

Occupational Health Guideline for Methylcyclohexanol

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: Hexahydroresols; mixture of 2-, 3-, and 4-methylcyclohexanols
- Appearance and odor: Straw-colored liquid with a weak coconut oil odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methylcyclohexanol is 100 parts of methylcyclohexanol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 470 milligrams of methylcyclohexanol per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has recommended for methylcyclohexanol a Threshold Limit Value of 50 ppm.

HEALTH HAZARD INFORMATION

• Routes of exposure

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

• Effects of overexposure

Headache and irritation of the eyes, nose, and throat may result from prolonged exposure to excessive concentrations of methylcyclohexanol. Prolonged or repeated contact of liquid methylcyclohexanol may cause a skin rash. In animal experiments methylcyclohexanol has caused drowsiness, unconsciousness, and mild liver and kidney damage.

• 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 methylcyclohexanol.

• Recommended medical surveillance

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

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

—Liver disease: Methylcyclohexanol causes liver damage in animals. 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: Methylcyclohexanol causes kidney damage in animals. The importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

—Skin disease: Methylcyclohexanol 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.

—Neurologic disorders: By analogy to effects observed in animals, methylcyclohexanol may adversely affect the nervous system.

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

• Summary of toxicology

Methylcyclohexanol vapor is a mild irritant of the eyes and mucous membranes in animals; high concentrations cause signs of narcosis. The oral LD50 in rats was approximately 2 g/kg; effects were signs of narcosis;

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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autopsy findings included congestive changes in several organs, including the liver and kidneys. Repeated daily application of large doses to the skin of rabbits caused skin irritation, weakness, tremor, narcosis, and death. Repeated daily exposure of rabbits to 503 ppm for 10 weeks caused conjunctivitis and lethargy; 230 ppm caused no effects; narcosis did not occur at the highest vapor concentration achievable at room temperature. In humans, headache and irritation of the eyes and upper respiratory tract may result from prolonged exposure to excessive concentrations. Prolonged or repeated contact of the liquid on the skin may cause dermatitis due to a defatting action.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 114.2
2. Boiling point (760 mm Hg): 155 – 180 C (311 – 356 F)
3. Specific gravity (water = 1): 0.92
4. Vapor density (air = 1 at boiling point of methylcyclohexanol): 3.9
5. Melting point: Less than –21 C (less than –6 F)
6. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Slight
8. Evaporation rate (butyl acetate = 1): 0.02

• Reactivity

1. Conditions contributing to instability: None
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 methylcyclohexanol.
4. Special precautions: Methylcyclohexanol will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: 65 C (149 F) (closed cup)
2. Autoignition temperature: 296 C (565 F)
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Foam, dry chemical, carbon dioxide

• Warning properties

1. Odor Threshold: Patty states that "methylcyclohexanol vapor in air can be detected and recognized by its odor when present to the extent of 500 ppm . . ."
2. Eye Irritation Level: The *Handbook of Organic Industrial Solvents* states that eye irritation does not occur until concentrations reach 500 ppm.
3. Other Information: Patty states that 500 ppm is capable of causing upper respiratory tract irritation.
4. Evaluation of Warning Properties: Since the odor and irritation thresholds of methylcyclohexanol are not within three times the permissible exposure limit, methylcyclohexanol is treated like a material with poor 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

An analytical method for methylcyclohexanol 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 repeated or prolonged skin contact with liquid methylcyclohexanol.

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

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

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

SANITATION

- Skin that becomes contaminated with methylcyclohexanol should be promptly washed or showered with soap or mild detergent and water to remove any methylcyclohexanol.
- Employees who handle liquid methylcyclohexanol should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as a solvent in lacquers, oils, gums, waxes, and resins	Process enclosure; local exhaust ventilation; personal protective equipment
Use as an auxiliary solvent for dry cleaning soaps in soap manufacture	Process enclosure; local exhaust ventilation; personal protective equipment
Use in textile industry as a blending agent in textile soaps; use as a degreaser; as an anti-oxidant in lubricants	Process enclosure; 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 liquid methylcyclohexanol gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If liquid methylcyclohexanol gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid methylcyclohexanol soaks through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of methylcyclohexanol, 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 methylcyclohexanol 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 methylcyclohexanol is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. 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 reclaimed or atomized in a suitable combustion chamber.

- Waste disposal methods:

Methylcyclohexanol 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

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RESPIRATORY PROTECTION FOR METHYLCYCLOHEXANOL

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
500 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
5000 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
10,000 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 10,000 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.