

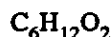
# OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR n-BUTYL ACETATE

## INTRODUCTION

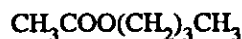
This guideline summarizes pertinent information about n-butyl acetate for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

## SUBSTANCE IDENTIFICATION

### • Formula



### • Structure



### • Synonyms

n-Butyl acetate; butyl ethanoate; acetic acid, n-butyl ester; 1-butyl acetate

### • Identifiers

1. CAS No.: 123-86-4
2. RTECS No.: AF7350000
3. DOT UN: 1123 26
4. DOT label: Flammable Liquid

### • Appearance and odor

n-Butyl acetate is a clear, colorless, flammable liquid with a fruity odor. The odor threshold is reported to be 0.7 part per million (ppm) parts of air.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 116.2
2. Boiling point (at 760 mm Hg): 126°C (258°F)

3. Specific gravity (water = 1): 0.88 at 20°C (68°F)
4. Vapor density (air = 1 at boiling point of n-butyl acetate): 4.0
5. Melting point: -77.9°C (-108.2°F)
6. Vapor pressure at 20°C (68°F): 10 mm Hg
7. Solubility: Slightly soluble in water; miscible with alcohol, ether, and most hydrocarbons
8. Evaporation rate: Data not available

### • Reactivity

1. Conditions contributing to instability: Heat, sparks, and open flame
2. Incompatibilities: Fires may result from contact of n-butyl acetate with potassium-tert-butoxide, nitrates, strong oxidizers, strong alkalis, and strong acids.
3. Hazardous decomposition products: Toxic gases and vapors (such as partial oxidation products, carbon dioxide, and carbon monoxide) may be released in a fire involving n-butyl acetate.
4. Special precautions: None

### • Flammability

The National Fire Protection Association has assigned a flammability rating of 3 (severe fire hazard) to n-butyl acetate.

1. Flash point: 22°C (72°F) (closed cup)
2. Autoignition temperature: 425°C (797°F)
3. Flammable limits in air (% by volume): Lower, 1.7; upper, 7.6
4. Extinguishant: Use dry chemical, alcohol foam, or carbon dioxide to fight fires involving n-butyl acetate. A stream of water should not be used to extinguish fires involving this substance because the water will scatter and spread the fire.

Fires involving n-butyl acetate should be fought upwind and from the maximum distance possible. Isolate the hazard area and deny access to unnecessary personnel.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service Centers for Disease Control  
National Institute for Occupational Safety and Health  
Division of Standards Development and Technology Transfer

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

Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Vapor explosion and poison hazards may occur indoors, outdoors, or in sewers. Vapors may travel to a source of ignition and flash back. Containers of n-butyl acetate may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool containers from the sides with water until well after the fire is out. Stay away from the ends of containers. Personnel should withdraw immediately if they hear a rising sound from a venting safety device or if a container becomes discolored as a result of fire. Dikes should be used to contain fire-control water for later disposal. If a tank car or truck is involved in a fire, personnel should isolate an area of a half mile in all directions. Firefighters should wear a full set of protective clothing (including a self-contained breathing apparatus) when fighting fires involving n-butyl acetate. Firefighters' protective clothing may not provide protection against permeation by n-butyl acetate.

## EXPOSURE LIMITS

### • OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for n-butyl acetate is 150 ppm (710 mg/m<sup>3</sup>) as an 8-hr time-weighted average (TWA) concentration and 200 ppm (950 mg/m<sup>3</sup>) as a short-term exposure limit (STEL). A STEL is a 15-min TWA exposure that should not be exceeded at any time during a workday [29 CFR 1910.1000, Table Z-1-A].

### • NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 150 ppm (710 mg/m<sup>3</sup>) as an 8-hr TWA and 200 ppm (950 mg/m<sup>3</sup>) as a STEL [NIOSH 1992].

### • ACGIH TLV®

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned n-butyl acetate a threshold limit value (TLV) of 150 ppm (713 mg/m<sup>3</sup>) as a TWA for a normal 8-hr workday and a 40-hr workweek and a STEL of 200 ppm (950 mg/m<sup>3</sup>) for periods not to exceed 15 min [ACGIH 1991b].

### • Rationale for limits

The limits are based on the risk of sensory irritation associated with exposure to n-butyl acetate.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Exposure to n-butyl acetate can occur through inhalation, ingestion, and eye or skin contact.

## • Summary of toxicology

1. *Effects on Animals:* n-Butyl acetate causes moderate to severe irritation of the eyes, skin, and upper respiratory tract in animals; at high concentrations, it can cause narcosis and death from respiratory failure. In rabbits, n-butyl acetate caused moderate skin irritation after 24 hr of exposure and severe eye irritation after instillation [NIOSH 1991]. Guinea pigs exposed to 3,300 ppm showed signs of eye irritation; exposure to 7,000 ppm for 11 hr caused narcosis [Proctor et al. 1988]. In rats, the oral LD<sub>50</sub> is 14 g/kg, and the LC<sub>50</sub> is 2,000 ppm for 4 hr [NIOSH 1991]. Nearly saturated vapor (10,000 ppm) was fatal to six rats following an 8-hr exposure. Mice exposed to n-butyl acetate at concentrations ranging from 3,100 to 4,200 ppm 6 hr/day for 6 days showed signs of fatigue, weight loss, and an increase in formed elements in the blood and in hemoglobin levels [NLM 1991]. When administered during pregnancy, n-butyl acetate was embryotoxic in mice and rats [NIOSH 1991; NLM 1991].

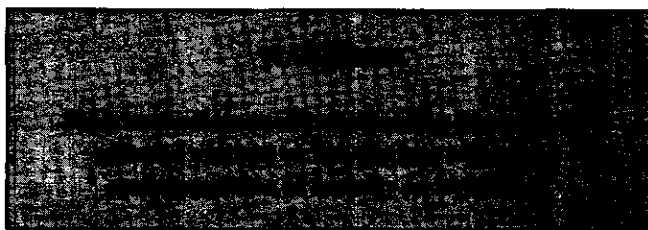
2. *Effects on Humans:* n-Butyl acetate is an irritant of the eyes, nose, respiratory tract, and skin in exposed workers. Volunteers exposed to n-butyl acetate at 200 ppm reported upper respiratory tract irritation; at 300 ppm, this irritation was reported to be severe [ACGIH 1991a]. Humans exposed to concentrations as high as 3,300 ppm experienced lacrimation and conjunctival redness [Grant 1986]. Vacuolar keratitis occurred in workers exposed to a mixture of butyl acetate and isobutyl alcohol. Hepatotoxicity has also been reported. Repeated skin contact with n-butyl acetate caused dermatitis in a pharmaceutical plant worker [NLM 1991].

### • Signs and symptoms of exposure

1. *Acute exposure:* Acute exposure to n-butyl acetate can cause contact irritation, headache, muscle weakness, giddiness, dizziness, ataxia, confusion, delirium, CNS and respiratory depression, coma, and death from respiratory failure.

2. *Chronic exposure:* Chronic exposure to n-butyl acetate can cause eye irritation and dryness, redness, scaling, and cracking of the skin.

### • Emergency procedures



Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Tissue irritation may result from exposure to concentrated solutions, vapors, mists, or aerosols of n-butyl acetate. *Immediately and thoroughly* flush the eyes with large amounts of water, occasionally lifting the upper and lower eyelids.

2. *Skin exposure:* Skin irritation may result. *Immediately* remove contaminated clothing and *thoroughly* wash contaminated skin with soap and water.

3. *Inhalation exposure:* If vapors, mists, or aerosols of n-butyl acetate are inhaled, move the victim to fresh air *immediately*.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if n-butyl acetate or a solution containing it is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do *not* force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

## EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve n-butyl acetate and may result in worker exposures to this substance:

—Use of n-butyl acetate as a solvent and thinner for gums, oil, fats, waxes, pitch, lacquers, enamels, nitrocellulose, camphor, ethyl cellulose acetate, pyroxylin, chlorinated rubber, artificial leathers, ester-soluble dyes, airplane dopes, perfumes, natural gums, synthetic resins, and vinyl, polystyrene, and methacrylate plastics

—Application of nitrocellulose lacquers by spraying, brushing, or dipping and of surface coatings other than nitrocellulose lacquers, including paper coatings, lamp coatings, and airplane dope enamels

—Use of n-butyl acetate as a dehydrating agent

—Production of protective coatings in the automobile industry, flavorings, perfumes, safety glass, plastics, cosmetics, adhesives, shoe polishes, stain removers, photographic films, penicillin, and larvicides

The following methods are effective in controlling worker exposure to n-butyl acetate, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. Industrial ventilation—a manual of recommended practice. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

2. Burton DJ [1986]. Industrial ventilation—a self study companion. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

3. Alden JL, Kane JM [1982]. Design of industrial ventilation systems. New York, NY: Industrial Press, Inc.

4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.

5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

## MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

- **Preplacement medical evaluation**

Before a worker is placed in a job with a potential for exposure to n-butyl acetate, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the skin and respiratory system. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to assess an individual's suitability for employment at a specific job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to n-butyl acetate at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with skin or respiratory disease.

- **Periodic medical examinations and biological monitoring**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to n-butyl acetate exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of n-butyl acetate on the skin and respiratory system. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for n-butyl acetate.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

## **WORKPLACE MONITORING AND MEASUREMENT**

A worker's exposure to airborne n-butyl acetate is determined by using coconut shell charcoal tubes (100/50-mg sections, 20/40 mesh). Samples are collected at a maximum flow rate of 0.2 liter/min until a maximum air volume of 10 liters is collected. The sample is then treated with carbon disulfide or carbon disulfide/dimethylformamide to extract the n-butyl acetate. Analysis is conducted by gas chromatography using a flame ionization detector. The limit of detection for this procedure is 0.02 mg per sample. This method is described in Method No. 1450 of the *NIOSH Manual of Analytical Methods* [NIOSH 1984].

## **PERSONAL HYGIENE**

If n-butyl acetate contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 min and then wash with soap and water.

Clothing contaminated with n-butyl acetate should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering contaminated clothing should be informed about the hazardous properties of n-butyl acetate, particularly its potential to be irritating to the skin.

A worker who handles n-butyl acetate should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where n-butyl acetate or a solution containing n-butyl acetate is handled, processed, or stored.

## **STORAGE**

n-Butyl acetate should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. This substance is an OSHA IB flammable liquid and must be handled accordingly. Containers of n-butyl acetate should be protected from physical damage

and should be stored separately from potassium tert-butoxide, strong oxidizers, nitrates, strong alkalis, strong acids, explosives, heat, sparks, open flame, and materials that are readily impregnable by odor. Only nonsparking tools may be used to handle n-butyl acetate. To prevent static sparks, containers and equipment should be grounded and bonded for transfers. Because containers that formerly contained n-butyl acetate may still hold product residues, they should be handled appropriately.

## SPILLS AND LEAKS

In the event of a spill or leak involving n-butyl acetate, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate potentially explosive atmospheres.
5. Absorb small liquid spills with sand or other noncombustible absorbent material and place the material in a covered container for later disposal.
6. For large liquid spills, build dikes far ahead of the spill to contain the n-butyl acetate for later reclamation or disposal.

## SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities for hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

### • Emergency planning requirements

n-Butyl acetate is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

### • Reportable quantity requirements for hazardous releases

A hazardous substance release is defined by EPA as any spilling, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous substances into the environment (including the abandonment or discarding of contaminated containers). In the

event of a release that is equal to or greater than the reportable quantity for that chemical, employers are required by EPA regulations resulting from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the proper Federal authorities.

The reportable quantity for n-butyl acetate is 5,000 lb. If an amount equal to or greater than this quantity is released within a 24-hr period in a manner that will expose persons outside the facility, employers are required to do the following:

- Notify the National Response Center *immediately* at (800) 424-8802 or at (202) 426-2675 in Washington D.C. [40 CFR 302.6].
- Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].
- Notify the community emergency coordinator of the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

### • Community right-to-know requirements

Employers are not required by Section 313 of the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022] to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of n-butyl acetate emitted or released from their facility annually.

### • Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although n-butyl acetate is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of n-butyl acetate are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

## RESPIRATORY PROTECTION

### • Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of n-butyl acetate exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

### • Respiratory protection program

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

## PERSONAL PROTECTIVE EQUIPMENT

Protective clothing should be worn to prevent skin contact with n-butyl acetate. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. The following materials have been tested against permeation by n-butyl acetate and have demonstrated protection for more than 4 but fewer than 8 hr: polyvinyl alcohol, Teflon<sup>®</sup>, and polyethylene/ethylene vinyl alcohol. Butyl rubber has demonstrated questionable protection from permeation. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl chloride, and Viton<sup>®</sup> have demonstrated poor resistance to permeation by n-butyl acetate.

If n-butyl acetate is dissolved in water or an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which n-butyl acetate might contact the eyes (e.g., through splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with n-butyl acetate. Contact lenses should not be worn if the potential exists for n-butyl acetate exposure.

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