

# Occupational Health Guideline for Monomethyl Aniline

## 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:  $C_6H_5NH(CH_3)$
- Synonyms: N-Methyl aniline; MA; methyl aniline
- Appearance and odor: Yellow to light brown liquid with a weak, ammonia-like odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for monomethyl aniline is 2 parts of monomethyl aniline per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 9 milligrams of monomethyl aniline per cubic meter of air ( $mg/m^3$ ). The American Conference of Governmental Industrial Hygienists has recommended for monomethyl aniline a Threshold Limit Value of 0.5 ppm with a skin notation.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

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

### • Effects of overexposure

1. *Short-term Exposure:* Monomethyl aniline may cause a bluish discoloration of the skin. Headache, dizziness, weakness, drowsiness, and unconsciousness may also occur.

2. *Long-term Exposure:* None known.

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 monomethyl aniline.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to monomethyl aniline at potentially hazardous levels:

#### 1. *Initial Medical Examination:*

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the respiratory system, liver, kidneys, and blood should be stressed.

—A complete blood count: Monomethyl aniline has been shown to cause methemoglobinemia and anemia in animals. A complete blood count should be performed including a red cell count, a white cell count, a differential count of a stained smear, as well as hemoglobin and hematocrit and a methemoglobin determination.

2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated on an annual basis.

### • Summary of toxicology

Monomethyl aniline vapor causes anoxia due to the formation of methemoglobin. Animal fatalities occurred from daily exposures to 7.6 ppm; signs of intoxication included prostration, labored breathing, and cyanosis; methemoglobinemia developed promptly in rabbits and cats; the rabbits also exhibited mild anemia and bone marrow hyperplasia. Autopsy of animals that died revealed pulmonary involvement ranging from edema to interstitial pneumonia, as well as occasional centrilobular hepatic necrosis and moderate kidney damage. The liquid readily caused poisoning in animals by absorption through the skin. No effects from industrial exposure have been reported.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 107.2

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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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Occupational Safety and Health Administration

2. Boiling point (760 mm Hg): 195.6 C (384 F)
3. Specific gravity (water = 1): 0.99
4. Vapor density (air = 1 at boiling point of monomethyl aniline): 3.70
5. Melting point: -80 C (-112 F) (approximately)
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):

Moderate

8. Evaporation rate (butyl acetate = 1): Less than 1

• **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact of liquid monomethyl aniline with strong acids will cause violent spattering. Contact with strong oxidizers may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving monomethyl aniline.

4. Special precautions: Liquid monomethyl aniline will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Flash point: 79.4 C (175 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Dry chemical, carbon dioxide, alcohol foam

• **Warning properties**

1. Odor Threshold: Cyanamid's *Chemical Safety Data Sheet* states that monomethyl aniline has a "moderate aniline-type odor," but no quantitative information is available concerning the odor threshold.

2. Eye Irritation Level: Monomethyl aniline vapor is not a known eye irritant.

3. Evaluation of Warning Properties: Since no information is available relating warning properties of monomethyl aniline to air concentrations, the substance is considered to have 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**

Sampling and analyses may be performed by collection of monomethyl aniline in a bubbler filled with sulfuric acid, followed by treatment with sodium hydroxide, and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure mono-

methyl aniline may be used. An analytical method for monomethyl aniline is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

## 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 use impervious clothing, gloves, face shields (eight-in minimum), and other appropriate protective clothing necessary to prevent skin contact with liquid monomethyl aniline, where skin contact may occur.

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

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

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

## SANITATION

• Skin that becomes contaminated with liquid monomethyl aniline should be immediately washed or showered with soap or mild detergent and water to remove any monomethyl aniline.

• Eating and smoking should not be permitted in areas where liquid monomethyl aniline is handled, processed, or stored.

- Employees who handle liquid monomethyl aniline 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 monomethyl aniline may occur and control methods which may be effective in each case:

Operation	Controls
Use during organic synthesis and in dye intermediates	Process enclosure; 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 monomethyl aniline gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If monomethyl aniline gets on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If monomethyl aniline soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Get medical attention.

### • Breathing

If a person breathes in large amounts of monomethyl aniline, 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 monomethyl aniline has been swallowed, 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 monomethyl aniline 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 atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

• Waste disposal methods:

Monomethyl aniline 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: "Monomethyl Aniline," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- American Cyanamid Corporation: *Chemical Safety Data Sheet - Monomethyl Aniline*.
- Gleason, M. N., Gosselin, R. E., Hodge, H. C., and Smith, R. P.: *Clinical Toxicology of Commercial Products* (3rd ed.), Williams and Wilkins, Baltimore, 1969.
- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- Mangelsdorff, A. F.: "Treatment of Methemoglobinemia," *A.M.A. Archives of Industrial Health*, 14:148-153, 1956.
- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.
- Spector, W. S. (Vols. I, II), Negherbon, W. O. (Vol. III), Grebe, R. M. (Vol. IV), and Dittmer, D. S. (Vol. V) (eds.): *Handbook of Toxicology*, Saunders, Philadelphia, 1956-1959.
- Treon, J. F., et al.: "The Toxic Properties of Xylidine and Monomethylaniline," *A.M.A. Archives of Industrial Hygiene and Occupational Medicine*, 1:506-524, 1950.

## RESPIRATORY PROTECTION FOR MONOMETHYL ANILINE

<b>Condition</b>	<b>Minimum Respiratory Protection* Required Above 2 ppm</b>
<b>Vapor Concentration</b>	
20 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
100 ppm or less	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 with a half facepiece operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 100 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 monomethyl aniline. Any escape self-contained breathing apparatus.

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