

Occupational Health Guideline for tert-Butyl Acetate

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: $\text{CH}_3\text{COOC}(\text{CH}_2)_3$
- Synonyms: Acetic acid, tert-butyl ester
- Appearance and odor: Colorless liquid with a fruity odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for tert-butyl acetate is 200 parts of tert-butyl acetate per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 950 milligrams of tert-butyl acetate per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

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

• Effects of overexposure

1. *Short-term Exposure:* Overexposure to tert-butyl acetate may cause irritation of the eyes, nose, and throat. Severe overexposure may cause weakness, drowsiness, and unconsciousness.

2. *Long-term Exposure:* Prolonged overexposure may produce irritation of the skin.

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 tert-butyl acetate.

• Recommended medical surveillance

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

—Kidney disease: Although tert-butyl acetate 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 possible impairment of renal function.

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

—Liver disease: Although tert-butyl acetate 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.

—Skin disease: tert-Butyl acetate 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.

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

• Summary of toxicology

Central nervous system depression may occur on exposure to high concentrations of tert-butyl acetate, producing narcosis. Irritation of the eyes, skin, and upper respiratory tract may occur.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 116
2. Boiling point (760 mm Hg): 98 C (208 F)

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

3. Specific gravity (water = 1): 0.87
4. Vapor density (air = 1 at boiling point of tert-butyl acetate): 4.0
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): Data not available
7. Solubility in water, g/100 g water at 20 C (68 F): Data not available
8. Evaporation rate (butyl acetate = 1): Data not available

• **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalis, and strong acids may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving tert-butyl acetate.
4. Special precautions: tert-Butyl acetate may soften or dissolve plastics.

• **Flammability**

1. Flash point: Between 17 to 22 C (62 to 72 F) (estimated)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 1.5 (estimated)
4. Extinguishant: Dry chemical, foam, carbon dioxide

• **Warning properties**

1. **Odor Threshold:** Both May and Summer report odor thresholds for isobutyl acetate and for butyl acetate of 4 ppm and 7 ppm, respectively. Although no quantitative information is available concerning the odor threshold of tert-butyl acetate, its odor is also assumed to be detectable below the TLV.

2. **Eye Irritation Level:** According to the *Documentation of TLVs*, "the irritative . . . effects of the acetates appear to be related to their physical properties, the higher boiling members being the more toxic. tert-Butyl acetate has the lowest boiling point of the four isomers of this ester."

'A limit of 200 ppm, slightly higher than that for the normal isomer, is recommended to prevent significant irritation of the eyes and respiratory passages.'

3. **Evaluation of Warning Properties:** By analogy with isobutyl acetate and butyl acetate, which have odor thresholds of 4 and 7 ppm respectively, for the purposes of this guideline, the odor threshold of tert-butyl acetate is assumed to be below the TLV (200 ppm). Therefore, 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 tert-butyl acetate vapors using an adsorption tube with subsequent desorption with 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 tert-butyl acetate may be used. An analytical method for tert-butyl acetate 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 tert-butyl acetate.

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

• Any clothing which becomes wet with liquid tert-butyl acetate should be removed immediately and not

reworn until the tert-butyl acetate is removed from the clothing.

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

SANITATION

- Skin that becomes wet with liquid tert-butyl acetate should be promptly washed or showered with soap or mild detergent and water to remove any tert-butyl acetate.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during use as a dry cleaning agent	General dilution ventilation
Liberation during spray application on surface coatings	Process enclosure; general dilution ventilation
Liberation during formulation of paint systems	Local exhaust ventilation
Liberation during use as an additive to improve antiknock properties of leaded aliphatic gasoline	Process enclosure; general dilution ventilation
Liberation during use as an activator in alkaline polymerization of caprolactam	Process enclosure; 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 tert-butyl acetate 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 tert-butyl acetate gets on the skin, promptly flush the contaminated skin with water. If tert-butyl acetate 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 tert-butyl acetate, 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 tert-butyl acetate 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 tert-butyl acetate 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. tert-Butyl acetate should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal methods:

tert-Butyl acetate 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: "tert-Butyl Acetate," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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- 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.

• Summer, W.: *Odor Pollution of Air: Causes and Control*, L. Hill, London, 1975.

RESPIRATORY PROTECTION FOR TERT-BUTYL ACETATE

Condition	Minimum Respiratory Protection* Required Above 200 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.