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: C₉H₁₆O
- 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/m³). 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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Public Health Service Centers for Disease Control National Institute for Occupational Safety and Health

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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. Extinguishing: 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

RESPRATORS

- 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 methylec- 
  hlohexanol may contact the eyes.

SANITATION

• Skin that becomes contaminated with methyleclo- 
  hexanol should be promptly washed or showered with 
  soap or mild detergent and water to remove any 
  methyleclohexanol.
• Employees who handle liquid methyleclohexanol 
  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 methyleclohexanol may occur and 
control methods which may be effective in each case:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Controls</th>
</tr>
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</table>
| 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 antioxidant in lubricants | Process enclosure;                      |
|                                   | local exhaust ventilation; personal    |
|                                   | protective equipment                   |

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid proce- 
dures and send for first aid or medical assistance.

• Eye Exposure
  If liquid methyleclohexanol 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 methyleclohexanol gets on the skin, promptly 
  wash the contaminated skin using soap or mild deter- 
  gent and water. If liquid methyleclohexanol 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 methyleclo- 
  hexanol, 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 methyleclohexanol has been swallowed and the 
  person is conscious, give the person large quantities of 
  water immediately. After the water has been swal- 
  lowed, 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 atten- 
  tion immediately.

• Rescue
  Move the affected person from the hazardous exposure. 
  If the exposed person has been overcome, notify some- 
  one else and put into effect the established emergency 
  rescue procedures. Do not become a casualty. Under- 
  stand 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 cloth- 
  ing should be restricted from areas of spills or leaks until 
  cleanup has been completed.
• If methyleclohexanol is spilled or leaked, the fol- 
  lowing steps should be taken:
  1. Ventilate area of spill or leak.
  2. For small quantities, absorb on paper towels. Evapo- 
     rate 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 quan- 
     tities can be collected and reclaimed or atomized in a 
     suitable combustion chamber.
• Waste disposal methods:
  Methyleclohexanol 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: “Methyleclohexanol,” Documentation of 
  the Threshold Limit Values for Substances in Workroom 
• Browning, E.: Toxicity and Metabolism of Industrial 
• Grant, W. M.: Toxicology of the Eye (2nd ed.), C. C. 
• Handbook of Organic Industrial Solvents, Technical 
  Guide No. 6 (4th ed.), American Mutual Insurance 
  Alliance, Chicago, 1972.
• International Labour Office: Encyclopedia of Occupa- 
  tional Health and Safety, McGraw-Hill, New York, 
  1971.
RESPIRATORY PROTECTION FOR METHYLCYCLOHEXANOL

<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum Respiratory Protection* Required Above 100 ppm</th>
</tr>
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<tbody>
<tr>
<td>Vapor Concentration</td>
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<tr>
<td>500 ppm or less</td>
<td>Any supplied-air respirator.</td>
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<tr>
<td></td>
<td>Any self-contained breathing apparatus.</td>
</tr>
<tr>
<td>5000 ppm or less</td>
<td>Any supplied-air respirator with a full facepiece, helmet, or hood.</td>
</tr>
<tr>
<td></td>
<td>Any self-contained breathing apparatus with a full facepiece.</td>
</tr>
<tr>
<td>10,000 ppm or less</td>
<td>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.</td>
</tr>
<tr>
<td>Greater than 10,000 ppm or entry and escape from unknown concentrations</td>
<td>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</td>
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<tr>
<td></td>
<td>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.</td>
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<tr>
<td>Fire Fighting</td>
<td>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</td>
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<tr>
<td>Escape</td>
<td>Any gas mask providing protection against organic vapors.</td>
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<tr>
<td></td>
<td>Any escape self-contained breathing apparatus.</td>
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*Only NIOSH-approved or MSHA-approved equipment should be used.