

Occupational Health Guideline for 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: $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
- Synonyms: 1-Butanol; propylcarbinol; n-butanol; n-butyl alcohol; NBA
- Appearance and odor: Colorless liquid with a strong, characteristic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

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

HEALTH HAZARD INFORMATION

• Routes of exposure

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

• Effects of overexposure

1. Short-term Exposure: Overexposure to butyl alcohol may cause irritation of the eyes, nose, and throat, headache, dizziness, and drowsiness. The overexposed person may also experience blurred vision and a burning sensation of the eyes, which may last for several days.

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 butyl alcohol.

• Recommended medical surveillance

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

—Skin disease: 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 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 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.

—Eye disease: Because butyl alcohol is reported to cause eye injury, those with pre-existing eye disease may be at increased risk.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of butyl 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

Butyl alcohol is an eye and mucous membrane irritant, and the vapor has a narcotic effect on animals at concentrations in excess of 6000 to 8000 ppm. Also,

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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cases of vacuolar keratitis have been reported in humans. Mild narcotic effects have been observed in humans exposed to high concentrations. Mild skin irritation occurs due to defatting action. No chronic systemic effects have been reported in humans.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 74
2. Boiling point (760 mm Hg): 118 C (244 F)
3. Specific gravity (water = 1): 0.8
4. Vapor density (air = 1 at boiling point of butyl alcohol): 2.6
5. Melting point: -89 C (-128 F)
6. Vapor pressure at 20 C (68 F): 4.2 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 7.7
8. Evaporation rate (butyl acetate = 1): 0.46

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fire and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving butyl alcohol.
4. Special precautions: Butyl alcohol will attack some forms of plastics, rubber, and coatings. Butyl alcohol may react with metallic aluminum at high temperatures.

• Flammability

1. Flash point: 28.9 C (84 F) (closed cup)
2. Autoignition temperature: 365 C (689 F)
3. Flammable limits in air, % by volume: Lower: 1.4; Upper: 11.2
4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide

• Warning properties

1. Odor Threshold: Summer and May report an odor threshold of 11 ppm. Patty reports that "Scherberger, Happ, Miller, and Fassett determined that the minimum concentration with identifiable odor of butyl alcohol was 15 ppm."
2. Eye Irritation Level: The *Documentation of TLV's* states that "Tabershaw et al. reported eye irritation in workmen in concentrations above 55 ppm . . ." According to Patty, Nelson reported mild eye irritation at 25 ppm. Sterner and associates, however, "revealed little or no irritation or complaints among workers when the average concentration was 100 ppm."
3. Other Information: Patty states that "Nelson et al. reported mild irritation of the nose, throat, and eyes of subjects briefly exposed to 25 ppm and stated that exposure to 50 ppm was objectionable because it produced irritation of the throat in all subjects and mild headaches in some instances."
4. Evaluation of Warning Properties: Because of its odor and irritant effects, butyl alcohol is treated as a material with good warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• Eight-Hour Exposure Evaluation

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).

• Ceiling Evaluation

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of butyl alcohol. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• Method

Sampling and analyses may be performed by collection of 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 butyl alcohol may be used. An analytical method for 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 butyl alcohol.
- Clothing wet with liquid butyl alcohol should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of butyl alcohol from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the butyl alcohol, the person performing the operation should be informed of butyl alcohol's hazardous properties.
- Any clothing which becomes wet with liquid butyl alcohol should be removed immediately and not reworn until the butyl alcohol is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid butyl alcohol may contact the eyes.

SANITATION

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

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use and liberation in spray applications of surface coatings	Local exhaust ventilation; personal protective equipment
Use during brush or dip application of surface coatings	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in adhesives and as a solvent adhesive in manufacture of garments from fabric coated with polyvinyl butyral	General dilution ventilation; personal protective equipment
Use in leather industry	Local exhaust ventilation; general dilution ventilation

Operation

Liberation during manufacture of safety glass; during manufacture of derivatives of butyl alcohol, including chemicals, herbicides, ore flotation agents, urea and melamine formaldehyde resins, and pharmaceuticals

Use as a solvent or diluent in manufacture of brake fluids, perfumes, detergents, adhesives, denatured alcohol, and surface coatings

Liberation during photographic processing operations

Use as a swelling agent in textiles

Use as an azeotropic dehydrating agent and blending agent in laboratory analysis; liberation as a by-product in furfural tetrahydrofuran conversion

Controls

Local exhaust ventilation; general dilution ventilation

Local exhaust ventilation; general dilution ventilation; personal protective equipment

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General dilution ventilation

General dilution ventilation; local exhaust 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 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 butyl alcohol gets on the skin, promptly flush the contaminated skin with water. If 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 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 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 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. 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:

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

- American Conference of Governmental Industrial Hygienists: "Butyl Alcohol," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- American Industrial Hygiene Association: "Butyl Alcohol," *Hygienic Guide Series*, Detroit, Michigan, 1955.
- Browning, E.: *Toxicity and Metabolism of Industrial Solvents*, Elsevier, New York, 1965.
- Christensen, H. E., and Luginbyhl, T. L. (eds.): *NIOSH Toxic Substances List*, 1974 Edition, HEW Publication No. 74-134, 1974.
- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.
- May, J.: "Solvent Odor Thresholds for the Evaluation of Solvent Odors in the Atmosphere," *Staub-Reinhalt*, 26:9, 385-389, 1966.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.
- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.
- Stauden, A. (exec. ed.): *Kirk-Othmer Encyclopedia of Chemical Technology* (2nd ed.), Interscience, New York, 1972.
- Summer, W.: *Odor Pollution of Air: Causes and Control*, L. Hill, London, 1975.

RESPIRATORY PROTECTION FOR BUTYL 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.

