Commonwealth of Massachusetts

RECOMMENDED SAFE PRACTICES BULLETIN

SULFUR DIOXIDE

Synonyms: sulfurous anhydride; sulfurous oxide
C.A.S. Number: 7446-09-5

Chemical Formula: SO_2
Date Completed: 6/89

HAZARD SUMMARY

- **Sulfur dioxide can affect the body if it is inhaled or if it comes into contact with the eyes or skin.**
- **Exposure to sulfur dioxide may cause severe breathing difficulties. Very high levels may lead to death.**

GENERAL DESCRIPTION

Sulfur dioxide is a colorless gas at room temperature with a characteristic strong, suffocating odor. It is one of the most widely encountered contaminants in the workplace environment. It is used in the production of sulfuric acid and paper, and as a bleaching agent for sugar, fibers, and leather. It is formed whenever sulfur-containing materials are burned, as in metal smelters and in plants that burn soft coal or high-sulfur oil.

HEALTH HAZARD INFORMATION

Exposure to sulfur dioxide may occur by inhalation or by contact with the eyes or skin.

ACUTE (short-term) HEALTH EFFECTS

Inhalation: Exposure to sulfur dioxide can irritate the eyes and respiratory tract causing burning of the eyes, tearing, choking, coughing, and chest tightness. Exposure to very high levels may cause severe breathing difficulties and may be fatal. Individuals with asthma may be at special risk for respiratory symptoms when exposed to sulfur dioxide.

Department of Labor and Industries - Division of Occupational Hygiene
1001 Watertown Street, West Newton, MA 02165

Table of Contents

PUBLICATION: #16006-6 pgs-50 cps 6/23/89
APPROVED BY: Ric Murphy, State Purchasing Agent

Skin: Contact with the liquid may cause burns, pain and redness.

Eye: Contact with sulfur dioxide may cause redness, pain and blurred vision.

Ingestion: Ingestion of the liquid may cause burning in the mouth, nausea, vomiting and irritation of the gastrointestinal tract.

CHRONIC (long-term) HEALTH EFFECTS

Inhalation: Prolonged exposure to sulfur dioxide at low levels may cause a progressive decline in lung function and lead to chronic lung disease.

Skin: Long-term exposure to liquid sulfur dioxide may cause inflammation.

Eye: Long-term exposure to sulfur dioxide may cause conjunctivitis.

Ingestion: Not available.

Cancer Hazard: Some studies of occupational groups exposed to sulfur dioxide and certain other substances have shown high rates of lung cancer. However, sulfur dioxide itself has not been proven to be a carcinogen.

Reproductive Hazard: In a limited number of studies, sulfur dioxide given to pregnant rodents has caused developmental abnormalities and reduced weight gain in the offspring. Information is lacking to determine other reproductive effects.

CONDITIONS THAT MAY BE AGGRAVATED BY EXPOSURE

Individuals with asthma or other respiratory diseases may be adversely affected by levels of sulfur dioxide which produce no effect in the rest of the population.

OCCUPATIONAL EXPOSURE LIMITS

Most OSHA exposure limits are based on recommendations made by the ACGIH. Other recommendations, made by NIOSH, may be more protective of human health. Many chemicals have not been studied for long-term effects. Because of individual susceptibility, a small percentage of workers exposed to this substance at or below any of the recommended limits may experience some ill effects.

OSHA: The legal airborne exposure limit is 2 ppm, averaged over an 8-hour workshift. The short-term exposure limit, not to be exceeded in any 15-minute period, is 5 ppm.

ACGIH: The recommended airborne exposure limit is 2 ppm, averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is 0.5 ppm, averaged over a 10-hour workshift.

MEDICAL MONITORING

Employees should have initial and annual medical exams including special attention to the respiratory tract and eyes.

EMERGENCY INFORMATION

FIRST AID

Inhalation: Remove the individual from exposure area to fresh air immediately. If breathing has ceased, properly trained personnel should begin artificial respiration or cardiopulmonary resuscitation (CPR) immediately. Get medical attention immediately.

Ingestion: If person is conscious, immediately give large amounts of water or milk. Do not induce vomiting; do not use gastric lavage or emesis. If vomiting occurs, administer fluids repeatedly. Get medical attention immediately.

Skin: Remove contaminated clothing immediately. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). In case of chemical burns, cover area with sterile, dry dressing. Get medical attention immediately.

Eyes: Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids until no evidence of chemical remains (at least 15 to 20 minutes). In case of burns, apply sterile bandages loosely without medication. Get medical attention immediately.

FIRE AND EXPLOSION

NFPA Rating

Flammability: 0
Reactivity: 0
Health: 2

Flash Point: Not flammable
Extinguishing Media: Dry chemical; carbon dioxide; halon; water spray; foam
Flammable Limits: NA

Respiratory Protection: Self-contained breathing apparatus with full facepiece, operated in pressure-demand or other positive-pressure mode. Supplied-air respirator with full facepiece, operated in pressure-demand or other positive-pressure mode, in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Protective Equipment: Impervious clothing is needed if contact with liquid sulfur dioxide is possible.

SPILL, LEAK, AND DISPOSAL PROCEDURES

The leak should be stopped if it can be done without risk. A water spray should be used to reduce vapors. The water is acidic and corrosive, and should be diked for neutralization and disposal. The area should be isolated until the gas has dispersed. Closed spaces should be ventilated before entering.

Federal law requires that a leak or spill of more than one pound of sulfur dioxide be reported to the State Emergency Response Commission, the local Fire Department, and the local Emergency Planning Committee.

Disposal: Pass the gas into an alkaline solution, such as sodium carbonate, then add calcium hypochlorite, neutralize, and flush with water.

EMERGENCY INFORMATION SOURCES

CHEMTREC: (800) 424-9300
Poison Information Center: (800) 682-9211; 232-2120 (Boston area only)

PROTECTIVE MEASURES

ENGINEERING CONTROLS

Engineering controls are almost always the best way to control employee exposure to hazardous chemicals. Engineering controls may include local exhaust ventilation, enclosure of the process, general dilution ventilation and others. However, for some jobs (such as outside work, confined space entry, non-routine maintenance, emergencies, and jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

RESPIRATORY PROTECTION

Only respirators that have been approved by NIOSH or MSHA for exposures to sulfur dioxide should be used. Such equipment should only be used if the employer has a written program that takes into account air concentrations of the contaminant, and includes respirator fit testing, regular training, maintenance, inspection, cleaning, and evaluation. Improper use of respirators can be dangerous.

Any of the following forms of respiratory protection may be used for sulfur dioxide at the indicated airborne levels. They are listed in order of increasing level of protection.

Airborne Concentration	Respiratory Protection
Up to 20 ppm	Any chemical cartridge respirator with a cartridge that provides protection against sulfur dioxide. A full facepiece should be used if eye irritation occurs.
Up to 100 ppm	A gas mask with a chin-style or a front or back-mounted canister that provides protection against sulfur dioxide. Any supplied-air respirator with full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.

Airborne Concentration	Respiratory Protection
Greater than 100 ppm or unknown	Self-contained breathing apparatus with full facepiece, operated in pressure-demand or other positive-pressure mode. Type C supplied-air respirator with full-facepiece, operated in pressure-demand or other positive-pressure mode, and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

PROTECTIVE EQUIPMENT

Eye Protection: Splash-proof safety goggles. Contact lenses should not be worn. Sulfur dioxide produces an acidic solution when it comes in contact with water, such as the fluid surrounding the eye.

Clothing: Appropriate impervious clothing to prevent skin contact. There is a dual hazard of skin freezing on contact with the liquid and acid burns on contact with the wet gas.

STORAGE AND REACTIVITY INFORMATION

REACTIVITY

Sulfur dioxide is stable at normal temperatures and pressures.

INCOMPATIBILITIES

Sulfur dioxide reacts explosively with oxidizing agents such as nitric acid and chlorates, with halogens, and with active metals such as sodium, aluminum, powdered chromium, and powdered manganese. Moist sulfur dioxide corrodes many metals and degrades plastic tubing.

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal decomposition may release other toxic and hazardous gases.

STORAGE

Protect containers against physical damage. Store outdoors, or in a well ventilated area of noncombustible construction, in accordance with NFPA 49, Hazardous Chemicals Data, 1975.

PHYSICAL AND CHEMICAL DATA

Boiling Point: 14°F (-10°C)
Melting Point: -104°F (-76°C)
Vapor Pressure: 2538 mmHg at 21°C
Specific Gravity: 1.5 at -10°C

Molecular Weight: 64.1
Solubility in Water: 10%; reacts
Evaporation Rate: gaseous
Vapor Density: 2.3

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits for exposure to workplace chemicals.

Action level is the amount of a chemical in the air above which OSHA-specified medical and air monitoring must be done.

A carcinogen is a substance that causes cancer.

The C.A.S. number is assigned by the Chemical Abstracts Service to identify a specific chemical.

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

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of how much of a chemical is in the air.

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A mutagen is a substance that causes 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.

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

ppm means parts of a substance per million parts of air. It is a measure of how much gas or vapor is in the air.

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

The vapor pressure is a measure of how easily a liquid or a solid gives off vapors. A higher vapor pressure indicates a higher concentration of the substance in the air, and therefore increases the amount of it breathed in.

WHERE TO GO FOR ADDITIONAL INFORMATION

The following information is available from the Massachusetts Department of Labor and Industries.

RIGHT TO KNOW INFORMATION

The Right to Know Program can answer questions about particular chemicals, training, labeling, and other Right to Know matters. Violations of the Right to Know Law should be reported to the nearest office of the Department of Labor and Industries.

PUBLIC PRESENTATIONS

Presentations and educational programs on occupational health or the Right to Know Law can be given for labor unions, trade associations and other groups.

OCCUPATIONAL HEALTH AND SAFETY SERVICES

Upon recept of a complaint, an inspection may be conducted at your workplace. An inspection may include a walk-through, air monitoring, and evaluation of existing conditions and controls. Complaints about workplace health and safety conditions may be reported to any office of the Department of Labor and Industries. Such complaints are maintained strictly confidential. In addition, employers may obtain free technical assistance in complying with OSHA standards and the Massachusetts Right to Know Law.

MEDICAL EVALUATION

The Division of Occupational Hygiene has the names of various occupational health services and occupational physicians who are board-certified. This information is available upon request.

MASSACHUSETTS DEPARTMENT OF LABOR AND INDUSTRIES

Division of Occupational Hygiene

West Newton (617) 969-7177

Division of Industrial Safety

Boston (617) 727-3460
Lawrence (617) 681-7798
New Bedford (617) 997-8263
Springfield (413) 734-1421
Worcester (617) 752-6504
Pittsfield (413) 445-4214