

# Occupational Health Guideline for Methyl Acetylene-Propadiene Mixture

## 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:  $C_3H_4$  isomers
- Synonyms: MAPP gas; methyl acetylene-allene mixture; propyne-allene mixture
- Appearance and odor: Colorless gas with a strong, characteristic, foul odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl acetylene-propadiene mixture is 1000 parts of methyl acetylene-propadiene mixture per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 1800 milligrams of methyl acetylene-propadiene mixture per cubic meter of air ( $mg/m^3$ ).

## HEALTH HAZARD INFORMATION

- Routes of exposure  
Methyl acetylene-propadiene mixture can affect the body if it is inhaled or if the liquid comes in contact with the skin or eyes
- Effects of overexposure  
Overexposure to methyl acetylene-propadiene mixture may cause a person to become drowsy or unconscious. Spilled on the skin or in the eyes, it may also cause frostbite.
- 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 acetylene-propadiene mixture.

- Recommended medical surveillance

Routine medical examinations should be provided to each employee who is exposed to methyl acetylene-propadiene mixture at potentially hazardous levels.

- Summary of toxicology

Methyl acetylene-propadiene mixture (MAPP) is a gas with anesthetic properties at high concentrations. Animals exposed for 7 hours daily for 16 weeks to 1000 ppm showed no adverse effects; at 5000 ppm there was only slight decline in body and organ weights of some rats, but no pathological changes. In another study of the main component of the mixture, methyl acetylene, rats survived a single 6-hour exposure at 42,000 ppm, which resulted in anesthesia with rapid recovery; autopsy of the rats 9 days after exposure showed bronchiolitis and pneumonitis. Some human subjects indicated that they could detect 25 ppm, and most could detect 100 ppm. The musty odor was considered to be strong at 1000 ppm and quite objectionable at higher concentrations. No adverse effects have been reported from repeated exposures. The liquefied gas may cause frostbite.

## CHEMICAL AND PHYSICAL PROPERTIES

- Physical data
  1. Molecular weight: 40
  2. Boiling point (760 mm Hg):  $-37.8$  to  $-20$  C ( $-36$  F to  $-4$  F)
  3. Specific gravity (water = 1): 0.576 (liquid)
  4. Vapor density (air = 1 at boiling point of methyl acetylene-propadiene mixture): 1.48
  5. Melting point: Data not available
  6. Vapor pressure at 20 C (68 F): Not pertinent
  7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble
  8. Evaporation rate (butyl acetate = 1): Much greater than 1
- Reactivity
  1. Conditions contributing to instability: Heat
  2. Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions. Contact with

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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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copper alloys containing more than 6% copper may form explosive copper compounds.

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

4. Special precautions: Methyl acetylene-propadiene mixture will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Flash point: Not applicable (gas)
2. Autoignition temperature: 454 C (850 F)
3. Flammable limits in air, % by volume: Lower: 3.4; Upper: 10.8
4. Extinguishant: Stop flow of gas

• **Warning properties**

1. Odor Threshold: According to the Biochemical Research Laboratory of the Dow Chemical Company, MAPP has a strong odor which is easily detectable at 100 ppm.

2. Eye Irritation Level: MAPP is not known to be an eye irritant.

3. Evaluation of Warning Properties: Since the odor threshold of MAPP is below the permissible exposure limit, MAPP 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**

An analytical method for methyl acetylene-propadiene mixture is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 6, 1980, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00369-6).

## 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 the skin from becoming frozen from contact with liquid methyl acetylene-propadiene mixture or from contact with vessels containing liquid methyl acetylene-propadiene mixture.

• Any clothing which becomes wet with liquid methyl acetylene-propadiene mixture should be removed immediately and not reworn until the methyl acetylene-propadiene mixture has evaporated.

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

## COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to methyl acetylene-propadiene mixture may occur and control methods which may be effective in each case:

Operation	Controls
Liberation from flame hardening, metallizing, brazing, welding and cutting	General dilution 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 methyl acetylene-propadiene mixture gets into the eyes, flush eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Do not use hot water for eye flushing. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

• **Skin Exposure**

If liquid methyl acetylene-propadiene mixture gets on the skin, immediately flush the contaminated skin with water. If liquid methyl acetylene-propadiene mixture soaks through the clothing, remove the clothing immediately and flush the skin with water. Do not use hot water for skin flushing. If irritation persists after washing, get medical attention.

- **Breathing**

If a person breathes in large amounts of methyl acetylene-propadiene mixture, 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.

- **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.

## LEAK AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of leaks until cleanup has been completed.

- If methyl acetylene-propadiene mixture is leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of leak.
3. Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair the leak or allow the cylinder to empty.

- **Waste disposal method:**

Methyl acetylene-propadiene mixture may be disposed of by burning at a safe location or in a suitable combustion chamber.

- **Personal Protection and Sanitation for Chemical Hazards**

These documents are available through the NIOSH Division of Technical Services, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

## REFERENCES

- American Conference of Governmental Industrial Hygienists: "Methylene Acetylene-Propadiene Mixture," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- Dow Chemical Company, Biochemical Research Laboratory: *Material Safety Data Sheet - Methyl Acetylene-Propadiene Mixture*, Midland, Michigan, 1964.
- Kirk, R., and Othmer, D.: *Encyclopedia of Chemical Technology* (2nd ed.), Interscience, New York, 1968.
- Torkelson, T. R., and Rowe, V. K.: "Results of Repeated Inhalation by Laboratory Animals and a Limited Human Sensory Study of a Mixture of Saturated and Unsaturated C<sub>2</sub> and C<sub>4</sub> Hydrocarbons (MAPP Industrial Gas)," *American Industrial Hygiene Association Journal*, 25:554-559, 1964.
- Underwriters' Laboratories: *Methyl Acetylene-Propadiene Mixture*.

# RESPIRATORY PROTECTION FOR METHYL ACETYLENE-PROPADIENE MIXTURE

Condition	Minimum Respiratory Protection* Required Above 1000 ppm
Vapor Concentration	
5000 ppm or less	A gas mask with a chin-style canister providing protection against methyl acetylene-propadiene mixture.
10,000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
20,000 ppm or less	A gas mask with a front- or back-mounted canister providing protection against methyl acetylene-propadiene mixture. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 20,000 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 methyl acetylene-propadiene mixture. Any escape self-contained breathing apparatus.

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