Occupational Health Guideline for Vinyl Toluene

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: $CH_3C_6H_4CH=CH_2$
- Synonyms: Methylstyrene; tolylethylene; meta- and para-vinyltoluene (mixed isomers)
- Appearance and odor: Colorless liquid with a strong, disagreeable odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for vinyl toluene is 100 parts of vinyl toluene per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 480 milligrams of vinyl toluene per cubic meter of air (mg/m³). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of its recommended Threshold Limit Value for vinyl toluene from 100 ppm to 50 ppm.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Vinyl toluene 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: Vinyl toluene may cause irritation of the nose, throat, eyes, and skin. It may also cause drowsiness.

2. Long-term Exposure: Repeated exposure may cause 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 vinyl toluene.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to vinyl toluene 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 vinyl toluene exposure.

—Kidney disease: Although vinyl toluene 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 vinyl toluene might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.

—Liver disease: Although vinyl toluene 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: Vinyl toluene 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**

The main toxic effect of vinyl toluene is irritation of the eyes, upper respiratory tract, and skin. With prolonged and repeated contact and absorption of high doses, 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

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CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**
  1. Molecular weight: 118
  2. Boiling point (760 mm Hg): 168 C (334 F)
  3. Specific gravity (water = 1): 0.92
  4. Vapor density (air = 1 at boiling point of vinyl toluene): 4.1
  5. Melting point: −77 C (−106 F)
  6. Vapor pressure at 20 C (68 F): 1.1 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): 0.009
  8. Evaporation rate (butyl acetate = 1): Less than 0.5
- **Reactivity**
  1. Conditions contributing to instability: Vinyl toluene is stabilized by a polymerization inhibitor (10 to 50 ppm of tert-butylcatechol). If this is not present in adequate concentrations, vinyl toluene can polymerize and explode in the container.
  2. Incompatibilities: Contact with oxidizing agents may cause fires and explosions. Also, catalysts for vinyl polymerization, such as peroxides, strong acids, and aluminum chloride should be avoided.
  3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving vinyl toluene.
  4. Special precautions: None
- **Flammability**
  1. Flash point: 53 C (127 F) (closed cup)
  2. Autoignition temperature: 495 C (923 F)
  3. Flammable limits in air, % by volume: Lower: 0.1; Upper: 11
  4. Extinguishant: Dry chemical, carbon dioxide, or foam.
- **Warning properties**
  1. Odor Threshold: No quantitative information is available concerning the odor threshold of vinyl toluene.
  2. Irritation Levels: According to the ILO, vinyl toluene "gives rise to irritation of the nasal and conjunctival mucosae at 400 ppm and is detectable at 50 ppm."
  3. Evaluation of Warning Properties: Since the ILO reports that vinyl toluene is detectable at a concentration below 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 vinyl toluene 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 vinyl toluene may be used. An analytical method for vinyl toluene 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 vinyl toluene.
- Clothing wet with liquid vinyl toluene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of vinyl toluene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the vinyl toluene, the person performing the operation should be informed of vinyl toluene's hazardous properties.
- Non-impervious clothing which becomes contaminated with liquid vinyl toluene should be removed promptly and not reworn until the vinyl toluene is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid vinyl toluene may contact the eyes.

SANITATION

• Skin that becomes contaminated with liquid vinyl toluene should be promptly washed or showered with soap or mild detergent and water to remove any vinyl toluene.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to vinyl toluene may occur and control methods which may be effective in each case:

Operation	Controls
Use during spray applications of vinyl toluene polyester surface coatings	Local downdraft ventilation; personal protective equipment
Liberation during preparation of unsaturated polyester resins and alkyd coatings	Local downdraft ventilation
Use during application of specialty paints and varnishes	Local exhaust ventilation; personal protective equipment
Liberation during manufacture of thermoplastic moldings via extrusion, injection, stamping, or other processes	Local downdraft ventilation; 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 vinyl toluene 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 vinyl toluene gets on the skin, promptly flush the contaminated skin with water. If vinyl toluene 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 vinyl toluene, 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 vinyl toluene 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 vinyl toluene 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. Vinyl toluene should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

• Waste disposal methods:

Vinyl toluene 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

• Browning, E.: *Toxicity and Metabolism of Industrial Solvents*, Elsevier, New York, 1965.

• Dow Chemical Company: *Material Safety Data Sheet – Vinyl Toluene*, Midland, Michigan.

• Fairhall, L. T.: *Industrial Toxicology* (2nd ed.), Williams and Wilkins, Baltimore, 1957.

• Grant, W. M.: *Toxicology of the Eye* (2nd ed.), C. C. Thomas, Springfield, Illinois, 1974.

• International Labour Office: *Encyclopedia of Occupational Health and Safety*, McGraw-Hill, New York, 1971.

• 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*, 14:387-398, 1956.

RESPIRATORY PROTECTION FOR VINYL TOLUENE

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
400 ppm or less	Any chemical cartridge respirator with an organic vapor cartridge(s).** Any supplied-air respirator.** Any self-contained breathing apparatus.**
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.

**If eye irritation occurs, full-facepiece respiratory protective equipment should be used.