

Occupational Health Guideline for Isopropylether

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $((\text{CH}_3)_2\text{CH})_2\text{O}$
- Synonyms: Diisopropyl ether; 2-isopropoxypropane
- Appearance and odor: Colorless liquid with a sharp, sweet, ether-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for isopropylether is 500 parts of isopropylether per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 2100 milligrams of isopropylether per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has recommended for isopropylether a Threshold Limit Value of 250 ppm.

HEALTH HAZARD INFORMATION

• Routes of exposure

Isopropylether can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

• Effects of overexposure

1. Short-term Exposure: Strong concentrations of isopropylether vapors may cause irritation of the eyes and nose. Animal experiments suggest that exposure to high concentrations of this chemical may cause drowsiness, dizziness, and unconsciousness.

2. Long-term Exposure: Repeated or prolonged exposure to liquid isopropylether may cause dryness and irritation of the skin.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to isopropylether.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to isopropylether at potentially hazardous levels:

1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from isopropylether exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of isopropylether might cause exacerbation of symptoms due to its irritant properties.

—Skin disease: Isopropylether is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

Isopropylether vapor is a mild irritant of the eyes and mucous membranes; high levels cause narcosis in animals. Animals exposed to 30,000 ppm for 1 hour showed signs of narcosis. Exposure of human subjects to 800 ppm for 5 minutes caused irritation of the eyes and nose and some reported respiratory discomfort; exposure to 500 ppm for 15 minutes was not irritating, but at 300 ppm one third of the subjects objected to the unpleasant odor. The liquid dropped in the eye of a rabbit caused minor injury. In rabbits, repeated skin exposure to the liquid for 10 days caused dermatitis, possibly due to defatting action.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

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

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 102.2
2. Boiling point (760 mm Hg): 68.9 C (156 F)
3. Specific gravity (water = 1): 0.7
4. Vapor density (air = 1 at boiling point of isopropylether): 3.5
5. Melting point: -85 C (-121 F)
6. Vapor pressure at 20 C (68 F): 119 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.2
8. Evaporation rate (butyl acetate = 1): 8

• Reactivity

1. Conditions contributing to instability: Contact with air causes formation of explosive peroxides that may detonate when heated or subjected to shock.

2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving isopropylether.

4. Special precautions: Isopropylether will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: -27.8 C (-18 F) (closed cup)
2. Autoignition temperature: 443 C (830 F)
3. Flammable limits in air, % by volume: Lower: 1.4; Upper: 7.9

4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide

• Warning properties

1. Odor Threshold: Patty states that 35% of human subjects exposed experimentally to isopropylether "objected to the unpleasant odor of this solvent at a vapor concentration of 300 ppm."

2. Irritation Level: Patty states that "Silverman et al. reported that humans exposed to a vapor concentration of 500 ppm isopropyl ether for 15 minutes while watching a movie noted no irritating properties At 800 ppm for 5 minutes most subjects reported irritation of the eyes and nose, and the most sensitive reported respiratory discomfort."

3. Evaluation of Warning Properties: Through its odor and irritant effects, isopropylether can be detected at or slightly above the permissible exposure limit.

For the purposes of this guideline, therefore, isopropylether is treated as a material with good warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

Sampling and analyses may be performed by collection of vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure isopropylether may be used. An analytical method for isopropylether is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid isopropylether.

- Clothing wet with isopropylether should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of isopropylether from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the isopropylether, the person performing the operation should be informed of isopropylether's hazardous properties.

- Any clothing which becomes wet with liquid isopropylether should be removed immediately and not reworn until the isopropylether is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where liquid isopropylether may contact the eyes.

SANITATION

- Skin that becomes wet with liquid isopropylether should be promptly washed or showered with soap or mild detergent and water to remove any isopropylether.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to isopropylether may occur and control methods which may be effective in each case:

Operation	Controls
Use as a solvent in extraction processes, rubber adhesives, lacquers, resins, oils, cellulose, pharmaceutical manufacture, smokeless gunpowder, and textile spot cleaning	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in organic synthesis as an alkylation agent; emulsion breaker in petroleum industry; and as blending agent for gasoline	Local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If liquid isopropylether gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If liquid isopropylether gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid isopropylether soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of isopropylether, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• Swallowing

When isopropylether has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

• Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

- If isopropylether is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber. Isopropylether should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. Sewers designed to preclude the formation of explosive concentrations of isopropylether vapors are permitted.

- Waste disposal method:

Isopropylether may be disposed of by atomizing in a suitable combustion chamber.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "Isopropylether," *Documentation of the Threshold Limit Values for Substances in Workroom Air*

(3rd ed., 2nd printing), Cincinnati, 1974.

• International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.

• Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

• Union Carbide Corporation, Industrial Medicine and Toxicology Department: *Toxicology Studies - Isopropylether*, New York, 1968.

RESPIRATORY PROTECTION FOR ISOPROPYLETHER

Condition	Minimum Respiratory Protection* Required Above 500 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
5000 ppm or less	A gas mask with a chin-style organic vapor canister.
10,000 ppm or less	A gas mask with a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 10,000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.