MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**Sulfur**
Version #	03
Issue date	22-March-2011
Revision date	29-July-2014
Supersedes date	03-April-2012
MSDS Number	602
Product use	Refinery feedstock.
Synonym(s)	Sulfur - Molten, Molten Sulfur See section 16 for complete information.
Manufacturer/Supplier	Valero Marketing & Supply Company and Affiliates P.O. Box 696000 San Antonio, TX 78269-6000
General Assistance	210-345-4593
Emergency	24 Hour Emergency 866-565-5220 1-800-424-9300 (CHEMTREC USA)

2. Hazards Identification

Physical state	Solid, Liquid.
Appearance	Yellow solid.
Emergency overview	DANGER! Flammable Solid. Will be easily ignited by heat, spark or flames. Heat may cause the containers to explode. May be fatal if inhaled. Irritating to eyes, respiratory system and skin. May form combustible dust concentrations in air (during processing). Hydrogen sulfide, a highly toxic gas, may be present or released. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.
OSHA regulatory status	This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Inhalation. Eye contact. Skin contact.
Eyes	Contact may irritate or burn eyes. Eye contact may result in corneal injury.
Skin	Irritating to skin. Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis.
Inhalation	May be fatal if inhaled. Causes respiratory tract irritation. May contain hydrogen sulfide: May rapidly cause irritation, breathing failure, coma, and death without necessarily any warning odor being sensed.
Ingestion	May cause burns in mucous membranes, throat, esophagus and stomach.
Signs and symptoms	Irritation of nose and throat. Irritation of eyes and mucous membranes. Skin irritation. Corneal damage. Defatting of the skin. Persons with pre-existing respiratory tract, skin and lung (such as asthma) disorders may be aggravated by exposure to this product. Hydrogen sulfide, a highly toxic gas, may be present. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.
Potential environmental effects	Not expected to be harmful to aquatic organisms.

3. Composition / Information on Ingredients

Components	CAS #	Percent
Sulfur	7704-34-9	100

4. First Aid Measures

First aid procedures

Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention.
Skin contact	Remove contaminated clothing and shoes. Wash off immediately with soap and plenty of water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes. If high pressure injection under the skin occurs, always seek medical attention.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.
Ingestion	Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center. Do not give mouth-to-mouth resuscitation. If vomiting occurs, keep head low so that stomach content does not get into the lungs. Get medical attention immediately.
Notes to physician	In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General advice	If exposed or concerned: get medical attention/advice. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use.

5. Fire Fighting Measures

Flammable properties	Combustible. Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Extinguishing media

Suitable extinguishing media	Water spray. Water fog. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use a solid water stream as it may scatter and spread fire.

Protection of firefighters

Specific hazards arising from the chemical	High concentrations of dust may form explosive mixture with air.
Protective equipment and precautions for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. In the event of fire, cool tanks with water spray.
Specific methods	In the event of fire and/or explosion do not breathe fumes.
Hazardous combustion products	Sulfur oxides. Hydrogen sulfide.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Local authorities should be advised if significant spills cannot be contained. Keep upwind. Keep out of low areas. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	If facility or operation has an "oil or hazardous substance contingency plan", activate its procedures. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Combustible dust. Review Firefighting Measures, Section 5, before proceeding with clean up. Keep all sources of ignition (flames , smoking, flares, etc.) and hot surfaces away from release. Contain spill in smallest possible area. Recover as much product as possible (e.g. by vacuuming). Stop leak if it can be done without risk. Spilled material may be absorbed by an appropriate absorbent, and then handled in accordance with environmental regulations. Prevent spilled material from entering sewers, storm drains, other unauthorized treatment or drainage systems and natural waterways. Contact fire authorities and appropriate federal, state and local agencies. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, contact the National Response Center at 1-800-424-8802. For highway or railways spills, contact Chemtrec at 1-800-424-9300.
Methods for containment	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Dike the spilled material, where this is possible. Prevent entry into waterways, sewers, basements or confined areas.

Methods for cleaning up

Sweep or scoop up and remove. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Nonsparking tools should be used. Clean surface thoroughly to remove residual contamination. This material and its container must be disposed of as hazardous waste.

Large Spills: Prevent product from entering drains. Do not allow material to contaminate ground water system. Should not be released into the environment.

Other information

Clean up in accordance with all applicable regulations.

7. Handling and Storage

Handling

Wear personal protective equipment. Do not breathe dust. Avoid contact with eyes, skin, and clothing. Do not taste or swallow. Avoid prolonged exposure. Use only with adequate ventilation. Wash thoroughly after handling. Do not handle or store near an open flame, heat or other sources of ignition. Take precautionary measures against static discharges. All equipment used when handling the product must be grounded. Use non-sparking tools and explosion-proof equipment. When using, do not eat, drink or smoke. Avoid release to the environment. In the United States of America, refer to NFPA® Pamphlet No. 654, Prevention of Fire and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries."

Storage

Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres. Refer to NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for safe handling. Do not handle or store near an open flame, heat or other sources of ignition. Keep container tightly closed in a cool, well-ventilated place. Keep away from food, drink and animal feedingstuffs. Keep out of the reach of children.

8. Exposure Controls / Personal Protection

Occupational exposure limits

ACGIH

Material	Type	Value	Form
Sulfur	TWA	0.5 mg/m3	(total dust)

US. ACGIH Threshold Limit Values

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	STEL	5 ppm
	TWA	1 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	20 ppm

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	21 mg/m3
		15 ppm
	TWA	14 mg/m3
		10 ppm
Sulfur (CAS 7704-34-9)	TWA	10 mg/m3

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	Ceiling	10 ppm

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	STEL	5 ppm
	TWA	1 ppm

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	STEL	15 ppm
	TWA	10 ppm

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	STEL	21 mg/m3
		15 ppm
	TWA	14 mg/m3
		10 ppm

Mexico. Occupational Exposure Limit Values

Components	Type	Value
Hydrogen sulfide (CAS 7783-06-4)	STEL	21 mg/m3
		15 ppm
	TWA	14 mg/m3
		10 ppm

Biological limit values No biological exposure limits noted for the ingredient(s).

Engineering controls Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

Personal protective equipment

Eye / face protection Safety glasses.

Skin protection Wear chemical-resistant, impervious gloves. Full body suit and boots are recommended when handling large volumes or in emergency situations. Flame retardant protective clothing is recommended.

Respiratory protection Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. If workplace exposure limits for product or components are exceeded, NIOSH approved equipment should be worn. Proper respirator selection should be determined by adequately trained personnel, based on the contaminants, the degree of potential exposure and published respiratory protection factors. This equipment should be available for nonroutine and emergency use.

Hand protection Wear protective gloves.

General hygiene considerations Consult supervisor for special handling instructions. Do not breathe dust. Keep away from food and drink. Wash hands before breaks and immediately after handling the product. Provide eyewash station and safety shower. Handle in accordance with good industrial hygiene and safety practice.

9. Physical & Chemical Properties

Appearance Yellow solid.

Physical state Solid, Liquid.

Form Prills or molten.

Color	Yellow.
Odor	Sulfurous.
Odor threshold	Not available.
pH	Not available.
Vapor pressure	Not applicable.
Vapor density	Not applicable.
Boiling point	832.28 °F (444.6 °C)
Melting point/Freezing point	246.2 °F (119 °C)
Solubility (water)	Very slightly soluble.
Specific gravity	1.8
Flash point	404.3 °F (206.9 °C)
Flammability limits in air, upper, % by volume	1400 g/m3
Flammability limits in air, lower, % by volume	35 g/m3
Auto-ignition temperature	449.33 °F (231.85 °C)
Evaporation rate	Not applicable.
Viscosity	Not applicable.
Other data	
Flammability (solid, gas)	Combustible dust.

10. Chemical Stability & Reactivity Information

Chemical stability	Stable under normal temperature conditions and recommended use.
Conditions to avoid	Heat. Ignition sources. Minimize dust generation and accumulation.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Sulfur oxides. Hydrogen sulfide.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Components	Species	Test Results
Hydrogen sulfide (CAS 7783-06-4)		
Acute		
Inhalation		
LC50	Mouse	1.5 mg/l, 18 Minutes
		0.38 mg/l, 410 Minutes
		0.096 mg/l, 804 Minutes
		> 0.024 mg/l, 960 Minutes
	Rat	1.5 mg/l, 14 Minutes
		> 0.38 mg/l, 960 Minutes

Sensitization	This product is not expected to cause skin sensitization.
Acute effects	May be fatal if inhaled. Causes skin, eye and respiratory tract irritation. Hydrogen sulfide, a highly toxic gas, may be present due to the contents of sulfur. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

12. Ecological Information

Ecotoxicological data

Components		Species	Test Results
Hydrogen sulfide (CAS 7783-06-4)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.007 mg/l, 96 hours

Ecotoxicity Not expected to be harmful to aquatic organisms.

Environmental effects Not available.

Aquatic toxicity Not available.

Persistence and degradability No data available.

Bioaccumulation / accumulation No data available.

Mobility in environmental media No data available.

13. Disposal Considerations

Disposal instructions Dispose in accordance with all applicable regulations. Incinerate the material under controlled conditions in an approved incinerator. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container.

14. Transport Information

DOT

Basic shipping requirements:

UN number UN2448
Proper shipping name Sulfur, molten
Hazard class 4.1
Labels required 4.1
Packing group III
Additional information:
Special provisions 30, IB1, T1, TP3
Packaging exceptions None
Packaging non bulk 213
Packaging bulk 247

IATA

UN number UN2448
UN proper shipping name Sulphur, molten
Transport hazard class(es) 4.1
ERG code 3L

IMDG

UN number UN2448
UN proper shipping name SULPHUR, MOLTEN
Transport hazard class(es) 4.1
Packing group III
EmS F-A, S-H

TDG

UN number UN2448
Proper shipping name SULPHUR, MOLTEN
Hazard class 4.1
Packing group III

15. Regulatory Information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard 29 CFR 1910.1200 (OSHA) and 8 CCR § 5194 (Cal/OSHA).
All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

Drug Enforcement Administration (DEA) (21 CFR 1308.11-15) Not controlled

WHMIS status Controlled

WHMIS classification

B4 - Flammable Solids
D2B - Other Toxic Effects-TOXIC

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

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

Sulfur (CAS 7704-34-9) Listed.

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

Not listed.

US. Massachusetts RTK - Substance List

Sulfur (CAS 7704-34-9) Listed.

US. New Jersey Worker and Community Right-to-Know Act

Sulfur (CAS 7704-34-9)

US. Pennsylvania Worker and Community Right-to-Know Law

Sulfur (CAS 7704-34-9)

16. Other Information

Other information

Note: This material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical Specifications vary greatly depending on the products and are not reflected in this document. Consult specification sheets for technical information.

HMIS® ratings

Health: 2
Flammability: 2
Physical hazard: 0

NFPA ratings

Disclaimer

This Material Safety Data Sheet (MSDS) was prepared in accordance with 29 CFR 1910.1200 by Valero Marketing & Supply Co., ("VALERO"). VALERO does not assume any liability arising out of product use by others. The information, recommendations, and suggestions presented in this MSDS are based upon test results and data believed to be reliable. The end user of the product has the responsibility for evaluating the adequacy of the data under the conditions of use, determining the safety, toxicity and suitability of the product under these conditions, and obtaining additional or clarifying information where uncertainty exists. No guarantee expressed or implied is made as to the effects of such use , the results to be obtained, or the safety and toxicity of the product in any specific application. Furthermore, the information herein is not represented as absolutely complete, since it is not practicable to provide all the scientific and study information in the format of this document, plus additional information may be necessary under exceptional conditions of use, or because of applicable laws or government regulations.

Prepared by

Not available.