Occupational Health Guideline for sec-Butyl 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: $CH_3CHOHCH_2CH_3$
- Synonyms: 2-Butanol; methyl ethyl carbinol; butylene hydrate; 2-hydroxybutane
- Appearance and odor: Colorless liquid with a strong, pleasant odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for sec-butyl alcohol is 150 parts of sec-butyl alcohol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 450 milligrams of sec-butyl alcohol per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of their recommended Threshold Limit Value for sec-butyl alcohol from 150 ppm to 100 ppm.

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HEALTH HAZARD INFORMATION

- **Routes of exposure**

sec-Butyl alcohol can affect the body if it is swallowed, is inhaled, or comes in contact with the eyes or skin.

- **Effects of overexposure**

1. Short-term Exposure: Overexposure to sec-butyl 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 sec-butyl alcohol.

- **Recommended medical surveillance**

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

—Skin disease: sec-Butyl 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 sec-butyl 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 sec-butyl 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.

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

- **Summary of toxicology**

sec-Butyl alcohol has a narcotic effect at high vapor concentrations. Rats exposed to 16,000 ppm for 4 hours died. Mice exposed to 5,330 ppm were narcotized but

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.

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Occupational Safety and Health Administration

survived, while mice exposed to 1650 ppm for 7 hours showed no signs of intoxication. The substance is regarded as an eye irritant, chiefly by analogy to n-butyl alcohol, since no symptoms or signs have been observed in workers exposed regularly at levels of 100 ppm. No chronic systemic effects have been reported in humans. Mild skin irritation may occur due to defatting action.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**
  1. Molecular weight: 74
  2. Boiling point (760 mm Hg): 99 C (211 F)
  3. Specific gravity (water = 1): 0.8
  4. Vapor density (air = 1 at boiling point of sec-butyl alcohol): 2.6
  5. Melting point: −115 C (−175 F)
  6. Vapor pressure at 20 C (68 F): 12.5 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): 15.4
  8. Evaporation rate (butyl acetate = 1): 1.3
- **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 sec-butyl alcohol.
  4. Special precautions: sec-Butyl alcohol will attack some forms of plastics, rubber, and coatings.
- **Flammability**
  1. Flash point: 24 C (75 F) (closed cup)
  2. Autoignition temperature: 405 C (761 F)
  3. Flammable limits in air, % by volume: Lower: 1.7; Upper: 9.8
  4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide
- **Warning properties**
  1. Odor Threshold: May reports an odor threshold for sec-butyl alcohol of 43 ppm.
  2. Eye Irritation Level: The *Documentation of TLV's* states that "no information is available on eye irritation from the vapor of sec-butyl alcohol. Liquid sec-butyl alcohol was less injurious to the eyes than n-butanol, however. This relatively meager information suggests that sec-butyl alcohol is somewhat less toxic and irritating than n-butanol. Many years of industrial experience with exposures approximating 100 ppm associated with manufacture have resulted in no difficulties. A threshold limit of 150 ppm is recommended, therefore, to prevent narcotic and irritative effects."
  3. Evaluation of Warning Properties: Since the odor threshold of sec-butyl alcohol is well below the permissible exposure limit, it is treated as a material with adequate 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 sec-butyl 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 sec-butyl alcohol may be used. An analytical method for sec-butyl 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 sec-butyl alcohol.
- Clothing wet with liquid sec-butyl alcohol should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of sec-butyl alcohol from the clothing. If the clothing is to

be laundered or otherwise cleaned to remove the sec-butyl alcohol, the person performing the operation should be informed of sec-butyl alcohol's hazardous properties.

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

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

SANITATION

• Skin that becomes wet with liquid sec-butyl alcohol should be promptly washed or showered to remove any sec-butyl alcohol.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during spray application of ethyl cellulose-based surface coatings; during open-tank mixing of surface coatings, dyes, oils, etc.	Local exhaust ventilation; personal protective equipment
Liberation during use of industrial cleaning compounds	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation during use of paint removers; during hand application of ethyl cellulose and nitrocellulose surface coatings	General dilution ventilation
Liberation during use of adhesives in manufacture of plywood; during manufacture of MEK, sec-butyl acetate, and xanthate; during mixing of hydraulic fluids, paint removers, perfumes, etc. in closed vessels	Local exhaust ventilation; 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 sec-butyl 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 sec-butyl alcohol gets on the skin, promptly flush the contaminated skin with water. If sec-butyl 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 sec-butyl 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 sec-butyl 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 sec-butyl 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. sec-Butyl alcohol should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

sec-Butyl 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 SEC-BUTYL ALCOHOL

Condition	Minimum Respiratory Protection* Required Above 150 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.
7500 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.
10,000 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 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.