

# Occupational Health Guideline for Ethyl Butyl Ketone

## 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:  $C_7H_{14}O$
- Synonyms: Butyl ethyl ketone; 3-heptanone
- Appearance and odor: Colorless liquid with a mild, fruity odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for ethyl butyl ketone is 50 parts of ethyl butyl ketone per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 230 milligrams of ethyl butyl ketone per cubic meter of air ( $mg/m^3$ ).

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Ethyl butyl ketone can affect the body if it is inhaled, is swallowed, or comes in contact with the eyes or skin.

### • Effects of overexposure

**1. Short-term Exposure:** Ethyl butyl ketone may cause irritation of the eyes, nose, throat, and lungs. Exposure to high concentrations may cause headaches, dizziness, or unconsciousness.

**2. Long-term Exposure:** Prolonged or repeated skin contact may cause dryness and 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 ethyl butyl ketone.

### • Recommended medical surveillance

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

—Kidney disease: Although ethyl butyl ketone 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 ethyl butyl ketone might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.

—Liver disease: Although ethyl butyl ketone 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: Ethyl butyl ketone 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

There is some local irritation of the skin and respiratory tract by solvent effect of ethyl butyl ketone on lipids. Central nervous depression occurs on exposure to high concentration, producing narcosis. Effects may be more pronounced in unacclimated individuals. No chronic systemic effects have been reported.

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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: 114
2. Boiling point (760 mm Hg): 147 C (297 F)
3. Specific gravity (water = 1): 0.82
4. Vapor density (air = 1 at boiling point of ethyl butyl ketone): 3.93
5. Melting point: -39 C (-38 F)
6. Vapor pressure at 20 C (68 F): 4 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.43
8. Evaporation rate (butyl acetate = 1): 0.45

### • Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with oxidizing agents may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving ethyl butyl ketone.
4. Special precautions: Ethyl butyl ketone will attack some forms of plastics, rubber, and coatings.

### • Flammability

1. Flash point: 46 C (115 F) (open cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 1.4;

Upper: 8.8

4. Extinguishant: Carbon dioxide, dry chemical, or foam

### • Warning properties

1. Odor Threshold: According to Patty, ethyl butyl ketone has a "typical ketone-type odor."
2. Eye Irritation Level: According to the *Documentation of TLV's*, "when in contact with skin and eyes, it (ethyl butyl ketone) produces, at most, irritation of mild degree."
3. Evaluation of Warning Properties: For the purposes of this guideline, ethyl butyl ketone 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 ethyl butyl ketone 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 ethyl butyl

ketone may be used. An analytical method for ethyl butyl ketone 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 ethyl butyl ketone.

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

• Non-impervious clothing which becomes contaminated with liquid ethyl butyl ketone should be removed promptly and not reworn until the ethyl butyl ketone is removed from the clothing.

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

## SANITATION

• Skin that becomes contaminated with liquid ethyl butyl ketone should be promptly washed or showered to remove any ethyl butyl ketone.

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during application of lacquers, varnishes, epoxies, vinyl coatings, finishes, and adhesives	Local exhaust ventilation; personal protective equipment
Liberation during application of lacquer, varnishes, epoxies, vinyl coatings, finishes, and adhesives by dipping, roller coating, tumbling, knifing, or brushing	Local exhaust ventilation; general dilution ventilation
Liberation during oven or air drying of coatings and adhesives	General dilution ventilation
Use during manual application of cellulosic, acetate, and rubber adhesives in shoe manufacturing, book binding, and packaging	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation during use of cellulosic household cements	General dilution ventilation
Liberation during application of mastics or other natural gum/ based adhesives for floor and wall tiles, other floor coverings, automobile silencer, and lining pads	General dilution ventilation; local exhaust ventilation
Liberation during cleaning and maintenance of ketone-processing equipment, such as distillation columns, reactors, mixers, and storage vessels	Personal protective equipment
Liberation during blending of coating and adhesive raw materials in open mixers	Local exhaust ventilation; personal protective equipment

## 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 ethyl butyl ketone 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 ethyl butyl ketone gets on the skin, promptly flush the contaminated skin with water. If ethyl butyl ketone soaks through the clothing, remove the clothing immediately and flush the skin with water. When there is evidence of skin irritation, get medical attention.

### • Breathing

If a person breathes in large amounts of ethyl butyl ketone, 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 ethyl butyl ketone 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 ethyl butyl ketone 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 equipped with an appropriate effluent gas cleaning device. Ethyl butyl ketone 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 ethyl butyl ketone vapors are permitted.

- Waste disposal methods:

Ethyl butyl ketone 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 equipped with an appropriate effluent gas cleaning device.

## REFERENCES

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## RESPIRATORY PROTECTION FOR ETHYL BUTYL KETONE

<b>Condition</b>	<b>Minimum Respiratory Protection* Required Above 50 ppm</b>
<b>Vapor Concentration</b>	
500 ppm or less	Any chemical cartridge respirator with an organic vapor cartridge(s).**
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
2500 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.
3000 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 3000 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.

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

\*\*If eye irritation occurs, a full-facepiece respirator should be worn.