

Occupational Health Guideline for Methyl Isobutyl Carbinol

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: $(CH_3)_2CHCH_2CHOHCH_3$
- Synonyms: Methyl amyl alcohol; 4-methyl-2-pentanol; MIBC
- Appearance and odor: Colorless liquid with a mild odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl isobutyl carbinol is 25 parts of methyl isobutyl carbinol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 100 milligrams of methyl isobutyl carbinol per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Methyl isobutyl carbinol can affect the body if it is swallowed, is inhaled, or comes in contact with the eyes or skin.

• Effects of overexposure

Overexposure to methyl isobutyl carbinol may cause eye and skin irritation. The overexposed person may also experience headache and drowsiness.

• 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 methyl isobutyl carbinol.

• Recommended medical surveillance

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

—Skin disease: Methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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.

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

• Summary of toxicology

Only limited observations of the effects of methyl isobutyl carbinol have been reported, but exposure of rats to 2000 ppm for 8 hours is fatal, while 1000 ppm is not. The most important effects of methyl isobutyl carbinol are narcosis and eye irritation. Unacclimated volunteer subjects exposed to 50 ppm vapor had eye irritation. Chronic systemic effects have not been reported in humans.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 102
2. Boiling point (760 mm Hg): 132 C (269 F)
3. Specific gravity (water = 1): 0.8

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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Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

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Occupational Safety and Health Administration

4. Vapor density (air = 1 at boiling point of methyl isobutyl carbinol): 3.5

5. Melting point: -90 C (-130 F)

6. Vapor pressure at 20 C (68 F): 3.8 mm Hg

7. Solubility in water, g/100 g water at 20 C (68 F): 1.5

8. Evaporation rate (butyl acetate = 1): 0.27

• **Reactivity**

1. Conditions contributing to instability: Heat

2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving methyl isobutyl carbinol.

4. Special precautions: Methyl isobutyl carbinol will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Flash point: 41 C (106 F) (closed cup)

2. Autoignition temperature: Data not available

3. Flammable limits in air, % by volume: Lower: 1.0; Upper: 5.5

4. Extinguishant: Alcohol foam, dry chemical, carbon dioxide

• **Warning properties**

1. Odor Threshold: The *Documentation of TLV's* states that Silverman and associates observed that human subjects did not find the odor objectionable at 50 ppm.

2. Eye Irritation: According to the *Documentation of TLV's*, Silverman and associates found that human subjects experienced eye irritation at 50 ppm.

3. Evaluation of Warning Properties: Since eye irritation occurs at a level only twice the permissible exposure limit, this substance is considered to have 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol may be used. An analytical method for methyl isobutyl carbinol is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office,

field, Virginia 22161, under the title "NIOSH Analyt-

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 methyl isobutyl carbinol.

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

• Non-impervious clothing which becomes wet with liquid methyl isobutyl carbinol should be removed promptly and not reworn until the methyl isobutyl carbinol is removed from the clothing.

• Employees should be provided with and required to use splash-proof safety goggles where liquid methyl isobutyl carbinol may contact the eyes.

SANITATION

• Skin that becomes wet with liquid methyl isobutyl carbinol should be promptly with soap or mild detergent and water washed or showered to remove any methyl isobutyl carbinol.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to methyl isobutyl carbinol may occur

and control methods which may be effective in each case:

Operation	Controls
Liberation during application of nitrocellulose lacquers and other coatings; application of hot-spray lacquers	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as an extractant in dewaxing of mineral oils; use as a frother in froth flotation of various minerals, especially copper; use as an extractant in manufacture of antibiotics	General dilution ventilation; local exhaust ventilation; personal protective equipment
Liberation during preparation of brake fluids; during preparation of lubricant additives	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in synthesis of surfactants; use in preparation of lubricating oil additives	General dilution ventilation; 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol gets on the skin, promptly wash the contaminated skin with water. If methyl isobutyl carbinol soaks through the clothing, remove the clothing promptly and flush the skin with water. If there is skin irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of methyl isobutyl carbinol, 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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. Methyl isobutyl carbinol should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Methyl isobutyl carbinol 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: "Methyl Isobutyl Carbinol," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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- 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.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

RESPIRATORY PROTECTION FOR METHYL ISOBUTYL CARBINOL

Condition	Minimum Respiratory Protection* Required Above 25 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s). 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.
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 organic vapors. Any escape self-contained breathing apparatus.

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