



Right to Know Hazardous Substance Fact Sheet

Common Name: **SULFUR**

Synonyms: Brimstone; Colloidal Sulfur; Molten Sulfur

Chemical Name: Sulfur

Date: August 2002 Revision: April 2011

CAS Number: 7704-34-9

RTK Substance Number: 1757

DOT Number: UN 1350
UN 2448 (Molten)

Description and Use

Sulfur is a pale yellow, crystalline (sand-like) solid that is odorless when pure or may have a faint "rotten egg" odor. **Sulfur** is often transported in a *molten* state that is an amber-colored liquid. It is used in making *Sulfuric Acid*, rubbers, detergents, fungicides and fertilizers, and in petroleum refining.

Reasons for Citation

- ▶ **Sulfur** is on the Right to Know Hazardous Substance List because it is cited by DOT and NFPA.

[SEE GLOSSARY ON PAGE 5.](#)

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact

- ▶ Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- ▶ Remove the person from exposure.
- ▶ Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- ▶ Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	-	2
FLAMMABILITY	-	1
REACTIVITY	-	0
FLAMMABLE (MOLTEN) COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- ▶ **Sulfur** can affect you when inhaled.
- ▶ Contact can severely irritate and burn the skin and eyes with possible eye damage.
- ▶ Inhaling **Sulfur** can irritate the nose, throat and lungs.
- ▶ Exposure to **Sulfur** can cause headache, nausea and vomiting.
- ▶ **Sulfur** may cause an asthma-like allergy.
- ▶ *Molten Sulfur* is FLAMMABLE and can release poisonous gases such as *Hydrogen Sulfide*.
- ▶ *For more information, consult the Right to Know Hazardous Substance Fact Sheet on HYDROGEN SULFIDE.*

Workplace Exposure Limits

The following exposure limits are for *Hydrogen Sulfide*:

NIOSH: The recommended airborne exposure limit (REL) is **10 ppm**, which should not be exceeded during any 10-minute work period.

ACGIH: The threshold limit value (TLV) is **1 ppm** averaged over an 8-hour workshift and **5 ppm** as a STEL (short-term exposure limit).

Determining Your Exposure

- ▶ Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- ▶ For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- ▶ You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- ▶ The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Sulfur**:

- ▶ Contact can severely irritate and burn the skin and eyes with possible eye damage.
- ▶ Inhaling **Sulfur** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- ▶ Exposure to **Sulfur** can cause headache, nausea and vomiting.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Sulfur** and can last for months or years:

Cancer Hazard

- ▶ According to the information presently available to the New Jersey Department of Health, **Sulfur** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

- ▶ According to the information presently available to the New Jersey Department of Health, **Sulfur** has not been tested for its ability to affect reproduction.

Other Effects

- ▶ **Sulfur** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- ▶ Repeated high exposure may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, coughing, and/or chest tightness.
- ▶ Prolonged or repeated contact can cause dermatitis with drying, cracking and redness of the skin.

Medical

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

- ▶ Lung function tests. The results may be normal if the person is not having an attack at the time of the test.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

You have a legal right to request copies of your medical testing under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- ▶ Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- ▶ Label process containers.
- ▶ Provide employees with hazard information and training.
- ▶ Monitor airborne chemical concentrations.
- ▶ Use engineering controls if concentrations exceed recommended exposure levels.
- ▶ Provide eye wash fountains and emergency showers.
- ▶ Wash or shower if skin comes in contact with a hazardous material.
- ▶ Always wash at the end of the workshift.
- ▶ Change into clean clothing if clothing becomes contaminated.
- ▶ Do not take contaminated clothing home.
- ▶ Get special training to wash contaminated clothing.
- ▶ Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- ▶ Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- ▶ Before entering a confined space where *molten Sulfur* may be present, check to make sure that an explosive concentration does not exist.
- ▶ For *solid Sulfur* use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- ▶ Avoid skin contact with **Sulfur**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- ▶ The recommended glove materials for *solid Sulfur* are Nitrile, Neoprene and Natural Rubber.
- ▶ The recommended protective clothing material for *solid Sulfur* is Tyvek®, or the equivalent.

- ▶ Wear heat-resistant gloves and clothing materials when working with *molten Sulfur*.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ Wear direct vent goggles when airborne particles or dust are present.
- ▶ Wear non-vented goggles when working with *molten Sulfur* as vapors and/or fumes may be produced. A face shield is also required if the vapors and/or fumes are severely irritating or corrosive to the skin and eyes.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- ▶ Where the potential exists for overexposure to *solid Sulfur*, use a NIOSH approved negative pressure, air-purifying, particulate filter respirator with an N, R or P95 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- ▶ Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Sulfur**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- ▶ Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- ▶ Where the potential for high exposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- ▶ Where the potential exists for exposure to *molten Sulfur*, especially when heated and in an enclosed area, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- ▶ *Molten Sulfur* is FLAMMABLE and a fire and explosion risk above 450°F (232°C).
- ▶ **Sulfur** is a COMBUSTIBLE SOLID.
- ▶ Use water spray to fight fires and to keep fire-exposed containers cool.

- ▶ POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Sulfide*, *Sulfur Dioxide* and *Sulfur Trioxide*.
- ▶ CONTAINERS MAY EXPLODE IN FIRE.
- ▶ Flow or agitation may generate electrostatic charges.
- ▶ **Sulfur** may form an ignitable vapor/air mixture in closed tanks or containers.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Sulfur** is spilled, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate all ignition sources.
- ▶ Cover *molten Sulfur* with dry sand, earth, or a noncombustible material and place into sealed containers for disposal.
- ▶ Collect solid material in the most convenient and safe manner and place into sealed containers for disposal.
- ▶ Keep *molten Sulfur* out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ Ventilate and wash area after clean-up is complete.
- ▶ DO NOT wash into sewer.
- ▶ It may be necessary to contain and dispose of **Sulfur** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Sulfur** you should be trained on its proper handling and storage.

- ▶ **Sulfur** reacts explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- ▶ **Sulfur** is not compatible with METALS and METAL POWDERS (such as ZINC and TIN); ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM); PHOSPHORUS; AMMONIA; CHARCOAL; and HYDROGEN.
- ▶ *Molten Sulfur* reacts with HYDROCARBONS to form toxic and flammable gases such as *Carbon Disulfide* and *Hydrogen Sulfide*.
- ▶ *Molten Sulfur* can reach temperatures of 320 °F (160 °C), resulting in the formation of flammable and toxic *Hydrogen Sulfide*, *Sulfur Dioxide* and *Sulfur Trioxide* gases. These gases can accumulate in the vapor space of tankers and enclosed spaces.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE and COMBUSTIBLES.
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Sulfur** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.
- ▶ **Sulfur** may accumulate static electricity.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **Sulfur**.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
 Right to Know
 PO Box 368
 Trenton, NJ 08625-0368
 Phone: 609-984-2202
 Fax: 609-984-7407
 E-mail: rtk@doh.state.nj.us
 Web address: <http://www.nj.gov/health/eoh/rtkweb>

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or Lower Explosive Limit, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or Upper Explosive Limit is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Common Name: **SULFUR**

Synonyms: Brimstone; Colloidal Sulfur; Molten Sulfur

CAS No: 7704-34-9

 Molecular Formula: S, S₈ (Molten)

RTK Substance No: 1757

 Description: Pale yellow, crystalline solid (odorless when pure or faint "rotten egg" odor) or an amber-colored liquid when *molten*

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health 1 - Fire 0 - Reactivity DOT#: UN 1350 UN 2448 (Molten) ERG Guide #: 133 Hazard Class: 4.1 (Flammable Solid)	<i>Molten Sulfur</i> is a FLAMMABLE SOLID and a fire and explosion risk above 450 °F (232 °C). Sulfur is a COMBUSTIBLE SOLID. Use water spray to fight fires and to keep fire-exposed containers cool. POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Hydrogen Sulfide</i> , <i>Sulfur Dioxide</i> and <i>Sulfur Trioxide</i> . CONTAINERS MAY EXPLODE IN FIRE. Flow or agitation may generate electrostatic charges. Sulfur may form an ignitable vapor/air mixture in closed tanks or containers.	Sulfur reacts explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE). Sulfur is not compatible with METALS and METAL POWDERS (such as ZINC and TIN); ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM); PHOSPHORUS; AMMONIA; CHARCOAL; and HYDROGEN. <i>Molten Sulfur</i> reacts with HYDROCARBONS to form toxic and flammable gases such as <i>Carbon Disulfide</i> and <i>Hydrogen Sulfide</i> . <i>Molten Sulfur</i> can reach temperatures of 320 °F (160 °C), resulting in the formation of flammable and toxic <i>Hydrogen Sulfide</i> , <i>Sulfur Dioxide</i> and <i>Sulfur Trioxide</i> gases. These gases can accumulate in the vapor space of tankers and enclosed spaces.

SPILL/LEAKS

Isolation Distance:

 Spill: 25 meters (75 feet) (*Solid*)
 50 meters (150 feet) (*Molten*)

Fire: 800 meters (1/2 mile)

 Cover *molten Sulfur* with dry sand, earth, or a noncombustible material and place into sealed containers for disposal.

Collect powdered material in the most convenient and safe manner and place into sealed containers for disposal.

Use only non-sparking tools and equipment.

 Keep *molten Sulfur* out of confined spaces, such as sewers, because of the possibility of an explosion.

DO NOT wash into sewer.

Sulfur is dangerous to aquatic life in high concentrations.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless to rotten egg odor
Flash Point:	405°F (207°C)
LEL:	3.3% (as <i>Hydrogen Sulfide</i>)
UEL:	46% (as <i>Hydrogen Sulfide</i>)
Auto Ignition Temp:	450°F (232°C)
Vapor Pressure:	1 mm Hg at 363°F (184°C)
Specific Gravity:	1.8 to 2.1 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	832°F (445°C)
Melting Point:	239°F (115°C)
Molecular Weight:	32.07(S), 256.81 (S ₈) (<i>molten</i>)

EXPOSURE LIMITS

NIOSH: 10 ppm, 10-min Ceiling for *Hydrogen Sulfide*
ACGIH: 1 ppm, 8-hr TWA; 5 ppm, STEL for *Hydrogen Sulfide*

 The Protective Action Criteria values for **Sulfur** are:

 PAC-1 = 4 mg/m³ PAC-2 = 30 mg/m³
 PAC-3 = 150 mg/m³

PROTECTIVE EQUIPMENT

Gloves:	Nitrile, Neoprene and Natural Rubber (for <i>solid Sulfur</i>) and Insulated materials (for <i>molten Sulfur</i>)
Coveralls:	Tyvek® for <i>solid Sulfur</i> ; use Turn out gear or heat/flame protection for <i>molten Sulfur</i>
Respirator:	Spill: full facepiece APR with N, R or P100 filters for <i>solid Sulfur</i> and SA or SCBA for <i>molten Sulfur</i> Fire: SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Nose, throat and lung irritation, with coughing, wheezing and shortness of breath Headache, nausea and vomiting

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.
Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.