



MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	Produced Water (sweet)
Version #	01
Revision date	November 2, 2016
CAS #	Mixture
Synonym(s)	Crude Oil Separated Water, Salt Water Brine, Salt Water, Formation Water
Manufacturer/Supplier	Cleo Energy Corp. 200 - 117 8th Ave. SW Calgary, AB T2P 1B4
Emergency #	1-866-512-7662

2. Hazards Identification

Physical state	Liquid.
Appearance	Dirty colored liquid with a faint hydrocarbon odor.
Emergency overview	WARNING! Causes eye irritation. This product may contain a small amount of hydrocarbons with a trace amount of benzene which may cause cancer and heritable genetic damage.
OSHA regulatory status	This preparation is not classified as dangerous according to Directive 1999/45/EC and its amendments. This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
<u>Potential health effects</u>	
Routes of exposure	Eye contact. Skin contact. Ingestion. Inhalation.
Eyes	Causes eye irritation.
Skin	Prolonged or repeated skin contact may cause irritation. Human and animal studies show that benzene is absorbed through the skin. However, absorption through the skin is normally low because benzene evaporates rapidly. In most cases, any skin contact would also involve significant inhalation exposure.
Inhalation	No inhalation hazard under normal conditions. If misting occurs: may cause mild mucous membrane irritation of the nose, throat, and upper respiratory tract. Produced water may contain benzene which may cause cancer and cause blood disorders.
Ingestion	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. The product may contain benzene which may cause cancer and cause blood disorders



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Chronic effects

Contains benzene. Human epidemiology studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-producing system and serious blood disorders, including leukemia. Animal tests suggest that prolonged and/or repeated overexposure to benzene may damage the embryo/fetus. The relevance of these animal studies to humans has not been fully established.

Potential environmental effects

Not expected to be harmful to aquatic organisms.

3. Composition / Information on Ingredients

Components	CAS #	Percent
Water	7732-18-5	80-95
Calcium chloride	10043-52-4	0-20
Potassium Chloride	7447-40-7	0-20
Produced water (sweet)		
Sodium chloride	7647-14-5	0-20
Benzene	71-43-2	<0.1

Composition comments

May contain small amounts of condensate or crude oil as a contaminate. All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First Aid Measures

Eye contact

In case of contact, immediately flush eyes with fresh water for at least 15 minutes while holding the eyelids open. Remove contact lenses if worn. Get medical attention if irritation persists.

Skin contact

Remove contaminated clothing and shoes. Wash affected area with mild soap and water. Get medical attention if irritation develops and persists.

Inhalation

If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Call a physician if symptoms develop or persist.

Ingestion

Rinse mouth thoroughly. Get medical attention if any discomfort occurs.

General advice

If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.



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5. Fire Fighting Measures

Flammable properties	This product is not flammable; however sufficient hydrocarbon vapors may accumulate from oil or natural gas condensate floating on the surface of the produced water to cause a flash fire. The fire should burn out fairly rapidly depending on the amount of oil and natural gas condensate floating on the surface of the produced water.
Extinguishing media	
Suitable extinguishing media	Dry chemical powder. Foam. Carbon dioxide (CO ₂).
Protection of firefighters	
Protective equipment and precautions for firefighters	A fire would be associated with vapors related to oil or natural gas condensate floating on the surface of the produced water. Water may be ineffective on flames and may even spread the fire but should be used to cool pressurized containers in the fire.
Special protective equipment for firefighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with full face-piece operated in positive pressure mode. Use approved gas detectors in confined spaces.
Specific methods	Promptly isolate the scene by removing persons from the vicinity of the incident if there is a fire. Do not extinguish flames at leak because of the possibility of an uncontrolled re-ignition exists. If it is safe to do so, cut off fuel supply and/or allow fire to burn out. The fire should burn out fairly rapidly depending on the amount of oil and natural gas condensate floating on the surface of the produced water. If leak or spill has not ignited, water spray or ventilation can be used to disperse the vapors.
Hazardous combustion products	Sodium oxides. Carbon oxides.

6. Accidental Release Measures

Personal precautions	Keep away from sources of ignition - No smoking. The vapors should dissipate fairly rapidly depend on the amount of oil and natural gas condensate floating on the surface of the produced water. Stay upwind. Keep unnecessary personnel away. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Prevent further leakage or spillage if safe to do so. Do not allow to enter drains, sewers or watercourses.
Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Prevent entry into waterways, sewer, basements or confined areas.
Methods for cleaning up	Recover by pumping (use an explosion-proof motor or hand pump) or by sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Where feasible and appropriate, remove contaminated soil or flush with fresh water. On water spills utilize absorbent material to remove oil and natural gas liquid from the surface of the water.



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Other information

Avoid excess skin contact with spilled material.

7. Handling and Storage

Handling

Handle as a flammable liquid. Tank headspaces should always be regarded as potentially flammable and care should be taken to avoid static electrical discharge and all ignition sources during filling, discharging and sampling from storage tanks. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion. Keep away from heat, sparks, and open flame. Electrical equipment should be approved for classified area. Wear appropriate personal protective equipment (see section 8). Special precautions should be taken when entering or handling equipment in this type of produced water service because of possible radioactive contamination. All equipment should be checked for radioactivity or opened to the atmosphere and have forced ventilation applied for at least 4 hours prior to entry or handling. Avoid direct skin contact with any surface. Avoid generation of dust, smoke, fumes, etc. in the work area, or if they cannot be avoided, a tested and certified radionuclide dust respirator should be worn. Smoking, eating or drinking should be prohibited when working with the equipment. Workers should wash thoroughly with soap and water and discard contaminated clothing after entering or handling the equipment. Workers should wash hands and face before eating, drinking and smoking.

Storage

Keep containers in well-ventilated area away from flame, sparks, excessive temperatures and open flames. Keep the containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition. Do not enter storage areas and confined spaces without adequate ventilation. Use appropriate respiratory protection if there is the potential to exceed the exposure limit(s). Vapors containing benzene may accumulate during storage and transport.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH Components	Type	Value
Benzene (71-43-2)	STEL TWA	2.5 ppm 0.5 ppm
US – OSHA Components	Type	Value
Benzene (71-43-2)	Ceiling STEL TWA	25 ppm 5 ppm 1 ppm



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Canada - Alberta Components	Type	Value
Benzene (71-43-2)	STEL	8 mg/m3 2.5 ppm
	TWA	1.6 mg/m3 0.5 ppm
Canada – British Columbia Components	Type	Value
Benzene (71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
Canada – Ontario Components	Type	Value
Benzene (71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
	TWA	5 mg/m3
Canada – Quebec Components	Type	Value
Benzene (71-43-2)	STEL	15.5 mg/m3 5 ppm
	TWA	3 mg/m3 1 ppm



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Engineering controls	Ensure adequate ventilation, especially in confined areas..
Personal protective equipment	
Eye / face protection	If eye contact is likely, safety glasses with side shields or chemical type goggles should be worn.
Skin protection	No special garments required. Wash contaminated clothing prior to reuse. Avoid unnecessary skin contamination with material. Use of chemical resistant gloves is advised to prevent skin contact.
Respiratory protection	No personal respiratory protective equipment normally required.
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. Discard contaminated clothing and footwear that cannot be cleaned. Handle in accordance with good industrial hygiene and safety practice.

9. Physical & Chemical Properties

Appearance	Dirty colored liquid with a faint hydrocarbon odor.
Color	Varies from clear to dark brown.
Odor	Faint. Hydrocarbon-like.
Odor threshold	Not available.
Physical state	Liquid.
Form	Liquid.
pH	4.9 - 8.5
Melting point	Not available.
Freezing point	< 32 °F (< 0 °C)
Boiling point	212 °F (100 °C) Approx.
Flash point	Variable organic oil and dissolved gases are flammable.
Evaporation rate	0.36
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.



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Vapor pressure	13.6 mm Hg @ 68°F (20°C)
Vapor density	< 1
Specific gravity	1.1 @ 68°F (20°C)
Solubility (water)	Complete
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.

10. Chemical Stability and Reactivity Information

Chemical stability	Stable.
Conditions to avoid	Keep away from heat, sparks and open flame.
Hazardous decomposition Products	Carbon Dioxide. Water vapor. May produce oxides of sulfur. Incomplete combustion may generate carbon monoxide.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological information	This product may contain detectable but varying quantities of the naturally occurring radioactive substance radon 222. The amount in the gas itself is not hazardous, but since radon rapidly decays ($t_{1/2} = 3.82$ days) to form other radioactive elements including lead 210, polonium 210, and bismuth 210, equipment may be radioactive. The radon daughters are solids and therefore may attach to dust particles or form films and sludges in equipment. Inhalation, ingestion or skin contact with radon daughters can lead to the deposition of radioactive material in the lungs, bone, blood forming organs, intestinal tract, kidney and colon. Occupational exposure to radon and radon daughters has been associated with an increased risk of lung cancer in underground uranium miners. Follow the special precautions listed in handling and storage section of this document (see section 7).
Local effects	Causes eye irritation. May cause skin irritation. May cause discomfort if swallowed.
Sensitization	Not a skin sensitizer.
Chronic effects	No additional adverse health effects noted.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.



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ACGIH Carcinogens

Benzene (CAS 71-43-2)

A1 Confirmed human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Benzene (CAS 71-43-2)

1 Carcinogenic to humans.

US NTP Report on Carcinogens: Known carcinogen

Benzene (CAS 71-43-2)

Known carcinogen.

US OSHA Specifically Regulated Substances: Cancer hazard

Benzene (CAS 71-43-2)

Cancer hazard.

Epidemiology

No epidemiological data is available for this product.

Mutagenicity

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

Neurological effects

No data available.

Reproductive effects

Contains no ingredient listed as toxic to reproduction

Teratogenicity

No known human teratogenic effect.

Further information

This product has no known adverse effect on human health.

12. Ecological Information

Ecotoxicological data

Components

Test Results

Calcium chloride (10043-52-4)

EC50 Water flea (Daphnia magna): 52 mg/l 48 hours

LC50 Fathead minnow (Pimephales promelas): 3930 – 5360 mg/l 96 hours

Benzene (71-43-2)

EC50 Water flea (Daphnia magna): 8.76 - 15.6 mg/l 48 hours

EC50 Water flea (Daphnia magna): 8.76 - 15.6 mg/l 48 Hours

LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 5 mg/l 96 Hours

Potassium Chloride (7447-40-7)

EC50 Water flea (Daphnia magna): 83 mg/l 48 hours

LC50 Western mosquitofish (Gambusia affinis): 435 mg/l 96 hours

Sodium chloride (7647-14-5)

EC50 Water flea (Daphnia magna): 340.7 - 469.2 mg/l 48 hours

LC50 American eel (Anguilla rostrata): 0 - 27260 mg/l 96 hours

Ecotoxicity

Not expected to be harmful to aquatic organisms.

Environmental effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Persistence and degradability

None known.



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Bioaccumulation / Accumulation No data available.

Partition coefficient (n-octanol/water) Not available.

Mobility in environmental media Not Available.

13. Disposal Considerations

Disposal instructions Do not allow this material to drain into sewers/water supplies. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

Waste from residues / unused products Not applicable.

Contaminated packaging Offer rinsed packaging material to local recycling facilities.

14. Transport Information

DOT
Not regulated as dangerous goods.

IATA
Not regulated as dangerous goods.

IMDG
Not regulated as dangerous goods.

TDG
Not regulated as dangerous goods.

15. Regulatory Information

US Federal Regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List.
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US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration
Benzene (CAS 71-43-2) 0.1 %

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance
Benzene (CAS 71-43-2) Listed.

CERCLA (Superfund) reportable quantity (lbs)
Benzene 10



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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

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Drug Enforcement Agency (DEA) Not controlled

WHMIS status Controlled

WHMIS classification D2B – Other Toxic Effects -TOXIC

WHMIS labeling



State regulations

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

US - California Hazardous Substances (Director's): Listed substance

Benzene (CAS 71-43-2) Listed.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Benzene (CAS 71-43-2) Listed.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Benzene (CAS 71-43-2) Listed: February 27, 1987 Carcinogenic.

US - California Proposition 65 - CRT: Listed date/Developmental toxin

Benzene (CAS 71-43-2) Listed: December 26, 1997 Developmental toxin.

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

Benzene (CAS 71-43-2) Listed: December 26, 1997 Male reproductive toxin.

US - Massachusetts RTK - Substance: Listed substance

Benzene (CAS 71-43-2) Listed.

US - New Jersey Community RTK (EHS Survey): Reportable threshold

Benzene (CAS 71-43-2) 500 LBS



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US - New Jersey RTK - Substances: Listed substance

Benzene (CAS 71-43-2) Listed.

US - Pennsylvania RTK - Hazardous Substances: Listed substance

Benzene (CAS 71-43-2) Listed.

US - Pennsylvania RTK - Hazardous Substances: Special hazard

Benzene (CAS 71-43-2) Special hazard.

16. Other Information

Further information

HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings

Health: 1
Flammability: 1
Physical hazard: 0
Health: 1

NFPA ratings

Flammability: 1
Instability: 0

Disclaimer

The information in the sheet was written based on the best knowledge and experience currently available.

Issue date

November 9, 2016