

# Occupational Health Guideline for 5-Methyl-3-Heptanone

## 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:  $C_8H_{16}O$
- Synonyms: Ethyl sec-amyl ketone; ethyl amyl ketone; amyl ethyl ketone
- Appearance and odor: Colorless liquid with a mild, fruity odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 5-methyl-3-heptanone is 25 parts of 5-methyl-3-heptanone per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 130 milligrams of 5-methyl-3-heptanone per cubic meter of air ( $mg/m^3$ ).

## HEALTH HAZARD INFORMATION

- Routes of exposure  
5-Methyl-3-heptanone 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:* 5-Methyl-3-heptanone may irritate the eyes, nose, and throat, and may cause headache, and dizziness. At very high air concentrations, the vapor may cause unconsciousness in a short time.
  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 5-methyl-3-heptanone.

- Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to 5-methyl-3-heptanone 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 5-methyl-3-heptanone exposure.

—Kidney disease: Although 5-methyl-3-heptanone 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 5-methyl-3-heptanone might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.

—Liver disease: Although 5-methyl-3-heptanone 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: 5-Methyl-3-heptanone 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 local irritation of tissues by solvent effect of 5-methyl-3-heptanone on lipids. Central nervous system depression may occur on exposure to high concentrations, producing narcosis. No chronic effects are reported.

## CHEMICAL AND PHYSICAL PROPERTIES

- Physical data
  1. Molecular weight: 128

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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.

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

U.S. DEPARTMENT OF LABOR  
Occupational Safety and Health Administration

2. Boiling point (760 mm Hg): 159 C (318 F)
3. Specific gravity (water = 1): 0.82
4. Vapor density (air = 1 at boiling point of 5-methyl-3-heptanone): 4.4
5. Melting point: -57 C (-70 F)
6. Vapor pressure at 20 C (68 F): 2 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.26

8. Evaporation rate (butyl acetate = 1): 0.26

• **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 5-methyl-3-heptanone.

4. Special precautions: None

• **Flammability**

1. Flash point: 43.3 C (110 F) (Tag closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available

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

• **Warning properties**

1. Odor Threshold: The *Documentation of TLVs* reports that Shell Chemical Corporation determined the odor threshold to be 6 ppm.

2. Irritation Levels: According to the *Documentation of TLVs*, "Shell Chemical Corporation presented the following observations in respect to sensory responses by unconditioned personnel during or following 5-minute exposures to the vapor: . . . 50% Threshold, eye irritation 50 ppm 50% Threshold, nose irritation 50 ppm"

The irritation of the nose and eyes is, according to the *Documentation of TLVs*, transient.

3. Evaluation of Warning Properties: Since 5-methyl-3-heptanone has an odor threshold which is lower than the permissible exposure limit, it is treated as a material with adequate 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 5-methyl-3-heptanone 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 5-methyl-3-heptanone may be used. An analytical method for 5-methyl-3-heptanone 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) number PB 245 851).

## 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 protect any area of the body which may come in contact with liquid 5-methyl-3-heptanone.

• Clothing wet with 5-methyl-3-heptanone should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 5-methyl-3-heptanone from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 5-methyl-3-heptanone, the person performing the operation should be informed of 5-methyl-3-heptanone's hazardous properties.

• Non-impervious clothing which becomes wet with 5-methyl-3-heptanone should be removed promptly and not reworn until the 5-methyl-3-heptanone is removed from the clothing.

• Employees should be provided with and required to use splash-proof safety goggles where liquid 5-methyl-3-heptanone may contact the eyes.

## SANITATION

• Skin that becomes wet with 5-methyl-3-heptanone should be promptly washed or showered to remove any 5-methyl-3-heptanone.

## COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to 5-methyl-3-heptanone may occur and control methods which may be effective in each case:

Operation	Controls
Liberation during spray application of resinous and lacquer surface coatings	Local exhaust ventilation; personal protective equipment
Liberation during subdivision of large quantities of ethyl amyl ketone or compounds containing it	General dilution ventilation; personal protective equipment
Use in preparation of perfumes	Local exhaust ventilation; personal protective equipment
Use as a specialized solvent in cleaning operations	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 5-methyl-3-heptanone 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 5-methyl-3-heptanone gets on the skin, promptly flush the contaminated skin with water. If 5-methyl-3-heptanone 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 5-methyl-3-heptanone, 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 5-methyl-3-heptanone 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 5-methyl-3-heptanone 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. 5-Methyl-3-heptanone 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 5-methyl-3-heptanone vapors are permitted.

• Waste disposal methods:

5-Methyl-3-heptanone 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

- American Conference of Governmental Industrial Hygienists: "Ethyl sec-Amyl Ketone," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.
- Shell Chemical Company: *Material Safety Data Sheet - Ethyl Amyl Ketone*.
- Thienes, C. H., and Haley, T. J.: *Clinical Toxicology* (5th ed.), Lea and Febiger, Philadelphia, 1972.

## RESPIRATORY PROTECTION FOR 5-METHYL-3-HEPTANONE

<b>Condition</b>	<b>Minimum Respiratory Protection* Required Above 25 ppm</b>
<b>Vapor Concentration</b>	
1000 ppm or less	<p>A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).</p> <p>A gas mask with a chin-style or a front- or back-mounted organic vapor canister.</p> <p>Any supplied-air respirator with a full facepiece, helmet, or hood.</p> <p>Any self-contained breathing apparatus with a full facepiece.</p>
3000 ppm or less	<p>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.</p>
Greater than 3000 ppm or entry and escape from unknown concentrations	<p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p> <p>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.</p>
Fire Fighting	<p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p>
Escape	<p>Any gas mask providing protection against organic vapors.</p> <p>Any escape self-contained breathing apparatus.</p>

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