

Occupational Health Guideline for Isobutyl Alcohol

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: $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$
- Synonyms: Isobutanol; IBA; 2-methyl-1-propanol; isopropylcarbinol
- Appearance and odor: Colorless liquid with a mild, non-residual odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for isobutyl alcohol is 100 parts of isobutyl alcohol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 300 milligrams of isobutyl alcohol per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has recommended for isobutyl alcohol a Threshold Limit Value of 50 ppm with a skin notation.

HEALTH HAZARD INFORMATION

- **Routes of exposure**
Isobutyl alcohol can affect the body if it is swallowed, inhaled, or comes in contact with the skin or eyes.
- **Effects of overexposure**
 1. **Short-term Exposure:** Overexposure to isobutyl alcohol may cause irritation of the eyes, nose, and throat, headache, dizziness, and drowsiness.
 2. **Long-term Exposure:** Drying and cracking of the skin may result from prolonged skin exposure.
 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 isobutyl alcohol.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to isobutyl alcohol 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 isobutyl alcohol exposure.

—Skin disease: Isobutyl alcohol 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.

—Liver disease: Although isobutyl alcohol is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Kidney disease: Although isobutyl alcohol is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

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

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

- **Summary of toxicology**

Isobutyl alcohol vapor had a narcotic effect in high concentrations (6400 ppm) for mice, and was lethal at 10,000 to 15,000 ppm. In employees, repeated exposures at 100 ppm had no significant effect, although irritation of the eyes and throat were observed in other studies where the vapor concentrations were higher. Isobutyl alcohol is a mild skin irritant. No chronic systemic effects have been reported in humans.

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: 74
2. Boiling point (760 mm Hg): 108 C (226 F)
3. Specific gravity (water = 1): 0.8
4. Vapor density (air = 1 at boiling point of isobutyl alcohol): 2.6
5. Melting point: -108 C (-162 F)
6. Vapor pressure at 20 C (68 F): 8.8 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 8.7
8. Evaporation rate (butyl acetate = 1): 0.82

• Reactivity

1. Conditions contributing to instability: Heat
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 isobutyl alcohol.

4. Special precautions: Isobutyl alcohol will attack some forms of plastics, rubber, and coatings. It may react with metallic aluminum at high temperatures.

• Flammability

1. Flash point: 27.8 C (82 F) (closed cup)
2. Autoignition temperature: 427 C (800 F)
3. Flammable limits in air, % by volume (at 212 F): Lower: 1.2; Upper: 10.9
4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide

• Warning properties

1. Odor Threshold: Both Summer and May report an odor threshold of 40 ppm.

2. Eye Irritation Level: Patty states, "Fassett has studied isobutyl alcohol under the same conditions of exposure as for n-butyl alcohol. No evidence of eye irritation was noted with repeated 8-hour exposures to levels on the order of 100 ppm. Animal data showed that it was very similar to n-butyl alcohol in its effects." n-Butyl alcohol is known to be an eye irritant.

3. Evaluation of Warning Properties: Since the odor threshold of isobutyl alcohol is below the permissible exposure limit, it 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 isobutyl alcohol vapors using an adsorption tube with subsequent desorption with 2-propanol in 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 isobutyl alcohol may be used. An analytical method for isobutyl alcohol is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

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 isobutyl alcohol.

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

• Any clothing which becomes wet with liquid isobutyl alcohol should be removed immediately and not reworn until the isobutyl alcohol is removed from the clothing.

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

SANITATION

- Skin that becomes wet with liquid isobutyl alcohol should be promptly washed or showered to remove any isobutyl alcohol.
- Employees who handle liquid isobutyl alcohol should wash their hands thoroughly before eating or smoking.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during spray applications of nitrocellulose lacquers	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation during use of industrial cleaners; during use of paint removers	General dilution ventilation; personal protective equipment
Liberation during hand application of nitrocellulose lacquers; during manufacture of lubricating oil and hydraulic fluids; during manufacture of amino resins and plasticizers	General dilution ventilation
Use during manufacture of nitrocellulose lacquers, paint removers, and industrial cleaners	General dilution ventilation; personal protective equipment
Liberation during manufacture of acetaldehyde; during distillation of whiskey	General dilution ventilation

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 isobutyl alcohol gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If isobutyl alcohol gets on the skin, promptly flush the contaminated skin with water. If isobutyl alcohol soaks through the clothing, remove the clothing immediately

and flush the skin with water. If there is skin irritation, get medical attention.

• Breathing

If a person breathes in large amounts of isobutyl alcohol, 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 isobutyl alcohol has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• 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 isobutyl alcohol 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 collected and atomized in a suitable combustion chamber. Isobutyl alcohol should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal methods:

Isobutyl alcohol may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber.

REFERENCES

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RESPIRATORY PROTECTION FOR ISOBUTYL ALCOHOL

Condition	Minimum Respiratory Protection* Required Above 100 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 or 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.
8000 ppm or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 8000 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.

