

Occupational Health Guideline for Ethylamine

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: $C_2H_5NH_2$
- Synonyms: Ethylamine, anhydrous; aminoethane; monoethylamine
- Appearance and odor: Colorless liquid or gas with a strong, ammonia-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for ethylamine is 10 parts of ethylamine per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 18 milligrams of ethylamine per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- Routes of exposure
Ethylamine 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
 1. *Short-term Exposure:* Ethylamine causes severe irritation of the eyes and skin. It may also cause irritation of the nose, throat, and lungs.
 2. *Long-term Exposure:* Repeated or prolonged exposure to ethylamine may also cause irritation of the lungs and kidney damage.
 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 ethylamine.

- Recommended medical surveillance

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

—Chronic respiratory disease: Ethylamine causes lung irritation in animals. In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of ethylamine might cause exacerbation of symptoms due to its irritant properties.

—Eye disease: Ethylamine is an eye irritant and has caused corneal edema in workers. Persons with pre-existing eye disorders may be more susceptible to the effects of this agent.

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

—Liver disease: Although ethylamine 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.

—Kidney disease: Although ethylamine 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 impaired renal function.

—Cardiovascular disease: Ethylamine causes myocardial degeneration in animals. Persons with cardiac disease may be at increased risk.

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

- Summary of toxicology
Ethylamine vapor is a primary irritant to mucous membranes, eyes, and skin. Exposure to 8000 ppm for 4 hours was lethal to rats. Rabbits survived exposures to

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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50 ppm daily for 6 weeks but showed pulmonary irritation and some myocardial degeneration; corneal damage was observed after 2 weeks of exposure. In the rabbit eye, 1 drop of a 70% solution of ethylamine caused immediate, severe irritation. Eye irritation and corneal edema in humans have been reported from industrial exposure. A 70% solution of the base dropped on the skin of guinea pigs caused prompt skin burns leading to necrosis; when held in contact with guinea pig skin for 24 hours there was severe skin irritation with extensive necrosis and deep scarring.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 45.1
2. Boiling point (760 mm Hg): 16.7 C (62 F)
3. Specific gravity (water = 1): 0.7
4. Vapor density (air = 1 at boiling point of ethylamine): 1.6
5. Melting point: -81 C (-114 F)
6. Vapor pressure at 20 C (68 F): 1.18 atmospheres
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions
8. Evaporation rate (butyl acetate = 1): Greater than 1

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact of liquid ethylamine with strong acids will cause violent spattering. Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving ethylamine.
4. Special precautions: Liquid ethylamine 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: 385 C (725 F)
3. Flammable limits in air, % by volume: Lower: 3.5; Upper: 14.0
4. Extinguishant: Alcohol foam, carbon dioxide, dry chemical

• Warning properties

1. Odor Threshold: No quantitative data are available concerning the odor threshold of ethylamine.
2. Eye Irritation Level: Patty and the *Documentation of TLV's* report that in repeated exposure experiments, "100 ppm ethylamine produced irritation of the cornea" in rabbits. In addition, corneal injury, which did not appear for 2 weeks, was produced in rabbits exposed repeatedly to 50 ppm ethylamine. This concentration (50 ppm) is not specifically stated to be the lowest concentration producing eye injury.
3. Other Information: Patty and the *Documentation of TLV's* report that rabbits exposed to both 100 ppm and 50 ppm ethylamine for 7 hours per day, 5 days per

week for 6 weeks, experienced lung irritation.

4. Evaluation of Warning Properties: Since no information is available concerning the odor threshold of ethylamine, and since the irritant effects produced by this substance are not stated to occur immediately upon exposure, ethylamine is treated as a substance 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

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

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

- Where exposure of an employee's body to liquid ethylamine 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 ethylamine should be removed immediately and not reworn until the ethylamine is removed from the clothing.

- Any clothing which becomes wet with liquid ethylamine should be removed immediately and not reworn until the ethylamine 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 ethylamine or solutions containing ethylamine contacting the eyes.

- Where there is any possibility that employees' eyes may be exposed to liquid ethylamine or solutions containing 0.75% or more of ethylamine by weight, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

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

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in synthesis of agricultural chemicals for herbicides; use as a dyestuff intermediate; use as a solvent for dyes, resins, and oils; use as a catalyst for polyurethane foams; use in pharmaceuticals, emulsifying agents, and as a vulcanization accelerator for sulfur-cured rubbers	General dilution ventilation; local exhaust ventilation

Operation	Controls
Use as a stabilizer for rubber latex; use as a catalyst for curing epoxy resins	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in synthesis of dimethylolethyltriazone, a wash and wear agent for cotton fabrics; synthesis of 1,3-diethylthiourea, a corrosion inhibitor	General dilution ventilation; local exhaust ventilation
Use in synthesis of chemical intermediates and solvents; use as plasticizers and in refining of lubricating oils	General dilution ventilation; local exhaust ventilation
Use as a selective solvent in refining of petroleum and vegetable oils	General dilution ventilation
Use in synthesis of alkyl isocyanates for intermediates in manufacture of organic products such as pharmaceuticals and resins	General dilution ventilation; local exhaust ventilation
Use in synthesis of rhodamine dyes	General dilution ventilation; local exhaust ventilation
Use as a deflocculating agent in ceramics industry; use in manufacture of detergents	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 ethylamine or solutions containing ethylamine get 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 ethylamine gets on the skin, immediately flush the contaminated skin with water. If ethylamine 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 ethylamine, 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 ethylamine has been swallowed, 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 AND LEAK PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

- If ethylamine is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. Allow ethylamine to evaporate. Ethylamine should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- **Personal Protection and Sanitation for Chemical Hazards**

These documents are available through the NIOSH Division of Technical Services, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "Ethylamine," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

- Brieger, H., and Hodes, W. A.: "Toxic Effects of Exposure to Vapors of Aliphatic Amines," *A.M.A. Archives of Industrial Hygiene and Occupational Medicine*, 3:287-291, 1951.

- Deichmann, W. B., and Gerarde, H. W.: *Toxicology of Drugs and Chemicals*, Academic Press, New York, 1969.

- Patty, F. A. (ed.): *Toxicology*, Vol. II of *Industrial Hygiene and Toxicology* (2nd ed. rev.), Interscience, New York, 1963.

- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.

- Smyth, H. F., et al.: "Range-Finding Toxicity Data, List IV," *American Industrial Hygiene Association Journal*, 23:12, pp. 95-107, 1962.

- Union Carbide Corporation, Industrial Medicine and Toxicology Department: *Toxicology Studies - Ethylamine*, New York, 1958.

- U.S. Coast Guard: "Ethylamine," *Characteristics of Liquid Chemicals Proposed for Bulk Water Movement*.

RESPIRATORY PROTECTION FOR ETHYLAMINE

Condition	Minimum Respiratory Protection* Required Above 10 ppm
Gas 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.
4000 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 4000 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 ethylamine. Any escape self-contained breathing apparatus.

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