1. IDENTIFICATION

Product Name:	Sulphur, Liquid
Synonyms/Other Means of Identification:	Sulphur Brimstone Elemental Sulphur Formed Sulphur Liquid Sulphur Soil Sulphur Sulphur Cake
Intended Use:	Feedstock
Manufacturer/ Supplier	CENOVUS ENERGY INC. 500 Centre Street SE, PO Box 766 Calgary, AB T2P 0M5
Prepared By	Cenovus Energy Inc. Health and Safety
Phone Number	1-403-766-2000
Emergency Telephone	Cenovus 1-877-458-8080 CANUTEC 1-613-996-6666 (Canada) CHEMTREC 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

H315 -- Skin corrosion/irritation -- Category 2

Hazards not Otherwise Classified

May contain or release poisonous hydrogen sulfide gas
Contact with hot product will cause thermal burns

Label Elements

WARNING
Causes skin irritation. (H315)*
May contain or release poisonous hydrogen sulfide gas
Contact with hot product will cause thermal burns.
Wash thoroughly after handling. (P264)*
Use personal protective equipment as required. (P281)*
Specific treatment (see ... on this label). (P321)*
IF ON SKIN:Rinse skin with water. (P353)*
If skin irritation occurs: Get medical advice/attention. (P313)*
Take off contaminated clothing and wash before reuse. (P362)*

** (Applicable GHS hazard code.)*

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CASRN	Concentration[1]
Sulfur	7704-34-9	100
Hydrogen Sulfide	7783-06-4	Variable (<1)

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention. For contact with hot material, gently open eyelids and flush affected eye(s) with cold (not icy) water. Seek immediate medical attention. For cold material, wash with plenty of water with eyelids open. If redness or pain develops, seek medical attention.

Skin Contact: For contact with molten product, remove clothing if not sticking to the skin. Attempts should not be made during first aid to remove molten sulfur stuck to skin, as underlying tissue may easily be torn away. Flush immediately with large amounts of cool water. Keep injury cool to minimize swelling and tissue damage. Be alert for sigins of shock from trauma, and hypothermia from excessive cooling of the injury. Thermal burns require immediate medical attention.

Inhalation (Breathing): If respiratory symptoms or other symptoms of exposure develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. If symptoms persist, seek immediate medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.

Ingestion (Swallowing): First aid is not normally required for the solid material; however, if molten material is swallowed, seek immediate medical attention.

Most important symptoms and effects

Acute: None known or anticipated.

Delayed: None known or anticipated.

Notes to Physician: At high concentrations hydrogen sulfide may produce pulmonary edema, respiratory depression, and/or respiratory paralysis. The first priority in treatment should be the establishment of adequate ventilation and the administration of 100% oxygen. Animal studies suggest that nitrites are a useful antidote, however, documentation of the efficacy of nitrites in humans is lacking. If the diagnosis of hydrogen sulfide poisoning is confirmed and if the patient does not respond rapidly to supportive care, the use of nitrites may be an effective antidote if delivered within the first few minutes of exposure. For adults the dose is 10 mL of a 3% $NaNO_2$ solution (0.5 gm $NaNO_2$ in 15 mL water) I.V. over 2-4 minutes. The dosage should be adjusted in children or in the presence of anemia, and methemoglobin levels, arterial blood gases, and electrolytes should be monitored closely.

Other Comments: Before attempting rescue, first responders should be alert to the possible presence of hydrogen sulfide, a poisonous gas with the smell of rotten eggs, and should consider the need for respiratory protection (see Section 8). Remove casualty to fresh air as quickly as possible. Immediately begin artificial respiration if breathing has ceased. Consider whether oxygen administration is needed. Obtain medical advice for further treatment.

5. FIRE FIGHTING MEASURES

NFPA 704 Hazard Class

Health: 2 **Flammability:** 1 **Instability:** 0 (0-Minimal, 1-Slight, 2-Moderate, 3-Serious, 4-Severe)

Unusual Fire & Explosion Hazards: Flash point varies depending on the impurities present in the product. Sulfur burns easily in air when ignited by flame or excess heat. Molten sulfur, at temperatures near the flash point, may flash and/or burn when exposed to air.

Flammability of headspace vapors containing hydrogen sulfide will differ appreciably from the values given for sulfur. Flammable and toxic hydrogen sulfide may form in closed tank headspaces.

Sulfur can form explosive mixtures with oxidizers (see Section 10). Water or foam may cause frothing of molten sulfur, with further application leading to boil over. Steam explosions may occur due to contact or mixing of water with molten product.

If container is not properly cooled, it can rupture in the heat of a fire. Hazardous combustion/decomposition products, including hydrogen sulfide, may be released by this material when exposed to heat or fire. Use caution and wear protective clothing, including respiratory protection.

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Fire Fighting Instructions: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area and keep unauthorized personnel out. Contain spill if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

Hazardous Combustion Products: Combstion may yield sulfur dioxide and other oxides of sulfur.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. May contain or release poisonous hydrogen sulfide gas. If the presence of dangerous amounts of H2S around the spilled product is suspected, additional or special actions may be warranted, including access restrictions and use of protective equipment. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify

persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. If spill/release in excess of EPA reportable quantity (see Section 15) is made into the environment, immediately notify the National Response Center (phone number 800-424-8802).

Methods for Containment and Clean-Up: Notify relevant authorities in accordance with all applicable regulations. Let molten material cool naturally. If necessary, cautiously use water fog to help the cooling. Do not play direct jets of foam or water on the spilled molten product, as this may cause splattering. Carefully shovel or sweep up spilled material and place in a suitable container. Minimize dust generation.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

7. HANDLING AND STORAGE

Precautions for safe handling: Keep away from flames and hot surfaces. Wear protective gloves/clothing and eye/face protection. May contain or release dangerous levels of hydrogen sulfide. Avoid breathing vapors or mists. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8).

The material storage and loading/unloading temperature range is 260°F - 300°F (127°C - 150°C). Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes. This material may be heated to high temperatures during use. Use caution when handling heated material, to avoid causing thermal burns. Vapors or fumes may cause watering or irritation of the eyes.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Liquid sulfur should not be put into any tank, rail car, or truck trailer that contains trace quantities of hydrocarbons, or more than trace amounts of moisture. This material may contain or release poisonous hydrogen sulfide gas. In a tank, barge, or other closed container, the vapor space above this material may accumulate hazardous concentrations of hydrogen sulfide. Check atmosphere for oxygen content, H2S, and flammability
prior to entry. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Component	ACGIH	OSHA	Alberta
Sulfur	TWA:10 mg/m^3 TWA-Total 3 mg/m^3-Resp. as Nuisance Dust, If Generated	TWA: 15 mg/m^3 -Total TWA: 5 mg/m^3 -Resp. as Nuisance Dust, If Generated	10 mg/m3 TWA8
Hydrogen Sulfide	STEL: 5 ppm TWA: 1 ppm	Ceiling: 20 ppm	TWA: 10 ppm 8hr Ceiling: 15 ppm

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye / Face Protection: The use of eye protection (such as splash goggles) that meets or exceeds ANSI Z.87.1 is recommended when there is potential liquid contact to the eye. Depending on conditions of use, a face shield may be necessary.

Skin / Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products. Depending on exposure and use conditions, additional protection may be necessary to prevent skin contact including use of items such as chemical resistant boots, aprons, arm covers, hoods, coveralls, or encapsulated suits. Wear thermal insulating gloves and face shield or eye protection when working with materials that present thermal hazards (hot or cold).

Respiratory Protection: Where there is potential for airborne exposure to hydrogen sulfide (H2S) above exposure limits, a NIOSH approved, self-contained breathing apparatus (SCBA) or equivalent operated in a pressure demand or other positive pressure mode should be used. Under conditions where hydrogen sulfide (H2S) is NOT detected, a NIOSH certified air purifying respirator equipped with R or P95 filters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health (IDLH).

Other Protective Equipment: Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance:	Yellow brown to Bright yellow
Physical Form:	Liquid
Odor:	Rotten egg / sulfurous
Odor Threshold:	No data
pH:	Not applicable
Vapor Pressure:	1mm Hg @ 363°F / 184°C
Vapor Density (air=1):	> 38.9
Initial Boiling Point/Range:	833 °F / 445 °C
Melting/Freezing Point:	246 °F / 119 °C
Solubility in Water	Insoluble
Partition Coefficient (n-octanol/water) (Kow):	No data
Specific Gravity (water=1):	1.8 @ 68ºF / 20ºC
Bulk Density:	15 lbs/gal
Viscosity:	6.5 cP @ 363°F / 184°C
Evaporation Rate (nBuAc=1):	No data
Flash Point:	405 °F / 207 °C
Test Method:	Cleveland Open Cup (COC), ASTM D92
Lower Explosive Limits (vol % in air):	35 g/m^3 as dust
Upper Explosive Limits (vol % in air):	1,400 g/m^3 as dust
Auto-ignition Temperature:	450 °F / 232 °C

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated conditions of use.

Conditions to Avoid: Avoid all possible sources of ignition. Avoid overheating.

Materials to Avoid (Incompatible Materials): Elemental sulfur can react with metals such as sodium, calcium, tin, nickel, or zinc under certain conditions. Avoid contact with strong oxidizing agents such as acids, chlorine, dichromates, or permanganates.

Hazardous Decomposition Products: Thermal decomposition can release toxic vapors or gases. Combustion can yield sulfur oxides. Molten sulfur reacts with hydrocarbons to form carbon disulfide and hydrogen sulfide. May contain or liberate poisonous hydrogen sulfide gas. Not anticipated under normal conditions of use.

Hazardous Polymerization: Not known to occur.

11. TOXICOLOGICAL INFORMATION

Information on Toxicological Effects of Substance/Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful	May contain or release poisonous hydrogen sulfide gas - see Other Comments.	>9 mg/L (dust)
Skin Absorption	Unlikely to be harmful		> 2g/kg
Ingestion (Swallowing)	Unlikely to be harmful		> 8.4 g/kg

Aspiration Hazard: Not applicable

Skin Corrosion / Irritation: Causes skin irritation. Contact with the heated material may cause thermal burns.

Serious Eye Damage / Irritation: Causes mild eye irritation. Vapors from molten sulfur may cause watering of the eyes. Contact with the heated material may cause thermal burns. Dusts created from the cooled material may be abrasive and irritating to the eyes and cause stinging, watering, and redness. Contact with the heated material may cause thermal burns. Vapors or fumes may cause watering of the eyes.

Signs and Symptoms: Effects of overexposure may include irritation of the digestive tract, irritation of the respiratory tract, headaches, coughing, runny nose, vomiting, diarrhea, shortness of breath, abdominal pain and chest pain.

Skin Sensitization: Not expected to be a skin sensitizer. Allergic skin responses after repeated contact with sulfur have been reported but are not common.

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): Not expected to cause organ effects from single exposure.

Specific Target Organ Toxicity (Repeated Exposure): Not known to cause organ damage.

Carcinogenicity: Not expected to cause cancer. This substance is not listed as a carcinogen by IARC, NTP or OSHA.

Germ Cell Mutagenicity: Not expected to cause heritable genetic effects.

Reproductive Toxicity: No information available.

Other Comments: This material may contain or liberate hydrogen sulfide, a poisonous gas with the smell of rotten eggs. The smell disappears rapidly because of olfactory fatigue so odor may not be a reliable indicator of exposure. Effects of overexposure include irritation of the eyes, nose, throat and respiratory tract, blurred vision, photophobia (sensitivity to light), and pulmonary edema (fluid accumulation in the lungs). Severe exposures can result in nausea, vomiting, muscle weakness or cramps, headache, disorientation and other signs of nervous system depression, irregular heartbeats, convulsions, respiratory failure, and death.

12. ECOLOGICAL INFORMATION

Toxicity: Sulfur is not classified as an environmental hazard. In six studies on ecological effects (involving bobwhite quail, two fish species, daphnia, mysid shrimp and honey bees), sulfur has been shown to be practically non-toxic to the species tested. While there is potential for non-target organisms to be exposed to sulfur, little hazard to these species is expected to result. Classification: No classified hazards.

Persistence and Degradability: Sulfur is a component of the environment, and there is a natural cycle of oxidation and reduction reactions which transforms sulfur into both organic and inorganic products. Sulfur is amenable to microbial utilization. Therefore, this material can be degraded by microorganisms and is regarded as inherently biodegradable.

Bioaccumulative Potential: Sulfur is not expected to have bioaccumulation or food chain contamination potential.

Mobility in Soil: Sulfur is not expected to be mobile in soil. Elemental sulfur is slowly converted to sulfate in soil by the action of autotrophic bacteria. Elemental sulfur leaches in soil as sulfate at a slow rate. About 3-6% of the sulfur (formulation and purity unspecified) applied at 56 kg/Ha leached through lysimeters of loam soil (soil depth unspecified) as a result of 40 inches of rain over a six-month period. After two years, 23-29% of the applied sulfur had leached.

Other Adverse Effects: None anticipated.

13. DISPOSAL CONSIDERATIONS

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations.

This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the MSDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.

Container contents should be completely used and containers should be emptied prior to discard.

14. TRANSPORT INFORMATION

Canadian (TDG)

Shipping Description: UN2448, Sulphur, molten, 4.1; , III
Small Means of Containment
Package Marking: Sulphur, molten, UN2448
Package Labeling: Class 4.1, Flammable solid
Large Means of Containment
Package Placard / Marking: Class 4.1 / 2448

U.S. Department of Transportation (DOT)

Shipping Description: NA2448, Sulfur, molten, 9, III
Non-Bulk Package Marking: Sulfur, molten, NA2448
Non-Bulk Package Labeling: Class 9
Bulk Package / Placard Marking: None / 2448 ***&*** MOLTEN SULFUR ***or*** Class 9 / 2448 ***&*** MOLTEN SULFUR
Packaging - References: None; 173.213; 173.247
(Exceptions; Non-bulk; Bulk)
Hazardous Substance: See Section 15 for RQ`s
Emergency Response Guide: 133
Note: ***The following alternate shipping description order may be used until January 1, 2013:***
Proper Shipping name, Hazard Class or Division, (Subsidiary Hazard if any), UN or NA number, Packing Group
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: *Not applicable*
Other shipping description elements may be required for DOT compliance.

International Maritime Dangerous Goods (IMDG)

Shipping Description: ***Not normally shipped using IMDG. Call 800-762-0942 for assistance.***

International Civil Aviation Org. / International Air Transport Assoc. (ICAO/IATA)

UN/ID #: ***Forbidden***

	LTD. QTY	Passenger Aircraft	Cargo Aircraft Only
Packaging Instruction #:	-	---	---
Max. Net Qty. Per Package:	-	---	---

15. REGULATORY INFORMATION

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):

This material contains the following chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372:

Component	TPQ	EPCRA RQ
Hydrogen Sulfide	500 lb	100 lb

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health: Yes
Chronic Health: No
Fire Hazard: No
Pressure Hazard: No
Reactive Hazard: No

CERCLA/SARA - Section 313 and 40 CFR 372:

This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds):

This material contains the following chemicals subject to the reporting requirements of 40 CFR 302.4:

Component	RQ
Hydrogen Sulfide	100 lb

California Proposition 65:

This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Hazard Classification

Canada:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the Regulations.

WHMIS Hazard Class:
B4 - Flammable Solids D2B

National Chemical Inventories

All components are either listed on the US TSCA Inventory, or are not regulated under TSCA All components are either on the DSL, or are exempt from DSL listing requirements

U.S. Export Control Classification Number: EAR99

16. OTHER INFORMATION

Date of Issue: May 15, 2017
Status: FINAL
Previous Issue Date: April 30, 2012; January 30, 2012

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)