

Occupational Health Guideline for Diethylamino Ethanol

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: $(C_2H_5)_2NC_2H_4OH$
- Synonyms: 2-Diethylaminoethyl alcohol; N,N-diethylethanolamine; diethyl (2-hydroxytriethyl) amine; 2-diethylamino ethanol; 2-hydroxy-triethylamine
- Appearance and odor: Colorless liquid with a weak ammonia odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for diethylamino ethanol is 10 parts of diethylamino ethanol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 50 milligrams of diethylamino ethanol per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- Routes of exposure
Diethylamino ethanol 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 enter the body through the skin.
- Effects of overexposure
 1. *Short-term Exposure:* Liquid diethylamino ethanol splashes will cause skin irritation. Liquid splashes in the eye will cause irritation and damage. Diethylamino ethanol vapor may cause nausea and vomiting. It may also cause cough and shortness of breath. Splashes may cause eye and skin irritation.
 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 diethylamino ethanol.

- Recommended medical surveillance

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

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

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

—Eye disease: Diethylamino ethanol is a severe eye irritant and may cause tissue damage. Those 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

Diethylamino ethanol vapor is a skin, eye, and respiratory irritant. Rats exposed to 500 ppm 6 hours daily for 5 days exhibited marked eye and nasal irritation, and a number of animals had corneal opacity by the end of the third day; the mortality rate was 20%, and at autopsy there was acute purulent bronchiolitis and bronchopneumonia. Daily exposure at 200 ppm for up to 6 months was fatal in some rats, with death occurring during the first 30 days. An attempt by a laboratory worker to remove animals from an inhalation chamber containing approximately 100 ppm resulted in nausea and vomiting within 5 minutes after a brief exposure; no irritation of the eyes or throat was noted during this

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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brief exposure. Other persons in the same room also complained of a nauseating odor but showed no ill effects. The liquid is a severe skin irritant; in the guinea pig it is a skin sensitizer. It is also a severe eye irritant and may produce permanent eye injury. No systemic effects from human exposure have been reported.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 117.2
2. Boiling point (760 mm Hg): 162 C (324 F)
3. Specific gravity (water = 1): 0.89
4. Vapor density (air = 1 at boiling point of diethylamino ethanol): 4.0
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): 1 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): 0.17

• 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 diethylamino ethanol.

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

• Flammability

1. Flash point: 52 C (126 F) (closed cup)
2. Autoignition temperature: 320 C (608 F)
3. Flammable limits in air, % by volume: Lower: 6.7; Upper: 11.7

4. Extinguishant: Alcohol foam, carbon dioxide, dry chemical

• Warning properties

1. Odor Threshold: Diethylamino ethanol has a weak ammoniacal odor, but no information is available concerning its odor threshold.

2. Eye Irritation Level: The Pennwalt Corporation *Material Safety Data Sheet* states that diethylamino ethanol is irritating to the eyes. Deichmann and Gerarde (in *Toxicology of Drugs and Chemicals*, p. 216) state that 2-diethylamino ethanol as the "undiluted" compound is a severe eye irritant capable of producing permanent eye injury. No information is available, however, concerning air concentrations producing eye irritation.

3. Other Information: Deichmann and Gerarde report that the vapors of diethylamino ethanol irritate the respiratory tract, but the concentrations producing this irritation are not given.

4. Evaluation of Warning Properties: Since no quantitative information is available relating the warning properties of diethylamino ethanol to air concentrations, it is treated as a material with 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

An analytical method for diethylamino ethanol 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 skin contact with liquid diethylamino ethanol, where skin contact may occur.

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

• Where exposure of an employee's body to liquid diethylamino ethanol may occur, facilities for quick

drenching of the body should be provided within the immediate work area for emergency use.

- Non-impervious clothing which becomes contaminated with liquid diethylamino ethanol should be removed immediately and not reworn until the diethylamino ethanol is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of solutions containing 5 percent or more of diethylamino ethanol by weight contacting the eyes and where solutions containing less than 5 percent diethylamino ethanol by weight may contact the eyes.
- Where there is any possibility that employees' eyes may be exposed to solutions containing 5 percent or more of diethylamino ethanol by weight, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

- Skin that becomes contaminated with liquid diethylamino ethanol should be immediately washed or showered to remove any diethylamino ethanol.
- Employees who handle liquid diethylamino ethanol 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 diethylamino ethanol may occur and control methods which may be effective in each case:

Operation	Controls
Use in preparation of medicinals and pharmaceuticals, pesticides, protective surface coatings for metals, emulsifying agents for polishes, resinous materials for treating fiber surfaces, fluorescent brightening agents, and in polymer production	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in organic synthesis to prepare compounds for surfactants, detergents, wetting agents, and yarn-treating	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in synthetic fiber dyeing and vat dyes; use as photographic stabilizing solutions	General dilution ventilation; local exhaust 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 diethylamino ethanol 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 diethylamino ethanol gets on the skin, immediately flush the contaminated skin with water. If diethylamino ethanol 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 diethylamino ethanol, 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 diethylamino ethanol 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 diethylamino ethanol 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. Diethylamino ethanol should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explo-

sion. Sewers designed to preclude the formation of explosive concentrations of diethylamino ethanol vapors are permitted.

• Waste disposal methods:

Diethylamino ethanol 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.

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RESPIRATORY PROTECTION FOR DIETHYLAMINO ETHANOL

Condition	Minimum Respiratory Protection* Required Above 10 ppm
Vapor Concentration	
500 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 500 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.

**Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of diethylamino ethanol; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 500 ppm, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

