Safety Data Sheet

1. Identification

Product Identifier: Produced Water (Sour, 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
	Flammable Liquids – Category 2	Highly flammable liquid and vapor
	Germ Cell Mutagenicity - Category 1B Carcinogenicity - Category 1A Reproductive Toxicity - Category 1A	May cause genetic defects. May cause cancer. May damage fertility or the unborn child.
	Acute Toxicity – Inhalation – Category 2	Fatal if inhaled.

Other Hazards

- Dissolved hydrogen sulphide may degas into the headspace above the produced water, and create a hydrogen sulphide (H_2S) rich atmosphere of up to 5-6% by volume.
- Hydrogen sulphide is flammable. The head space with high concentration of hydrogen sulphide (H_2S) may contain a flammable atmosphere.
- 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).
- Toxic 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.
- Keep container tightly closed.
- Ground and bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting equipment.
- Use non-sparking tools.
- Take action to prevent static discharges.
- Wear respiratory protection.
- Wear protective gloves/ protective clothing/ eye protection/ face protection.
  Gloves: neoprene, nitrile.
  Clothing: fire-retardant Nomex, Proban.
  Eye: Safety glasses with side shields or goggles.

- Do not breathe gas or vapour.
- Wash hands and exposed areas thoroughly after handling.
- Do not eat, drink or smoke when using this product.
- Use only outdoors or in a well-ventilated area.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.

Response

- In case of fire: use dry chemical, CO_2, or fire-fighting foam to extinguish.
- In case of leakage, eliminate all ignition sources.

- If inhaled: Remove person to fresh air and keep comfortable for breathing. Immediately call a doctor or physician.
- If on skin (or hair): take off immediately all contaminated clothing. Rinse skin with water/shower.
- If exposed or concerned: Call a doctor/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.

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 – 0.7	7783-06-4
Crude oil and hydrocarbons	0 - Trace	8002-05-9
Benzene	0 – 0.4	71-43-2
Toluene	0 – 0.1	108-88-3
Xylene (all isomers)	0 – 0.2	1330-20-7
Ethylbenzene	0 – 0.02	100-41-4

Dissolved hydrogen sulphide will degas into the atmosphere, resulting in high concentration of hydrogen sulphide gas of up to 5-6% in the head-space.

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 loss of consciousness to fatality.
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: Yes. Residual hydrocarbon on top of the produced water may be highly flammable.	**Hazardous Combustion Products:** Carbon monoxide (CO), carbon dioxide (CO_2), acrid smoke and sulphur dioxide (SO_2).
Explosion: Sensitive to impact: No.	**Sensitive to static discharge:** No

Extinguishing Media:
Small Fire: dry chemical, CO_2. Water spray or alcohol-resistant foam.
Large Fire: water spray or fog. Do not use straight streams.

Unsuitable Extinguishing Media:

- Foam, high pressure water streams.

Special Protective Equipment for Firefighters:

- Wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full face-piece, when anticipating handling of H_2S.
- Suitable materials for skin protection against H_2S: Tychem® BR/LV, Tychem® Responder® CSM

Precautions for Firefighters:

- **If H_2S Degasses: Do Not Extinguish a Leaking Gas Fire Unless the Leak Can Be Stopped.**
- H_2S flame will be bluish, forming toxic by-products such as sulphur dioxide (SO_2), which is corrosive.
- 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).
- If tank, rail car or tank truck is involved in a fire, ISOLATE and consider initial evacuation in all directions for 800 meters (0.5 mile).
- Move container from fire area if you can do it without risk.
- Apply cooling water to sides of containers exposed to flames until well after fire is out.
- Cool fire-exposed containers with flooding quantities of water applied from as far a distance as possible.
- A vapour-suppressing foam may be sued to reduce vapours.
- Stay away from ends of tanks.
- Containers exposed to fire may explode or vent through pressure-relief devices.
- Refer to Guide 131 of the Emergency Response Guidebook (Transport Canada/US Dept. of Transportation).

Unusual Fire and Explosion Hazards:

- Degassed H_2S is highly flammable. The vapors are heavier than air and may accumulate in low areas and /or spread along ground to distant ignition sources and flash back.
- Although hydrogen sulphide is heavier than air, it may behave like a light gas and can be carried some distance downwind of the release source, when it is carried upward by wind, or released at a temperature higher than the ambient air temperature.

6. Accidental Release Measures

Protective Equipment:

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

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

Suitable materials for skin protection: Tychem® BR/LV, Tychem® Responder® CSM

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 (hydrocarbon and/or H_2S).
- 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).
- The flammable vapors are heavier than air and may accumulate in low areas and /or spread along ground to distant ignition sources and flash back.
- Although hydrogen sulphide is heavier than air, it may behave like a light gas and can be carried some distance downwind of the release source, when it is carried upward by wind, or released at a temperature higher than the ambient air temperature.

Emergency Procedures:

- Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Shut off leak/release source, if it can be done safely. Ventilate area of leak or spill.
- Evacuate area of all unnecessary personnel.
  Small spill: absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
  Large spill: dike far ahead of liquid spill for containment and cleanup. Water spray may reduce vapour but may not prevent ignition in closed spaces.
- Consider downwind evacuation of at least 800 m (½ mile.). If tank, rail car or tank truck is involved in a fire, ISOLATE & consider initial evacuation all directions for 800 m (½ mile).
- Emergency personnel must wear appropriate personal protective equipment.

Containment and Clean-up:

- Use non-sparking tools and equipment. All equipment used must be grounded.
- Dike far ahead of liquid spill for containment and cleanup. Collect spillage with inert material (vermiculite, dry sand, earth), and place in coated metal container which can be grounded. Do not use combustible materials, such as sawdust, as absorbent.
- If a leak or spill has not ignited, use water spray to disperse the vapors or divert vapor cloud draft. Do not direct water at spill or source of leak.
- Prevent entry into waterways, sewers, basements or confined areas.
- Hydrogen sulphide reacts with the iron in steel equipment to form iron sulphide scale, which is pyrophoric. Use coated or stainless-steel containers.
- Dispose of contents/container in accordance with applicable local, provincial/state, and federal regulations.
- Refer to Guide 131 of the Emergency Response Guidebook (Transport Canada/US Dept. of Transportation).

7. Handling and Storage

Handling Precautions:

- Do not breathe gas or vapour. Use only outdoors or in a well-ventilated area.
- 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).
- Keep away from heat, hot surfaces, sparks, open flames & other ignition sources. No smoking.
- Ground and bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting equipment. Use non-sparking tools.
- Take action to prevent static discharges.
- Wear protective gloves/ protective clothing/ eye protection/ face protection.
  Gloves: neoprene, nitrile. Clothing: fire-retardant Nomex, Proban.
  Suitable materials for skin protection against H_2S: Tychem® BR/LV, Tychem® Responder® CSM.
- Eye: Safety glasses with side shields or goggles.

Storage Precautions:

Locations

- Store in a well-ventilated place. Keep container tightly closed. Keep cool.
- Storage and use areas should be No Smoking areas. Store locked-up.

Containers

- Keep container tightly closed.
- Hydrogen sulphide reacts with the iron in steel equipment to form iron sulphide scale, which is pyrophoric. Use coated or stainless-steel containers.
- Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition.

Other precautions

- Handle product as having hydrogen sulphide potentially degas into the headspace.

8. Exposure Controls / Personal Protection

EXPOSURE LIMITS

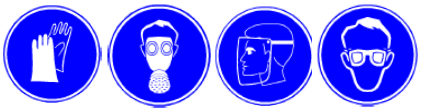
	Authority	15 MINS STEL or Ceiling	8-HOURS
Hydrogen sulphide (CAS 7783-06-4)	Alberta, Ontario	15 ppm (21 mg/m^3) Ceiling	10 ppm (14 mg/m^3)
	BC	10 ppm (14 mg/m^3) Ceiling	-

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, stored and/or handled to maintain airborne concentrations below the LEL and OEL, especially in confined spaces.
- 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	**Physical State:** Liquid
Appearance: Slight amber color		**Odor:** Hydrocarbon & rotten egg odor	**Odor Threshold:** ~ 10 ppb (H_2S)
pH: ~5-9	**Melting/Freezing Point:** 0 to -5°C	**Boiling Point:** 50 to 100°C	**Boiling Range:** Not available
Flash Point: 0-60°C		**Flammability:** Yes	**Evaporation Rate:** Not available
Upper-Lower Explosive Limit: 4.01% (LEL), 44.0% (UEL) (H_2S)		**Vapor Pressure:** Not available	**Vapor Density:** Not available
Density: ~ 1.00 kg/m^3		**Soluble in water (@20°C):** ~100%	**Percent Volatile:** < 1
Partition Coefficient n-octanol/water: Not available		**Auto-Ignition Temperature:** Not available	**Decomposition Temp.:** Not available
Viscosity: 1.0 – 2.3 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 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 on the Central Nervous system (CNS) may range from mild (respiratory depression) to severe effects (asphyxiation)	may range from rapid breathing, dizziness to respiratory arrest, loss of consciousness (narcosis) and death in extreme cases.
Skin:	In gas form: no known effects.	-
	In liquid form: skin irritation.	Itchy skin.
Eye:	In gas form: no known effects.	-
	In liquid form: contact with 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 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:
Possibly asthma.

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

Carcinogenicity:	**Irritancy:**	**Target Organs:**
Benzene: ACGIH A1, IARC Gp 1 NTP Known Human Carcinogen; OSHA: Present	No	H_2S: Single exposure: 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 Rat 700 mg/m^3 4 h
Benzene	71-43-2	Oral Rat 810 mg/kg Dermal Rabbit >8200 mg/kg	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: A toxic aquatic hazard with long term effect (H_2S).	**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 waste treatment/disposal facility in accordance with applicable local, provincial, and federal regulations.
- Do not dispose of waste with normal garbage, or to sewer systems.

14. Transport Information

TDG (CANADA) CLASSIFICATION

PROPER SHIPPING NAME: Flammable Liquid, Toxic, N.O.S. (Hydrogen Sulphide)
CLASS: 3 (6.1) **UN NUMBER:** UN1992
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, etc.) and not steamed or rinsed, the product remaining in these trucks may change the composition of this product (Sour, 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 differently*

15. Regulatory Information

CANADA

	Benzene	Toluene	Xylenes	Ethylbenzene
CAS	71-43-2	108-88-3	1330-20-7	100-41-4
DSL	yes	yes	yes	yes
NPRI	yes	yes	yes	yes
E2	yes	yes	yes	yes

16. Other Information

Prepared for: Keyera Health and Safety
Issue Date/ Revision No: August 17, 2021/ Revision #3

Revisions:	**Dates:**	**Main Changes**
• Original:	January 3, 2011	None
• 1st revision:	August 6, 2019	Reformat; added risk phrase for H_2S in airspace
• 2nd revision:	September 30, 2019	Added BTEX and salt content in composition & update H2S information
• 3rd revision	August 17, 2021	Updated Phone number 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

Disclaimer of Expressed and Implied Warranties

The information presented in the Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. However, neither Keyera nor its affiliates assume any liability whatsoever for the accuracy or completeness of the information contained herein. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use.

~ End of Safety Data Sheet ~