

# Occupational Health Guideline for Diethylamine

## 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:  $(C_2H_5)_2NH$
- Synonyms: None
- Appearance and odor: Colorless liquid with a fishy odor, like ammonia.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for diethylamine is 25 parts of diethylamine per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 75 milligrams of diethylamine per cubic meter of air ( $mg/m^3$ ). The American Conference of Governmental Industrial Hygienists has recommended for diethylamine a Threshold Limit Value of 3 ppm.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Diethylamine can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may be absorbed through the skin.

### • Effects of overexposure

**1. Short-term Exposure:** Diethylamine vapors may cause irritation of the respiratory tract, causing coughing, chest pain, or immediate or delayed breathing difficulties. High vapor concentrations may also cause severe irritation of the eyes. Contact of the liquid with bare skin may cause irritation. Covered contact as with clothing wet with diethylamine may cause skin burns. Contact of the liquid with the eyes is an emergency and may result in serious eye injury.

**2. Long-term Exposure:** Prolonged or repeated skin contact with liquid diethylamine may cause chronic irritation. Prolonged or repeated contact of the eyes with vapors of diethylamine at levels near the irritant level often results in swelling of the eye, causing foggy vision and the appearance of halos around lights.

**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 diethylamine.

### • Recommended medical surveillance

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

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of diethylamine might cause exacerbation of symptoms due to its irritant properties.

—Skin disease: Diethylamine is a primary skin irritant. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Eye disease: Diethylamine is a severe eye irritant and may cause tissue damage. Persons with pre-existing eye problems may be at increased risk from exposure.

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

### • Summary of toxicology

Diethylamine vapor is a severe irritant to mucous membranes, eyes, and skin. Rabbits repeatedly exposed to 50 ppm for 7 hours daily showed corneal damage and pulmonary irritation. In one reported human case, liquid splashed into the eye caused immediate intense pain. In spite of emergency irrigation and treatment the cornea became swollen and cloudy. Some permanent

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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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visual impairment resulted. Contact with the liquid causes vesiculation and necrosis of the skin.

## CHEMICAL AND PHYSICAL PROPERTIES

1. Molecular weight: 73.14
2. Boiling point (760 mm Hg): 55.5 C (132 F)
3. Specific gravity (water = 1): 0.71
4. Vapor density (air = 1 at boiling point of diethylamine): 2.5
5. Melting point: -50 C (-58 F)
6. Vapor pressure at 20 C (68 F): 195 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions
8. Evaporation rate (butyl acetate = 1): 16.9

### • Reactivity

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

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

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

### • Flammability

1. Flash point: Less than -18 C (less than 0 F) (closed cup)
2. Autoignition temperature: 312 C (594 F)
3. Flammable limits in air, % by volume: Lower: 1.8; Upper: 10.1
4. Extinguishant: Dry chemical, alcohol foam, carbon dioxide

### • Warning properties

1. Odor Threshold: The MCA's *Material Safety Data Sheet* states that "diethylamine has a strong ammoniacal odor which gives good warning of its presence." The Department of Transportation's CHRIS manual for the Coast Guard gives an odor threshold of 0.14 ppm.

2. Eye Irritation Level: Grant reports that "chronic exposure to the vapors at concentrations as low as 50 ppm in air causes conjunctival and pulmonary irritation in rabbits; corneal erosion develops after 2 weeks of exposure." Patty notes that both edema of the cornea and eye irritation have been observed during industrial exposures to diethylamine. The concentrations producing these effects are not given. Permanent eye injury is reported to occur after repeated exposure to 50 ppm, according to Brieger and Hodes.

3. Other Information: The MCA's *Material Safety Data Sheet* states that diethylamine is a respiratory tract irritant, and the AIHA *Hygienic Guide* reports that this compound irritates mucous membranes. No quantitative information is given.

4. Evaluation of Warning Properties: Since the odor threshold of diethylamine (0.14 ppm) is well below the permissible exposure limit, this substance is considered to have 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

Sampling and analyses may be performed by collection of vapors in a silica gel tube, followed by desorption with sulfuric acid in methanol, and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure diethylamine may be used. An analytical method for diethylamine 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 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 diethylamine, where skin contact may occur.

• Clothing wet with liquid diethylamine should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of diethylamine from the clothing. If the clothing is to be

laundered or otherwise cleaned to remove the diethylamine, the person performing the operation should be informed of diethylamine's hazardous properties.

- Where exposure of an employee's body to liquid diethylamine may occur, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

- Any clothing which becomes wet with or non-impervious clothing which becomes contaminated with liquid diethylamine should be removed immediately and not re-worn until the diethylamine is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of liquid diethylamine or solutions containing more than 0.5 percent by weight of diethylamine contacting the eyes.

- Employees should be provided with and required to use splash-proof safety goggles where solutions containing 0.5 percent or less of diethylamine by weight may contact the eyes.

- Where there is any possibility that employees' eyes may be exposed to liquid diethylamine or solutions containing more than 0.5 percent by weight of diethylamine, an eye-wash fountain should be provided within the immediate work area for emergency use.

## SANITATION

- Skin that becomes contaminated with liquid diethylamine should be immediately washed or showered to remove any diethylamine.

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in preparation of textile finishing agents, surfactants, rubber processing chemicals, agricultural chemicals, and pharmaceuticals	Process enclosure; local exhaust ventilation; general dilution ventilation
Use as a corrosion inhibitor in iron, steel, and metal industries	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as polymerization inhibitor and catalyst in polymer industry; intermediate in dye industry	Process enclosure; local exhaust ventilation; general dilution ventilation

## Operation

Use as depilatory of animal skins; and in electroplating solutions

## Controls

Local exhaust ventilation; 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 diethylamine gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

### • Skin Exposure

If diethylamine gets on the skin, immediately flush the contaminated skin with water. If diethylamine soaks through the clothing, remove the clothing immediately and flush the skin with water. If irritation persists after washing, get medical attention.

### • Breathing

If a person breathes in large amounts of diethylamine, 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 diethylamine has been swallowed and the person is conscious, 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 diethylamine 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 reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Diethylamine should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. Sewers designed to preclude the formation of explosive concentrations of diethylamine vapors are permitted.

- **Waste disposal method:**

Diethylamine may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

## REFERENCES

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- U.S. Department of Transportation: *CHRIS Hazardous Chemical Data*, CG-446-2, U.S. Government Printing Office, Washington, January 1974.

## RESPIRATORY PROTECTION FOR DIETHYLAMINE

Condition	Minimum Respiratory Protection* Required Above 25 ppm
Vapor Concentration	
1250 ppm or less	A chemical cartridge respirator with a full facepiece and an cartridge(s) which provide protection against diethylamine.  A gas mask with a chin-style or a front- or back-mounted canister which provides protection against diethylamine.  Any supplied-air respirator with a full facepiece, helmet, or hood.  Any self-contained breathing apparatus with a full facepiece.
2000 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 2000 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 diethylamine.  Any escape self-contained breathing apparatus.

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

