medical Attention and Special Treatment:
Treat symptomatically and supportively. Refer also to Table below.

First Aid:	
Inhalation:	Remove person to fresh air and keep comfortable for breathing. If exposed or concerned: Call a doctor/physician.
Skin:	Rinse skin with water/shower. If skin irritation occurs: get medical advice/attention.
Eyes:	Rinse cautiously with water for several minutes. If eye irritation persists: get medical advice/attention.
Ingestion:	If swallowed: Do not induce vomiting. Get medical advice/attention.

Most Important Effects and Symptoms, Acute or Delayed:		
Exposure Route	**Health Effects**	**Symptoms of Exposure**
Inhalation:	Inhalation of large amount of hydrogen sulphide may cause damage to the cardiovascular system, central nervous system, and respiratory system.	Shortness of breath to dizziness to death.
Skin:	Not expected to be an entry route.	Irritation.
Eyes:	Contact with hydrogen sulphide gas may cause burn or eye damage.	Irritation, tearing, visual disturbances.

5. Fire Fighting Measures

Flammability: No. Considered Combustible Liquid when flash point is 60-100°C.	**Hazardous Combustion Products:** Combustion of degassed H_2S may produce sulphur dioxide (SO_2), which is corrosive.
Explosion: Sensitive to Impact: No.	**Sensitive to static discharge:** No.
Extinguishing Media: Small Fire: dry chemical, CO_2, or water spray. Large Fire: alcohol-resistant foam or water spray. Do not use straight streams.	**Unsuitable Extinguishing Media:** High-pressure water jet.

Special Protective Equipment for Firefighters:

- Wear full protective clothing and NIOSH-approved SCBA with full face-piece.

Precautions for Firefighters:

- There are no visible warning signs of presence H_2S because it is colorless. Although it typically has a "rotten-egg" odor even at very low concentrations (<1 ppm), it becomes odorless at high concentrations (approx. >50 ppm) due to the loss of olfactory function (sense of smell).
- Combustible material: may burn but does not ignite readily.
- **If** the material burns due to presence of H_2S: the flame will be bluish, forming toxic by-products such as sulphur dioxide (SO_2), which is corrosive.
- Containers may explode when heated.
- Move container from fire area if it can be done without risk.
- Stay away from tanks engulfed in fire.
- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (½ mile) in all directions; also, consider initial evacuation for 800 meters (½ mile) in all directions.
- Cool fire-exposed containers with flooding quantities of water from a far distance.
- Apply cooling water to containers that are exposed to flames until well after fire is out.
- Refer to Guide 152 of the Emergency Response Guidebook (Transport Canada/US Dept. of Transportation).

Unusual Fire and Explosion Hazards:

- None.

6. Accidental Release Measures

Protective Equipment:

Gloves:	Recommended: neoprene and nitrile. Not recommended: polyvinyl chloride PVC.
Clothing:	Flame-retardant coverall e.g. Nomex, Proban.
Respirator:	NIOSH Approved Supplied-Air Respirator or SCBA where large H_2S concentration is anticipated, and the exposure level is unknown or where an oxygen-deficient atmosphere may exist.
Eye:	Safety glasses with side shields, safety goggles or face shields.

Large spills: wear full protective clothing and NIOSH-approved SCBA with full face-piece.

Precautions:

- Do not breathe gas/vapors if there is chance that the H_2S may degas.
- There are no visible warning signs of presence H_2S because it is colorless. Although it typically has a "rotten-egg" odor even at very low concentrations (<1 ppm), it becomes odorless at high concentrations (approx. >50 ppm) due to the loss of olfactory function (sense of smell).

Emergency Procedures:

- Evacuate area of all unnecessary personnel.
- As an immediate precautionary measure, isolate spill/leak area in all directions for at least 50 meters (150 feet), and twice the distance in direct downwind direction.
- Emergency personnel must wear appropriate personal protective equipment.
- Eliminate all ignition sources.
- Stop leak if you can do it without risk.
- Ventilate area of leak or spill.
- Refer to Guide 152 of the Emergency Response Guidebook (Transport Canada/US Dept. of Transportation).

Containment and Clean-up:

- Dike far ahead of liquid spill for containment and cleanup. Collect spillage with inert or other non-combustible material (e.g., vermiculite, dry sand, earth), and place in container for later disposal.
- Hydrogen sulphide reacts with the iron in steel equipment to form iron sulphide scale, which is pyrophoric. Use coated or stainless-steel containers.
- Prevent entry into waterways, sewers, basements or confined areas.
- Runoff may pollute waterways.
- Dispose of contents/container in accordance with applicable local, provincial/state, and federal regulations.

7. Handling and Storage

Handling Precautions:

- Use only outdoors or in a well-ventilated area.
- Do not breathe gas/vapors if there is chance that the H_2S may degas.
- There are no visible warning signs of presence H_2S because it is colorless. It typically has a "rotten-egg" odor even at very low concentrations (<1 ppm), it becomes odorless at high concentrations (approx. >50 ppm) due to the loss of olfactory function (sense of smell).
- Do not eat, drink or smoke when using this product.
- Wear protective gloves/clothing and eye/face protection.

Storage Precautions:

Locations

- Store in a cool, dry, well-ventilated location, away from any area of fire-hazard.
- Outside or detached storage is preferred.

Containers

- Hydrogen sulphide reacts with the iron in steel equipment to form iron sulphide scale, which is pyrophoric. Use coated or stainless-steel containers.
- Keep container tightly closed.

Other precautions

- Handle product as H_2S containing material: dissolved gas may degas into the headspace.

8. Exposure Controls / Personal Protection

EXPOSURE LIMITS

	Authority	15 MINS STEL or Ceiling	8-HOURS
Hydrogen sulphide (CAS 7783-06-4)	Alberta, Ontario	15 ppm (21 mg/m^3) Ceiling	10 ppm (14 mg/m^3)
	BC	10 ppm (14 mg/m^3) Ceiling	-
Benzene (CAS 71-43-2)	Alberta	2.5 ppm (8 mg/m^3) – skin	0.5 ppm (1.6 mg/m^3) – skin
	Ontario, BC	2.5 ppm – skin	0.5 ppm – skin
Toluene (CAS 108-88-3)	Alberta	-	50 ppm (188 mg/ m^3)
	Ontario, BC	-	20 ppm (75 mg/ m^3)
Xylene (o-,m-,p- isomers) (CAS 1330-20-7)	Alberta	150 ppm (650 mg/ m^3)	100 ppm (434 mg/m^3)
	Ontario, BC	150 ppm	100 ppm
Ethylbenzene (CAS 100-41-4)	Alberta	125 ppm (543 mg/ m^3)	100 ppm (434 mg/ m^3)
	Ontario, BC	-	20 ppm (87 mg/ m^3)

ENGINEERING CONTROLS

- Ventilate area where product is used.
- Exhaust/ventilate to the outside. Ventilation equipment must be explosion proof.
- Ventilation system should be grounded and separate from other exhaust ventilation systems. Adequate make-up air must be provided.

PERSONAL PROTECTIVE EQUIPMENT

Gloves: Recommended: neoprene and nitrile;
Not recommended: polyvinyl chloride PVC.

Clothing: Flame-retardant coverall e.g. Nomex, Proban.

Respirator: NIOSH Approved Supplied-Air Respirator or SCBA where large H_2S concentration is anticipated, or when the exposure level is unknown.

Eye: Safety glasses with side shields, safety goggles or face shields.

9. Physical and Chemical Properties

Chemical Formula: H_2O		**Molecular Weight:** 18.00 g/mole (water)	**Physical State:** Liquid
Appearance: Slight amber color		**Odor:** Slight rotten egg odor (if H_2S degassed)	**Odor Threshold:** ~ 10 ppb (degassed H_2S)
pH: ~5-9	**Melting/Freezing Point:** 0 to -5°C	**Boiling Point:** 95 - 100°C	**Boiling Range:** Not available
Flash Point: 60 - 100°C (closed cup)		**Flammability:** No	**Evaporation Rate:** Not available
Upper-Lower Explosive Limit: Not Applicable (non-explosive)		**Vapor Pressure:** Not available	**Vapor Density:** Not available
Density: ~ 1.00 – 1.100 kg/m^3		**Soluble in water (@20°C):** ~100%	**Percent Volatile:** ~ 0%
Partition Coefficient n-octanol/water: Not available		**Auto-Ignition Temperature:** None	**Decomposition Temp.:** None (does not decompose)
Viscosity: 1.0 – 1.3 cSt (15°C)		**Henry's Law Constant:** Not available	**Isobaric Heat Capacity:** Not available

10. Stability and Reactivity

Reactivity:
Avoid incompatible materials: may react violently with oxidizers.

Chemical Stability:
Stable under normal temperatures and pressures.

Possibility of Hazardous Reactions:
Polymerization has not been reported to occur under normal temperature and pressure conditions.

Conditions to Avoid:
- Extreme temperatures and pressures.
- Incompatible materials.

Incompatible Materials:
- Strong, oxidizing agents.
- Iron. Hydrogen sulphide if degassed, will react with the iron in steel equipment to form iron sulphide scale, which is pyrophoric.

Hazardous Decomposition Products:
- No known decomposition product of this material.
- Combustion (of the hydrocarbon or H_2S) forms carbon monoxide, carbon dioxide, sulphur dioxide, and acrid smoke.

11. Toxicological Information

Exposure Route	Acute Health Effects	Symptoms of Exposure
Inhalation:	Effects of H_2S gas on the Central Nervous system (CNS) may include mild respiratory depression.	rapid breathing to dizziness to fatality.
Skin:	Skin irritation.	Itchy skin.
Eye:	In the unlikely event, contact with degassed H_2S may cause eye damage.	Irritation, tearing, visual disturbances.
Ingestion:	Not expected to be a route of exposure.	

Chronic Exposure:

Inhalation:
Repeated or prolonged exposure to degassed H_2S may cause damage to the central nervous system (CNS), the nervous and the heart system.

Skin:
Not known to be a skin-sensitizer. Repeated and prolonged contact may cause dry, red, cracked skin (dermatitis).

Medical Conditions Aggravated by Exposure:
None.

Sensitization:	**Reproductive Toxicology:**	**Teratogenicity:**	**Mutagenicity:**
No	No	No	No

Carcinogenicity:	**Irritancy:**	**Target Organs:**
Benzene: • ACGIH A1 • IARC: Group 1 • NTP Known Human Carcinogen • OSHA: Present	No.	Single exposure: If exposed to H_2S, Central Nervous System (CNS), heart. Repeated exposure: no data available.

Lethality Tests:

Chemical Name	CAS No.	LD50	LC50
Hydrogen sulphide	7783-06-4		Rat, inhalation 0.99 mg/L, 1 h
Benzene	71-43-2	Oral, Rat 810 mg/kg Dermal Rabbit >8200 mg/kg	Inhalation Rat 44.66 mg/L 4 h
Toluene	108-88-3	Oral Rat 2600 mg/kg Dermal Rabbit 12000 mg/kg	Rat 12.5 mg/L 4 h
Xylenes	1330-20-7	Oral Rat 3500 mg/kg Dermal Rabbit >4350 mg/kg	Rat 29.08 mg/L 4 h
Ethyl benzene	100-41-4	Oral Rat 3500 mg/kg Dermal Rabbit 15400 mg/kg	Rat 17.4 mg/L 4 h

12. Ecological Information

Persistence & Degradability: Chronic aquatic toxicity Category 3.	**Bioaccumulative Potential:** No.
Mobility: No data available.	**Other Adverse Effects:** See below.

Eco Toxicity Tests:

Chemical Name	CAS No.		
Hydrogen sulphide	7783-06-4	Fish	Lepomis macrochirus (Bluegill) LC50 = 0.0448 mg/L: 96 hrs flow-through
			Pimephales promelas (Fathead minnow) LC50 = 0.016 mg/L: 96 hrs. flow-through
Benzene	71-43-2	Fish	LC50 96 h Lepomis macrochirus 22.49 mg/L [static] LC50 96 h Pimephales promelas 22330 - 41160 µg/L [static]
Toluene	108-88-3	Fish	LC50 96 h Pimephales promelas 15.22 - 19.05 mg/L [flow-through] (1 day old); LC50 96 h Pimephales promelas 12.6 mg/L [static]
Xylene	1330-20-7	Fish	LC50 96 h Pimephales promelas 15.22 - 19.05 mg/L [flow-through] (1 day old); LC50 96 h Pimephales promelas 12.6 mg/L [static] LC50 96 h Pimephales promelas 15.22 - 19.05 mg/L [flow-through] (1 day old); LC50 96 h Pimephales promelas 12.6 mg/L [static]
Ethylbenzene	100-41-4	Fish	LC50 96 h Lepomis macrochirus 32 mg/L [static] LC50 96 h Pimephales promelas 7.55 - 11 mg/L [flow-through]

13. Disposal Considerations

Waste Disposal:

- Dispose of waste material at an approved (hazardous) waste treatment/disposal facility in accordance with applicable local, provincial/state, and federal regulations.
- Do not dispose of waste with normal garbage, or to sewer systems.

14. Transport Information

TDG (CANADA) CLASSIFICATION

PROPER SHIPPING NAME: Toxic Liquid, N.O.S. (Hydrogen Sulphide)
CLASS: 6.1 **UN NUMBER:** UN3287
PACKING GROUP: II **LABEL/PLACARD:**

Special Provision: 16

The technical name of at least one of the most dangerous substances that predominantly contributes to the hazard or hazards posted by the dangerous goods must be shown, in parenthesis, on the shipping document following the shipping name in accordance with clause 3.5(1)(c)(ii)(A) of Part 3 (Documentation)

Caution:

- *As produced water is traditionally hauled by trucks that previously transported other products (e.g. crude, condensate) and not steamed or rinsed, the product remaining in these trucks may change the composition of this product (Sour, Non-Flammable Produced Water)*
- *The Consignor must review the content remaining in the incoming truck, by examining "residue-last-contained", and may need to placard the produced water accordingly*

15. Regulatory Information

CANADA

DSL – yes (H_2S, benzene, toluene, xylene and ethyl benzene).

16. Other Information

Prepared for: Keyera Health and Safety
Issue Date/ Revision No: August 17, 2021/ Revision #2

Revisions:	**Dates:**	**Main Changes**
• Original:	January 3, 2011	None
• 1st revision:	October 31, 2014	Reformat to comply with GHS requirement
• 2nd revision	August 17, 2021	Updated phone numbers and address

Glossary

ACGIH – American Conference of Governmental Industrial Hygiene
DOT – US Department of Transportation
DSL – Domestic Substance List (Canada)
E2 – Environmental Emergencies (Canada)
GHS – Globally Harmonized System
IARC – International Agency for Research on Cancer
IDLH – Immediately Dangerous to Life and Health
NIOSH – National Institute for Occupational Safety & Health
NPRI – National Pollutant Release Inventory (Canada)
NTP – National Toxicology Program
OSHA – Occupational Safety & Health Administration of the US Depart of Labour
PEL – Permissible Exposure Limit
SARA – Superfund Amendments and Reauthorization Act of 1986
STEL – Short Term Exposure Limit
TRI – US Toxic Release Inventory
TSCA – Toxic Substance Control Act
TWA – Time Weighed Average

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~ End of Safety Data Sheet ~