



Right to Know Hazardous Substance Fact Sheet

Common Name: **SULFUR TRIOXIDE**

Synonyms: Sulfuric Anhydride; Sulfuric Oxide

Chemical Name: Sulfur Trioxide

Date: September 1999 Revision: August 2008

CAS Number: 7446-11-9

RTK Substance Number: 1767

DOT Number: UN 1829

Description and Use

Sulfur Trioxide is a colorless to white, crystalline (sand-like) solid which can also exist as a gas or liquid. It is used primarily as a *Sulfating* agent in making detergents, as a disinfectant and preservative, and in textile and battery manufacturing.

- ▶ **ODOR THRESHOLD = 1 ppm**
- ▶ Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- ▶ **Sulfur Trioxide** is on the Right to Know Hazardous Substance List because it is cited by DOT, NTP, DEP, IARC and EPA.
- ▶ This chemical is on the Special Health Hazard Substance List.

[SEE GLOSSARY ON PAGE 5.](#)

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of water for at least 30 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention immediately.

Skin Contact

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

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.
- ▶ Medical observation is recommended for 24 to 48 hours after overexposure, as pulmonary edema may be delayed.

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 BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	-
FLAMMABILITY	0	-
REACTIVITY	2W	-

CARCINOGEN
CORROSIVE AND REACTIVE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE
DO NOT USE WATER

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

- ▶ **Sulfur Trioxide** can affect you when inhaled.
- ▶ **Sulfur Trioxide** is a CARCINOGEN. HANDLE WITH EXTREME CAUTION.
- ▶ **Sulfur Trioxide** is CORROSIVE and contact can severely irritate and burn the skin and eyes with possible eye damage.
- ▶ Inhaling **Sulfur Trioxide** can irritate the nose and throat.
- ▶ Inhaling **Sulfur Trioxide** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- ▶ Exposure to **Sulfur Trioxide** can cause headache, dizziness, nausea and vomiting.
- ▶ **Sulfur Trioxide** is REACTIVE and a DANGEROUS EXPLOSION HAZARD.
- ▶ **Sulfur Trioxide** is not combustible but is a STRONG OXIDIZER which enhances the combustion of other substances.

Workplace Exposure Limits

ACGIH: The threshold limit value (TLV) is **0.2 mg/m³** (as *Sulfuric Acid, thoracic fraction*) averaged over an 8-hour workshift.

ACGIH: The threshold limit value (TLV) is **0.25 ppm** as a STEL (short-term exposure limit), which should not be exceeded at any time, for *Sulfur Dioxide*.

- ▶ **Sulfur Trioxide** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

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, 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 Trioxide**:

- ▶ Contact can severely irritate and burn the skin and eyes with possible eye damage.
- ▶ Inhaling **Sulfur Trioxide** can irritate the nose and throat.
- ▶ Inhaling **Sulfur Trioxide** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- ▶ Exposure to **Sulfur Trioxide** can cause headache, dizziness, nausea and vomiting.

Chronic Health Effects

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

Cancer Hazard

- ▶ **Sulfur Trioxide** is a CARCINOGEN in humans. There is evidence that *strong inorganic acid mists containing Sulfuric Acid* cause cancer of the lung and larynx in humans.
- ▶ Many scientists believe there is no safe level of exposure to a carcinogen. Such substance may also have the potential for causing reproductive damage in humans.

Reproductive Hazard

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

Other Effects

- ▶ **Sulfur Trioxide** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.

Medical

Medical Testing

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

- ▶ Consider chest x-ray after acute overexposure

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.

Request copies of your medical testing. You have a legal right to this information 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 **Sulfur Trioxide** may be present, check to make sure that an explosive concentration does not exist.
- ▶ For *solid Sulfur Trioxide* use a vacuum to reduce dust during clean-up.

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 Trioxide**. 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.
- ▶ Safety equipment manufacturers recommend Silver Shield®/4H® and Fluoroelastomer as glove material for *Oleum* and DuPont Tychem® CPF 4 and TK; Kappler® Zytron® 300; and Saint-Gobain ONESuit® TEC, or the equivalent, as protective materials for *Oleum*.

- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- ▶ Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- ▶ Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- ▶ Do not wear contact lenses when working with this substance.

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 exposure over **0.2 mg/m³** (as *Sulfuric Acid*), use a NIOSH approved full facepiece respirator with an acid gas cartridge which is specifically approved for *Sulfuric Acid*. Increased protection is obtained from full facepiece powered-air purifying respirators.
- ▶ Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Sulfur Trioxide**, (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 exists for exposure to **Sulfur Trioxide** as a *liquid* or *gas*, or if *Sulfur Dioxide* is present at levels over **0.25 ppm**, 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 operated in a pressure-demand or other positive-pressure mode.
- ▶ Where the potential exists for exposure over **2 mg/m³** (as *Sulfuric Acid*), 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 operated in a pressure-demand or other positive-pressure mode.

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).

- ▶ **Sulfur Trioxide** is not combustible but is a STRONG OXIDIZER which enhances the combustion of other substances.
- ▶ Use dry chemical or CO₂ as extinguishing agents.
- ▶ DO NOT USE WATER directly on **Sulfur Trioxide** as an explosion may result.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE.
- ▶ CONTAINERS MAY EXPLODE IN FIRE.
- ▶ Use water spray to keep fire-exposed containers cool. DO NOT get water inside containers.
- ▶ **Sulfur Trioxide** may ignite combustibles (wood, paper and oil).

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 *solid* or *liquid* **Sulfur Trioxide** is spilled or leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate all ignition sources.
- ▶ Cover spilled material with crushed limestone, soda ash or lime.
- ▶ Cover with a plastic sheet to protect from rain and water.
- ▶ Collect material in the most convenient and safe manner and deposit into sealed containers.
- ▶ DO NOT USE WATER OR WET METHOD.
- ▶ Ventilate and wash area after clean-up is complete.
- ▶ DO NOT wash into sewer.
- ▶ Keep **Sulfur Trioxide** out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ It may be necessary to contain and dispose of **Sulfur Trioxide** 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 Trioxide** you should be trained on its proper handling and storage.

- ▶ **Sulfur Trioxide** reacts explosively with WATER to form toxic *Sulfuric Acid*.
- ▶ **Sulfur Trioxide** reacts violently with ORGANIC MATERIALS; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); TETRAFLUOROETHYLENE; OXYGEN DIFLUORIDE; ANHYDROUS PERCHLORIC ACID; and REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES) to release heat and cause fires, and form toxic gases.
- ▶ **Sulfur Trioxide** is AIR SENSITIVE.

- ▶ Store in tightly closed containers in a cool, well-ventilated area away from HEAT and COMBUSTIBLES.
- ▶ **Sulfur Trioxide** is corrosive to METALS.

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 (AEGs) 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.

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 are intended to 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 maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

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.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

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

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 *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Common Name: **SULFUR TRIOXIDE**

Synonyms: Sulfuric Anhydride; Sulfuric Oxide

CAS No: 7446-11-9

Molecular Formula: SO₃

RTK Substance No: 1767

Description: Colorless to white, crystalline solid or a colorless gas or liquid

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
<p>3 - Health</p> <p>0 - Fire</p> <p>2W - Reactivity</p> <p>DOT#: UN 1829</p> <p>ERG Guide #: 137</p> <p>Hazard Class: 8</p> <p>(Corrosive)</p>	<p>Sulfur Trioxide is not combustible but is a STRONG OXIDIZER which enhances the combustion of other substances.</p> <p>Use dry chemical or CO₂ as extinguishing agents.</p> <p>DO NOT USE WATER directly on Sulfur Trioxide as an explosion may result.</p> <p>POISONOUS GASES ARE PRODUCED IN FIRE.</p> <p>CONTAINERS MAY EXPLODE IN FIRE.</p> <p>Use water spray to keep fire-exposed containers cool. DO NOT get water inside containers.</p> <p>Sulfur Trioxide may ignite combustibles (wood, paper and oil).</p>	<p>Sulfur Trioxide reacts explosively with WATER to form toxic <i>Sulfuric Acid</i>.</p> <p>Sulfur Trioxide reacts violently with ORGANIC MATERIALS; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); TETRAFLUOROETHYLENE; OXYGEN DIFLUORIDE; ANHYDROUS PERCHLORIC ACID; and REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES) to release heat and cause fires, and form toxic gases</p> <p>Sulfur Trioxide is AIR SENSITIVE.</p>

SPILL/LEAKS

Isolation Distance:

Small Spill: 60 meters (200 feet)

Large Spill: 300 meters (1,000 feet)

Fire: 800 meters (1/2 mile)

Cover spilled material with crushed limestone, soda ash, or lime.

Cover with a plastic sheet to protect from rain and water.

Collect material in the most convenient and safe manner and deposit into sealed containers.

DO NOT wash into sewer.

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

May be toxic to aquatic life.

PHYSICAL PROPERTIES

Odor Threshold:	1 ppm
Flash Point:	Noncombustible
Vapor Density:	2.8 (air = 1)
Vapor Pressure:	73 mm Hg at 77°F (25°C)
Specific Gravity:	1.9 (water = 1)
Water Solubility:	Reacts
Boiling Point:	113°F (45°C)
Ionization Potential:	12.8 +/- 0.04 (liquid)
Molecular Weight:	80

EXPOSURE LIMITS

ERPG-1: 2 mg/m³

ERPG-2: 10 mg/m³

ERPG-3: 30 mg/m³

PROTECTIVE EQUIPMENT

Gloves:	Silver Shield®/4H® and Fluoroelastomer (>8-hr breakthrough for <i>Oleum</i>)
Coveralls:	DuPont Tychem® CPF 4 and TK; Kappler® Zytron® 300; and Saint-Gobain ONESuit® TEC (>8-hr breakthrough for <i>Oleum</i>)
Respirator:	< 2 mg/m ³ - Supplied air > 2 mg/m ³ - SCBA

HEALTH EFFECTS

Eyes:	Severe irritation and burns
Skin:	Severe irritation and burns
Inhalation:	Nose, throat and lung irritation with coughing and severe shortness of breath (pulmonary edema)
	Headache, dizziness, nausea and vomiting
Chronic:	Strong inorganic acid mists containing <i>Sulfuric Acid</i> cause cancer of the lung and larynx in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Seek medical attention immediately.
Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water. Seek medical attention immediately.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.
Medical observation is recommended as symptoms may be delayed.