

Occupational Health Guideline for alpha-Methyl Styrene

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: $C_6H_5C(CH_3)=CH_2$ or C_9H_{10}
- Synonyms: 1-Methyl-1-phenylethylene; AMS
- Appearance and odor: Colorless liquid with a characteristic odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for alpha-methyl styrene is a ceiling level of 100 parts of alpha-methyl styrene per million parts of air (ppm). This may also be expressed as 480 milligrams of alpha-methyl styrene per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of its recommended Threshold Limit Value for alpha-methyl styrene from 100 ppm to 50 ppm as a ceiling value.

HEALTH HAZARD INFORMATION

• Routes of exposure

alpha-Methyl styrene 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:* alpha-Methyl styrene may cause irritation of the eyes, nose, and throat. The overexposed person may experience drowsiness.

2. *Long-term Exposure:* Prolonged exposure may produce 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 alpha-methyl styrene.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to alpha-methyl styrene 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 alpha-methyl styrene exposure.

—Skin disease: alpha-Methyl styrene can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of alpha-methyl styrene might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.

—Kidney disease: Although alpha-methyl styrene 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.

—Liver disease: Although alpha-methyl styrene 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.

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

• Summary of toxicology

Overexposure to alpha-methyl styrene causes slight irritation of the eyes, upper respiratory tract, and skin. With prolonged and repeated contact, there may be depression of the central nervous system.

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.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

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

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 118
2. Boiling point (760 mm Hg): 165 C (329 F)
3. Specific gravity (water = 1): 0.92
4. Vapor density (air = 1 at boiling point of alpha-methyl styrene): 4.1
5. Melting point: -23 C (-9 F)
6. Vapor pressure at 20 C (68 F): 1.9 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F):

Insoluble

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

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with oxidizing agents (including peroxides and halogens) may cause fires and explosions. Also, avoid contact with catalysts for vinyl polymerization and catalysts for ionic polymerization, such as aluminum or iron chloride.

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

4. Special precautions: None

• Flammability

1. Flash point: 54 C (129 F) (closed cup)
2. Autoignition temperature: 574 C (1066 F)
3. Flammable limits in air, % by volume: Lower: 1.9; Upper: 6.1

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

• Warning properties

1. Odor Threshold: According to the *Documentation of TLVs*, "four human subjects exposed to a concentration of 200 ppm of alpha-methyl styrene reported definite unpleasant odor . . . after two minutes." This concentration is not necessarily the odor threshold.

2. Eye Irritation Level: The *Documentation of TLVs* also notes that at 200 ppm human subjects experienced eye irritation. This concentration is not necessarily the threshold of eye irritation.

3. Evaluation of Warning Properties: alpha-Methyl styrene can be detected at a concentration less than twice the permissible exposure limit. Even though the permissible exposure limit is a ceiling concentration, alpha-methyl styrene is still treated as a material with adequate warning properties, since the ceiling appears to have been established to avoid irritant effects. The *Documentation of TLVs* gives the following quote of Dow Chemical Company: "We suggest, therefore, an Industrial Hygiene Standard of 200 ppm based on toxicity. For engineering purposes, we suggest that the vapor concentration be controlled to 100 ppm alpha-methyl styrene in order to minimize complaints of exposed persons."

MONITORING AND MEASUREMENT PROCEDURES

• Ceiling Evaluation

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of alpha-methyl styrene. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• Method

Sampling and analyses may be performed by collection of alpha-methyl styrene 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 alpha-methyl styrene may be used. An analytical method for alpha-methyl styrene 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).

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 alpha-methyl styrene.

• Clothing wet with liquid alpha-methyl styrene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of

alpha-methyl styrene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the alpha-methyl styrene, the person performing the operation should be informed of alpha-methyl styrene's hazardous properties.

- Non-impervious clothing which becomes contaminated with liquid alpha-methyl styrene should be removed promptly and not reworn until the alpha-methyl styrene is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid alpha-methyl styrene may contact the eyes.

SANITATION

- Skin that becomes contaminated with liquid alpha-methyl styrene should be promptly washed or showered with soap or mild detergent and water to remove any alpha-methyl styrene.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Liberation during manufacture of styrene-butadiene rubber	General dilution ventilation
Liberation during spray application of specialized alpha-methyl-styrene-polyester surface coatings	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Liberation during manufacture of high-impact acrylonitrile-butadiene-styrene plastics; during manufacture of specialized alpha-methyl-styrene-polyester and alkyd surface coating resins; during manufacture of certain plasticizers in varnishes, adhesives, and plastics; during manufacture of carbolic acid with cumene peroxidation process	General dilution ventilation; local exhaust ventilation
Liberation during brush application of specialized surface coatings	General dilution ventilation

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 alpha-methyl styrene 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 alpha-methyl styrene gets on the skin, promptly flush the contaminated skin with water. If alpha-methyl styrene soaks through the clothing, remove the clothing immediately and flush the skin with water. When there is skin irritation, get medical attention.

• Breathing

If a person breathes in large amounts of alpha-methyl styrene, 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

If alpha-methyl styrene has been swallowed, do not induce vomiting. 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 alpha-methyl styrene 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. Combustion may be improved by mixing with a flammable liquid. Liquid alpha-methyl styrene should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal methods:

alpha-Methyl styrene 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. Combustion may be improved by mixing with a flammable liquid.

REFERENCES

- Allied Chemical Company: *Material Safety Data Sheet - alpha-Methyl Styrene.*
- American Conference of Governmental Industrial Hygienists: "alpha-Methyl Styrene," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

- Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.
- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.
- Wolf, M. A., et al.: "Toxicological Studies of Certain Alkylated Benzenes and Benzene," *Archives of Industrial Health*, 14:4, pp. 387-398, 1956.

RESPIRATORY PROTECTION FOR ALPHA-METHYL STYRENE

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
5000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 5000 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.