

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR ALLYL PROPYL DISULFIDE

INTRODUCTION

This guideline summarizes pertinent information about allyl propyl disulfide for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Structure



• Synonyms

2-Propenyl propyl disulfide; onion oil; 4,5-dithia-1-octene; propyl allyl disulfide

• Identifiers

1. CAS No.: 2179-59-1
2. RTECS No.: JO0350000
3. DOT UN: None
4. DOT label: None

• Appearance and odor

Allyl propyl disulfide is a pale yellow, combustible liquid with a strong, pungent, irritating odor. It is the chief volatile constituent of onion oil.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 148.3

2. Boiling point (13 mm Hg): 78° to 80°C (172.4° to 176°F)
3. Specific gravity (water = 1): 0.93 at 15°C (59°F)
4. Vapor density: (air = 1 at boiling point of allyl propyl disulfide) 5.12
5. Melting point: Solidifies at -15°C (5°F)
6. Vapor pressure at 20°C (68°F): Data not available; however, this substance is known to be volatile.
7. Solubility: Insoluble in water; soluble in ether, carbon disulfide, and chloroform
8. Evaporation rate: Data not available

• Reactivity

1. Conditions contributing to instability: Heat, sparks, and open flame
2. Incompatibilities: Fires and explosions may result from contact of allyl propyl disulfide with oxidizers.
3. Hazardous decomposition products: Toxic gases (such as sulfur oxides) may be released in a fire involving allyl propyl disulfide.
4. Special precautions: None known

• Flammability

The National Fire Protection Association has not assigned a flammability rating to allyl propyl disulfide. Other sources rate allyl propyl disulfide as a moderate fire hazard.

1. Flash point: Data not available
2. Autoignition temperature: Data not available
3. Flammable limits in air: Data not available
4. Extinguishant: Use foam, carbon dioxide, or dry chemical to fight fires involving allyl propyl disulfide. Water may be ineffective, but it may be used to cool fire-exposed containers. If a leak or spill has not ignited, water spray may be used to disperse vapors and to protect persons attempting to stop the leak.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

EXPOSURE LIMITS

• OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for allyl propyl disulfide is 2 ppm (12 mg/m^3) as an 8-hr time-weighted average (TWA) concentration and 3 ppm (18 mg/m^3) as a short-term exposure limit (STEL). A STEL is a 15-min TWA exposure that should not be exceeded at any time during a workday [29 CFR 1910.1000, Table Z-1-A].

• NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 2 ppm (12 mg/m^3) as an 8-hr TWA and 3 ppm (18 mg/m^3) as a STEL [NIOSH 1992].

• ACGIH TLV[®]

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned allyl propyl disulfide a threshold limit value (TLV) of 2 ppm (12 mg/m^3) as a TWA for a normal 8-hr workday and a 40-hr workweek and a STEL of 3 ppm (18 mg/m^3) for periods not to exceed 15 min [ACGIH 1991b].

• Rationale for limits

The limits are based on the risk of eye, nose, and upper respiratory tract irritation associated with exposure to allyl propyl disulfide.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to allyl propyl disulfide can occur through inhalation and eye or skin contact.

• Summary of toxicology

1. *Effects on Animals:* No studies are available on the toxicity of allyl propyl disulfide in animals.

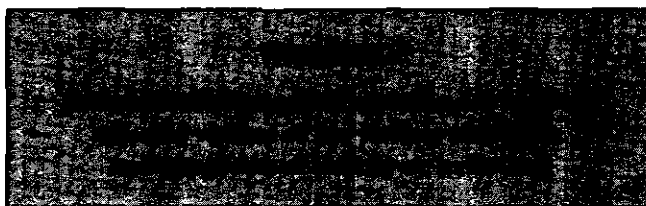
2. *Effects on Humans:* Allyl propyl disulfide irritates the eyes, nose, throat, and mucous membranes [Proctor et al. 1988]. Allyl propyl disulfide is reported to cause lacrimation at concentrations of 2 to 3 ppm and above [Grant 1986]. Workers in an onion dehydration plant who were exposed to allyl propyl disulfide at 3.4 ppm experienced eye, nose, and throat irritation [ACGIH 1991a].

• Signs and symptoms of exposure

1. *Acute exposure:* Acute exposure to allyl propyl disulfide can cause tearing eyes, runny nose, and throat irritation.

2. *Chronic exposure:* No signs or symptoms of chronic exposure to allyl propyl disulfide have been reported.

• Emergency procedures



Initiate the following emergency procedures:

1. *Eye exposure:* Tissue irritation may result from exposure to the liquid or vapors, mists, or aerosols of allyl propyl disulfide. *Immediately and thoroughly* flush eyes with large amounts of water, occasionally lifting the upper and lower eyelids.

2. *Skin exposure:* Skin irritation may result. *Immediately* remove contaminated clothing and *thoroughly* wash contaminated skin with soap and water.

3. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

EXPOSURE SOURCES AND CONTROL METHODS

The following operation may involve allyl propyl disulfide and may result in worker exposures to this substance:

—Slicing of onions

The following methods are effective in controlling worker exposures to allyl propyl disulfide, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. *Industrial ventilation—a manual of recommended practice*. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

2. Burton DJ [1986]. *Industrial ventilation—a self study companion*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

3. Alden JL, Kane JM [1982]. *Design of industrial ventilation systems*. New York, NY: Industrial Press, Inc.

4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.

5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to allyl propyl disulfide, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the respiratory system and skin. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to assess an individual's suitability for employment at a specific job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to allyl propyl disulfide at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the respiratory system or skin.

• Periodic medical examinations and biological monitoring

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to allyl propyl disulfide exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of allyl propyl disulfide on the respiratory system and skin. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for allyl chloride.

• Medical examinations recommended at the time of job transfer or termination

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne allyl propyl disulfide is determined by using a Chromosorb 106 tube (100/50-mg sections, 60/80 mesh). Samples are collected at a maximum flow rate of 0.2 liter/min until a maximum air volume of 10 liters is collected. The sample is then treated with trichloroethylene to extract the allyl propyl disulfide. Analysis is conducted by gas chromatography using a flame photometric detector. This method has a sampling and analytical error of 0.09 and is described in the OSHA Laboratory In-House Methods File [OSHA 1991].

PERSONAL HYGIENE

If allyl propyl disulfide contacts the skin, workers should wash the affected areas with soap and water.

Clothing contaminated with allyl propyl disulfide should be removed.

A worker who handles allyl propyl disulfide should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where allyl propyl disulfide is handled, processed, or stored.

STORAGE

Allyl propyl disulfide should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of allyl propyl disulfide should be protected from physical damage and should be stored separately from oxidizers, heat, sparks, and open flame. Because containers that formerly contained allyl propyl disulfide may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving allyl propyl disulfide, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Notify safety personnel.
2. Remove all sources of heat and ignition.
3. Ventilate the area of the spill or leak.
4. Absorb spills with sand or other noncombustible absorbent material and place the material in a covered container for later disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

• Emergency planning requirements

Allyl propyl disulfide is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [40 USC 11022].

• Reportable quantity requirements for hazardous releases

Employers are not required by the emergency release notification provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

[40 CFR 355.40] to notify the National Response Center of an accidental release of allyl propyl disulfide; there is no reportable quantity for this substance.

• Community right-to-know requirements

Employers are not required by Section 313 of SARA to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of allyl propyl disulfide emitted or released from their facility annually.

• Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although allyl propyl disulfide is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

• Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of allyl propyl disulfide exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

• Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements

of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Safety glasses, goggles, or face shields should be worn during operations in which allyl propyl disulfide might contact the eyes (e.g., through splashes of solution).

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