Occupational Health Guideline for Xylidine

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: $(CH_3)_2C_6H_3NH_2$
- Synonyms: 2,4-Dimethylaniline, etc. (6 isomers); xylidine isomers; xylidines mixed o-m-p
- Appearance and odor: Pale yellow to brown liquid with a weak, aromatic amine odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for xylidine is 5 parts of xylidine per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 25 milligrams of xylidine 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 xylidine from 5 ppm to 2 ppm with a skin notation.

- Method

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Xylidine 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**

Exposure to xylidine may affect the ability of the blood to carry oxygen normally. The earliest effect may be a bluish discoloration of the skin, especially the lips. If the lack of oxygen becomes severe, a person may have drowsiness, headache, nausea, and vomiting. If oxygen lack is very severe, it may cause unconsciousness and even death. Heart, liver, and kidney damage have occurred in animals exposed to this chemical, but have not been reported in man.

- **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 xylidine.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to xylidine 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 blood, lungs, liver, kidneys, and cardiovascular system should be stressed.

—A complete blood count: Xylidine has been shown to cause methemoglobinemia. Those with blood disorders may be at increased risk from exposure. 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.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis. Methemoglobin concentration in blood should be determined when xylidine intoxication is suspected.

- **Summary of toxicology**

Xylidine absorption, whether from inhalation of the vapor or absorption of the liquid through skin, causes anoxia due to the formation of methemoglobin; lung, liver, and kidney damage results in experimental animals. Repeated exposure of cats to 138 ppm caused loss of leg coordination, cyanosis, prostration, and death; at autopsy there was pulmonary edema and lobular pneumonia, necrosis of the liver, and toxic nephrosis. In cats exposed to 132 ppm for 3 days the methemoglobin concentration was 55%; repeated exposure of cats to

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17.4 ppm caused toxic hepatitis and some deaths, while repeated exposure to 7.8 ppm caused no adverse effects. Liquid xylidine penetrated the skin of rabbits in sufficient quantity to cause cyanosis and death; there were no local effects on the skin. In humans, the onset of xylidine intoxication may be insidious, in that early warning signs of methemoglobinemia such as headache and dizziness are not always interpreted as being due to overexposure, and even mild cyanosis may not be recognized.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**

1. Molecular weight: 121.2
2. Boiling point (760 mm Hg): 212– 226 C (415–439 F)
3. Specific gravity (water = 1): 1.0
4. Vapor density (air = 1 at boiling point of xylidine): 4.17
5. Melting point: Data not available
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): Insoluble
8. Evaporation rate (butyl acetate = 1): Data not available

- **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions. Contact with hypochlorite bleaches may form chloroamines that are explosive substances.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving xylidine.
4. Special precautions: Liquid xylidine will attack some forms of plastics, rubber, and coatings.

- **Flammability**

1. Flash point: 96.7 C (206 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 1.5 (calculated at flash point)
4. Extinguishant: Carbon dioxide, dry chemical, foam

- **Warning properties**

1. Odor Threshold: May reports an odor threshold of 0.0048 ppm.
2. Eye Irritation Level: Xylidine is not known to be an eye irritant.
3. Evaluation of Warning Properties: Since the odor threshold of xylidine is below the permissible exposure limit, xylidine 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 xylidine in an adsorption tube containing silica gel, followed by desorption with ethanol, and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure xylidine may be used. An analytical method for xylidine 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).
(order number PB 250 159).

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 any possibility of skin contact with liquid xylidine.
- Clothing contaminated with xylidine should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of xylidine from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the xylidine, the person performing the operation should be informed of xylidine's hazardous properties.
- Where exposure of an employee's body to liquid xylidine may occur, facilities for quick drenching of the

RESPIRATORY PROTECTION FOR XYLENE (XYLOL)

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.
10,000 ppm or less	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.
Greater than 10,000 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 organic vapors. Any escape self-contained breathing apparatus.

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

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