Safety Data Sheet

Material Name: Sulfur

SDS No. 6192
EU/CLP GHS

Synonyms: Brimstone; Sulphur

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
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Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Solid - Category 2
Acute Toxicity, Oral – Category 3
Acute Toxicity, Inhalation – Category 2
Skin Corrosion/Irritation – Category 2
Specific Target Organ Toxicity (Single Exposure) - Category 1 (respiratory system)
Specific Target Organ Toxicity (Repeat Exposure) - Category 2 (respiratory system, skin)

Additional hazard not resulting in classification:

May form combustible dust concentrations in air.
Material may be heated. If heated, care must be taken to avoid injury from thermal burns. Heating may also release toxic hydrogen sulfide gas.

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

DANGER

Hazard Statements

Flammable solid.
Toxic if swallowed.
Fatal if inhaled.
Causes skin irritation.
Causes damage to respiratory system.
May cause damage to respiratory system and skin through prolonged or repeated exposure.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Ground/Bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting equipment.

Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands thoroughly after handling.
Do not eat, drink or smoke when using this product.
Do not breathe dust or fumes.
Use only outdoors or in a well-ventilated area.
In case of inadequate ventilation, wear appropriate respiratory protection.

Response

In case of fire: Use water spray, fog, or foam to extinguish.
If swallowed: Immediately call a poison center or doctor. Rinse mouth.
If inhaled: Remove person to fresh air and keep in a position comfortable for breathing. Immediately call a poison center or doctor.
IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
If exposed: Call a poison center or doctor.
Get medical advice or attention if you feel unwell.

Storage

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

Disposal

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

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
7704-34-9	Sulfur	100
7783-06-4	Hydrogen sulfide	<1

Hydrogen Sulfide (H2S) may be present in trace quantities (by weight) in molten sulfur but may accumulate to toxic or flammable concentrations in enclosed spaces such as molten sulfur storage pits, tanks, or tanker/railcar headspaces. H2S is not considered a hazard associated with solid sulfur.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.
Reference NFPA 655 Prevention of Sulfur Fires and Explosions, 1993.

Flammable solid with a relatively low ignition temperature. Sulfur dust ignites easily in air. Grinding sulfur may produce an explosion hazard. Static discharge may ignite sulfur dust.

Sulfur burns with a pale blue flame that may be difficult to see in daylight. Burning sulfur will flow and emits large quantities of sulfur dioxide (SO2), a toxic, irritating, and suffocating gas that can cause severe lung damage and death.

Molten sulfur may evolve hydrogen sulfide (H2S) - H2S is a flammable gas and may present an explosion hazard in a confined space. Under certain conditions, H2S can react to form pyrophoric iron compounds in enclosed spaces such as sulfur pits.

Hazardous Combustion Products

Sulfur burns to sulfur dioxide. Sulfur reactions with hydrocarbons and other organic materials may produce hydrogen sulfide and carbon disulfide. Other possibly toxic reaction or decomposition products are highly dependent on the incompatible material.

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or gaseous extinguishing agent.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Product may release substantial amounts of flammable vapors and gases (e.g., methane, ethane, and propane), at or below ambient temperature depending on source and process conditions and pressure.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection - do not discharge solid water stream patterns into the liquid resulting in splashing.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Protect against hot liquid. Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use gasoline or solvents (naphtha, kerosene, etc.) for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Consider the need to discard contaminated leather shoes and gloves.

Storage Procedures

Store solid sulfur in a well ventilated area away from incompatible materials. The hazards of hydrogen sulfide should be considered when storing or transporting molten sulfur. H2S can accumulate in confined spaces such as sulfur pits and headspaces of truck trailers and railcars. Exposure to H2S is possible during product transfer into/out of truck trailers and railcars.

Use appropriate engineering controls or respiratory protection. Sulfur pits should be vented away from possible worker exposure areas.

Prohibit smoking in storage and work areas. Electrical installations and equipment in hazardous locations should be installed according to articles 501 and 502 of the National Electric Code. Reference also NFPA 655 Standard for the Prevention of Sulfur Fires and Explosions.

Incompatibilities

Sulfur is incompatible with a number of chemical materials including, but not limited to, chlorates, nitrates, other oxidizers, carbides, halogens, phosphorus, and heavy metals.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Hydrogen sulfide (231-977-3)

ACGIH:	5 ppm STEL 1 ppm TWA
Austria:	10 ppm STEL [KZW]; 15 mg/m3 STEL [KZW] 10 ppm TWA [TMW]; 15 mg/m3 TWA [TMW]
Belgium:	10 ppm STEL; 14 mg/m3 STEL 5 ppm TWA; 7 mg/m3 TWA
Denmark:	10 ppm TWA; 15 mg/m3 TWA
Finland:	10 ppm STEL; 14 mg/m3 STEL; 15 ppm STEL (blasting and quarrying); 20 mg/m3 STEL (blasting and quarrying) 5 ppm TWA; 7 mg/m3 TWA; 10 ppm TWA (blasting and quarrying); 15 mg/m3 TWA (blasting and quarrying)
France:	10 ppm STEL [VLCT]; 14 mg/m3 STEL [VLCT] 5 ppm TWA [VME]; 7 mg/m3 TWA [VME]
Germany:	5 ppm TWA AGW (The risk of damage to the embryo or fetus can be excluded when MAK and BAT values are observed, exposure factor 2); 7.1 mg/m3 TWA AGW (The risk of damage to the embryo or fetus can be excluded when MAK and BAT values are observed, exposure factor 2) 5 ppm TWA MAK; 7.1 mg/m3 TWA MAK 10 ppm Peak; 14.2 mg/m3 Peak
Greece:	15 ppm STEL; 21 mg/m3 STEL 10 ppm TWA; 15 mg/m3 TWA
Ireland:	10 ppm STEL; 14 mg/m3 STEL 5 ppm TWA; 7 mg/m3 TWA
Netherlands:	2.3 mg/m3 TWA
Portugal:	10 ppm TWA [VLE-MP]
Spain:	15 ppm STEL [VLA-EC]; 21 mg/m3 STEL [VLA-EC] 10 ppm TWA [VLA-ED]; 14 mg/m3 TWA [VLA-ED]
Sweden:	10 ppm LLV; 14 mg/m3 LLV 15 ppm CLV; 20 mg/m3 CLV

Engineering Measures

Use adequate ventilation to keep vapor, hydrogen sulfide and dust concentrations of this product below occupational exposure limits and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified/controlled areas.

Personal Protective Equipment: Respiratory

If a hydrogen sulfide hazard is present (that is, exposure potential above H2S permissible exposure limit), use a positive-pressure SCBA or Type C supplied air respirator with escape bottle.

Dust protection: where it has been determined that there is no hydrogen sulfide exposure hazard (that is, exposure potential below H2S permissible exposure limit), a NIOSH-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

For protection from molten sulfur, gloves and skin protection constructed of leather or heat resistant materials are recommended.

Personal Protective Equipment: Eyes

Safety goggles are recommended for excessive dust exposure. Use faceshield for protection against molten sulfur.

Personal Protective Equipment: Skin and Body

For protection from molten sulfur, skin protection constructed of leather or heat resistant materials are recommended.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Yellow solid in block or pellet form; easily crushed into yellow dust. Hot, yellow liquid.	**Odor:**	Odorless (pure sulfur)/Rotten egg (with trace H2S)
Physical State:	Solid or liquid	**pH:**	ND
Vapor Pressure:	4x10-6 mm Hg @ 86 °F (30 °C)	**Vapor Density:**	NA
Boiling Point:	832 °F (445 °C)	**Melting Point:**	235-248°F (113-120°C)
Solubility (H2O):	Insoluble	**Specific Gravity:**	AP 1.96
Evaporation Rate:	ND	**VOC:**	ND
Octanol/H2O Coeff.:	ND	**Flash Point:**	405°F (207 °C)
Flash Point Method:	ASTM D-93	**Upper Flammability Limit (UFL):**	1,400 gm/m3 (dust); 44% for hydrogen sulfide
Lower Flammability Limit (LFL):	35 gm/m3 (dust); 4% for hydrogen sulfide	**Burning Rate:**	ND
Auto Ignition:	450°F (232°C)		

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, welding, smoking and ignitions sources. Under certain conditions, H2S can react to form pyrophoric iron compounds in enclosed spaces such as sulfur pits. Exposure of pyrophoric compounds to air or moisture can cause excessive heat generation, smoke and toxic gases, and fire.

Incompatible Products

Sulfur is incompatible with a number of chemical materials including, but not limited to, chlorates, nitrates, other oxidizers, carbides, halogens, phosphorus, and heavy metals. This incompatibility may result in fire, excessive heat generation, uncontrolled reaction, release of toxic products and/or explosion.

Hazardous Decomposition Products

Sulfur burns to sulfur dioxide. Sulfur reactions with hydrocarbons and other organic materials may produce hydrogen sulfide and carbon disulfide. Other possibly toxic reaction or decomposition products are highly dependent on the incompatible material.

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Dust particles may be irritating to the eyes, nose, throat, and skin. Molten sulfur can cause thermal burns.

B: Component Analysis - LD50/LC50

Sulfur (7704-34-9)

Inhalation LC50 Rat >9.23 mg/L 4 h; Oral LD50 Rat >3000 mg/kg; Dermal LD50 Rabbit >2000 mg/kg

Hydrogen sulfide (7783-06-4)

Inhalation LC50 Rat 0.701 mg/L 4 h; Inhalation LC50 Rat 0.99 mg/L 1 h

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Prolonged contact with sulfur dust in a localized area may result in irritation, primarily from abrasive action. Molten sulfur may cause 1st, 2nd, or 3rd degree thermal burns.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with molten sulfur may cause serious burns and blindness. Sulfur vapor may cause eye irritation. Dust contact with eyes may cause mechanical irritation (abrasion), characterized by a scratchy discomfort. This may progress to burning and tearing, with blurring of vision upon repeated or prolonged exposure. These symptoms are generally reversible once exposure is discontinued. Excessive exposure may cause more severe symptoms such as redness, pain, sensitivity to light, and conjunctivitis. Some severe exposure cases have resulted in permanent damage. Exposure to approximately 8 ppm sulfur vapor has been shown to cause eye irritation.

Potential Health Effects: Ingestion

Ingestion of small amounts of solid sulfur should not cause significant health effects. Large does can produce mucous membrane irritation, difficult swallowing, redness of the throat and tongue, stomach, and urinary disturbances. Vomiting, abdominal pain and diarrhea may also occur. Long-term ingestion of small amounts may have a laxative effect. Ingestion of very large amounts may cause sore throat, nausea, headache, and possibly unconsciousness in severe cases. May be converted into hydrogen sulfide in the intestine.

Potential Health Effects: Inhalation

Inhalation of low concentrations of dust should not cause significant health effects. Inhalation of large amounts of dust may cause inflammation of the nose and throat, resulting in secretions from the nose. Symptoms include sore throat, tightness of the chest, chest pain, lightheadedness, and persistent cough with sputum.

WARNING: Irritating and toxic hydrogen sulfide gas may be found in confined vapor spaces. Greater than 15 - 20 ppm continuous exposure can cause mucous membrane and respiratory tract irritation. 50 - 500 ppm can cause headache, nausea, and dizziness, loss of reasoning and balance, difficulty in breathing, fluid in the lungs, and possible loss of consciousness. Greater than 500 ppm can cause rapid or immediate unconsciousness due to respiratory paralysis and death by suffocation unless the victim is removed from exposure and successfully resuscitated.

The "rotten egg" odor of hydrogen sulfide is not a reliable indicator for warning of exposure, since olfactory fatigue (loss of smell) readily occurs, especially at concentrations above 50 ppm. At high concentrations, the victim may not even recognize the odor before becoming unconscious.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product is not reported to have any mutagenic effects.

Carcinogenicity

A: General Product Information

This product is not reported to have any carcinogenic effects.

B: Component Carcinogenicity

None of this product's components are listed by ACGIH, IARC, OSHA, NIOSH, or NTP.

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

Causes damage to organs (respiratory system)

Specified Target Organ General Toxicity: Repeated Exposure

May cause damage to organs through prolonged or repeated exposure (respiratory system, skin). Prolonged inhalation of dust over several years (as demonstrated in miners) may cause respiratory disease, complicated by emphysema and bronchiectasis. Asthma and inflammation of the frontal and maxillary sinuses are frequent complications. Pulmonary function may be reduced showing increased oxygen consumption, reduced respiratory volume, and impaired carbon dioxide diffusion capacity. Radiological examinations have revealed irregular opacities in the lungs and nodulation.

Aspiration Respiratory Organs Hazard

This product is not reported to have any aspiration hazard effects.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Sulfur (7704-34-9)

Test & Species		Conditions
96 Hr LC50 Brachydanio rerio	866 mg/L [static]	
96 Hr LC50 Lepomis macrochirus	<14 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	>180 mg/L [static]	

Hydrogen sulfide (7783-06-4)

Test & Species		Conditions
96 Hr LC50 Lepomis macrochirus	0.0448 mg/L [flow-through]	
96 Hr LC50 Pimephales promelas	0.016 mg/L [flow-through]	

96 Hr LC50 Gammarus pseudolimnaeus	0.022 mg/L

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

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

* * * Section 14 - Transportation Information * * *

IATA Information

Shipping Name: Sulfur/Sulfur, Molten
UN #: 1350/2448 **Hazard Class:** 4.1 **Packing Group:** III

ICAO Information

Shipping Name: Sulfur/Sulfur, Molten
UN #: 1350/2448 **Hazard Class:** 4.1 **Packing Group:** III

IMDG Information

Shipping Name: Sulfur/Sulfur, Molten
UN #: 1350/2448 **Hazard Class:** 4.1 **Packing Group:** III

* * * Section 15 - Regulatory Information * * *

Regulatory Information

Component Analysis – Inventory

Component/CAS	EC #	EEC	CAN	TSCA
Sulfur 7704-34-9	231-722-6	EINECS	DSL	Yes
Hydrogen sulfide 7783-06-4	231-977-3	EINECS	DSL	Yes

* * * Section 16 - Other Information * * *

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

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End of Sheet