

Occupational Health Guideline for Butylamine

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: $C_4H_9NH_2$
- Synonyms: n-Butylamine; 1-aminobutane
- Appearance and odor: Colorless liquid with an odor like ammonia or fish.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for butylamine is a ceiling level of 5 parts of butylamine per million parts of air (ppm). This may also be expressed as 15 milligrams of butylamine per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Butylamine can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may enter the body through the skin.

• Effects of overexposure

1. *Short-term Exposure:* Butylamine vapor is irritating to the nose, throat, and eyes. Inhalation of concentrations slightly above the permissible exposure may produce mild headache and flushing of the skin and face. Contact with the liquid may produce severe damage to the skin and eyes.

2. *Long-term Exposure:* None known.

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 butylamine.

• Recommended medical surveillance

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

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

—Skin disease: Butylamine is a primary skin irritant. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Eye disease: Butylamine is a severe eye irritant and may cause tissue damage. Those with pre-existing eye problems may be at increased risk from exposure.

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

• Summary of toxicology

Butylamine vapor irritates the upper respiratory tract and eyes. It is a known histamine release agent. In rats exposed to 3000 to 5000 ppm there was an immediate irritant response, labored breathing, pulmonary edema, and death within minutes to hours. The liquid produced severe eye damage and skin burns in animals. In man, the liquid on the skin causes severe primary irritation and second-degree burns with vesiculation. Workers exposed daily to 5 to 10 ppm complained of irritation of the nose, throat, and eyes, and, in some instances, headache and flushing of the skin of the face. Concentrations of 10 to 25 ppm are unpleasant and even intolerable to some subjects for exposures of more than a few minutes; daily exposures of workers to less than 5 ppm (usually 1 to 2 ppm) resulted in no symptoms.

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: 73.14
2. Boiling point (760 mm Hg): 77.8 C (172 F)
3. Specific gravity (water = 1): 0.74
4. Vapor density (air = 1 at boiling point of butylamine): 2.5
5. Melting point: -49 C (-56 F)
6. Vapor pressure at 20 C (68 F): 82 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions
8. Evaporation rate (butyl acetate = 1): 7.3

• Reactivity

1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions. Contact with strong acids will cause spattering.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving butylamine.
4. Special precautions: Liquid butylamine will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: -12 C (10 F) (closed cup)
2. Autoignition temperature: 312 C (594 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: Patty reports that "the odor of butylamine is slight at less than 1 ppm, noticeable at 1 to 2 ppm, moderately strong at 2 to 5 ppm, strong at 5 to 10 ppm, and strong and irritating at concentrations exceeding 10 ppm."
2. Eye Irritation Level: Grant reports that n-butylamine vapor is only a mild eye irritant. The concentrations producing eye irritation are not given.
3. Other Information: The AIHA *Hygienic Guide* reports that the vapor of n-butylamine is an upper respiratory tract irritant, and Stecher reports that the vapor is a mucous membrane irritant. The *Hygienic Guide* states that "10 to 15 ppm is highly irritating for short exposure."
4. Evaluation of Warning Properties: Since the odor threshold of n-butylamine is below the permissible exposure limit, this material is considered to have adequate warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• Ceiling Evaluation

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of butylamine. 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

An analytical method for butylamine is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 4, 1978, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00317-3).

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 any possibility of skin contact with liquid butylamine.
- Clothing contaminated with liquid butylamine should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of butylamine from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the butylamine, the person performing the operation should be informed of butylamine's hazardous properties.
- Where there is any possibility of exposure of an employee's body to liquid butylamine, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.
- Any clothing which becomes wet with or non-impervious clothing which becomes contaminated with liquid butylamine should be removed immediately and not reworn until the butylamine is removed from the

clothing.

- Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of liquid butylamine contacting the eyes.
- Where there is any possibility that employees' eyes may be exposed to liquid butylamine, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

- Skin that becomes contaminated with liquid butylamine should be immediately washed or showered to remove any butylamine.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as a vulcanizing accelerator and reaction initiator in rubber and polymer industries	Process enclosure; local exhaust ventilation; general dilution ventilation
Use as chemical intermediate in production of emulsifying agents	Process enclosure; local exhaust ventilation; general dilution ventilation
Use in chemical synthesis of developers for photography, pharmaceuticals, antioxidants for gasoline, synthetic tanning materials, curing agent for siloxane elastomers, gum inhibitors, ultraviolet absorber for plastics	Process enclosure; local exhaust ventilation; general dilution ventilation
Use as acid neutralizer as corrosion inhibitor in metal, alkyd, and urea enamel pH control, stabilizer of aviation fuels	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use on stored agricultural crops as fungicide to prevent decay	Local exhaust ventilation; general dilution ventilation; personal protective equipment

Operation

Use in polymer industry as a catalyst, accelerator, telomer, and reaction initiator

Controls

Process enclosure; 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 liquid butylamine gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If butylamine gets on the skin, immediately flush the contaminated skin with water. If butylamine soaks through the clothing, remove the clothing immediately and flush the skin. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of butylamine, 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 butylamine 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 butylamine 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 equipped with an appropriate effluent gas cleaning device. Butylamine 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 butylamine vapors are permitted.

• **Waste disposal method:**

Butylamine may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

REFERENCES

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RESPIRATORY PROTECTION FOR BUTYLAMINE

Condition	Minimum Respiratory Protection* Required Above 5 ppm
Vapor Concentration	
250 ppm or less	A chemical cartridge respirator with a full facepiece and a cartridge(s) providing protection against butylamine. A gas mask with a chin-style or a front- or back-mounted canister providing protection against butylamine. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
2000 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 2000 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 butylamine. Any escape self-contained breathing apparatus.

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

**Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of butylamine; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 2000 ppm, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

