

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** TRIETHYLAMINE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for TRIETHYLAMINE

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance TRIETHYLAMINE.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

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(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of triethylamine not in excess of 25 parts per million (ppm) (100 milligrams per cubic meter, (mg/m³)) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one half of the permissible exposure for triethylamine.

(b) Exposure determination and measurement. (1) Each employer who has a place of employment in which triethylamine is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of triethylamine at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of triethylamine.

(2) A written record of the determination shall be made and shall contain at least the following information:

(i) Any information, observations, or calculation which may indicate employee exposure to triethylamine;

(ii) Any measurements of triethylamine taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to triethylamine; and

(iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.

(3) If the employer determines that any employee may be exposed to triethylamine at or above the action level, the exposure of the employee in each work operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

(4) If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to triethylamine at or above the action level, the employer shall:

(i) Identify all employees who may be exposed at or above the action level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to triethylamine at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

(6) If an employee exposure measurement reveals that an employee is exposed to triethylamine above the permissible exposure, the employer shall:

(i) Measure the exposure monthly of the employee so exposed; and

(ii) Institute control measures as required by paragraph (d) of this section; and

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to triethylamine above the permissible exposure. The employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to triethylamine below the action level, the employer may terminate measurement for the employee.

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(8) For purposes of this paragraph, employee exposure is that which would occur if the employee were not using a respirator.

(c) Methods of measurement. (1) An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight-hour work shift (See Appendix B (iv) of this section).

(2) The method of measurement shall have an accuracy, to a confidence level of 95 percent, of not less than that given in Table 1.

Table 1

Concentration

Required Accuracy

Above permissible exposure

$\pm$ 25%

At or below permissible exposure

and above the action level

$\pm$ 35%

At or below the action level

$\pm$ 50%

(d) Compliance. (1) No employee shall be exposed to triethylamine above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of triethylamine shall be controlled to at or below the permissible exposure by engineering and work practice controls:

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not technically feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d)(4) of this section.

(3) Engineering controls. (i) When mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of triethylamine.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving triethylamine shall be classified as B-1 at 70 degrees F (21 degrees C).

(4) Compliance with the permissible exposure shall not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement engineering or work practice controls; or

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(ii) In work situations in which engineering and work practice controls are technically not feasible; or

(iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of triethylamine to at or below the permissible exposure; or

(iv) For operations which require entry into tanks or closed vessels; or
(v) In emergencies.

(5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR TRIETHYLAMINE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
1000 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 1000 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. (Supplied-air suits may be necessary.) -----
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 triethylamine. ----- Any escape self-contained breathing apparatus. -----

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(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

(e) Fire and safety. (1) The employer shall familiarize himself with the information contained in the Substance Technical Guidelines (Appendix B of this section) for triethylamine.

(2) For the purpose of compliance with § 1910.309, locations classified as hazardous locations due to the presence of triethylamine shall be Class I, Group C.

(3) For the purpose of compliance with § 1910.157, triethylamine is classified as a Class B fire hazard.

(4) For the purpose of compliance with § 1910.178, locations classified as hazardous locations due to the presence of triethylamine shall be Class I, Group C.

(5) For the purpose of compliance with § 1910.106, liquid triethylamine is classified as a Class IB flammable liquid.

(6) Spray finishing operations shall be performed in accordance with §§ 1910.107 and 1910.94(c).

(7) Dip tank operations shall be performed in accordance with §§ 1910.108 and 1910.94(d).

(8) Where a fan is located in ductwork and where triethylamine is present in the ductwork in concentrations greater than 3000 ppm (approximately 25 percent of the lower flammable limit), the fan rotating element shall be of nonsparking material or the casing shall consist of, or be lined with, nonsparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

(9) Sources of ignition such as smoking or open flames are prohibited where triethylamine presents a fire or explosion hazard.

(10) Triethylamine shall be stored so as not to come in contact with strong oxidizers and strong acids.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid triethylamine. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that clothing wet with liquid triethylamine is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of triethylamine from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the triethylamine, the employer shall inform the person performing the operation of the hazardous properties of triethylamine.

(3) Where exposure of an employee's body to liquid triethylamine may occur, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(4) Employers shall ensure that any clothing which becomes wet with or non-impervious clothing which becomes contaminated with triethylamine be removed immediately and not reworn until the triethylamine is removed from the clothing.

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(5) Employers shall provide and ensure that employees use splash-proof safety goggles (cup-cover type dust and splash safety goggles) which comply with § 1910.133 (a)(2)-(a)(6) where there is any possibility of liquid triethylamine or liquids containing triethylamine contacting the eyes.

(6) Where there is any possibility that an employee's eyes may be exposed to liquid triethylamine or liquids containing 1% or more of triethylamine by weight, employers shall provide an eye-wash fountain within the immediate work area for emergency use.

(g) Spills and disposal. (1) In the event that liquid triethylamine is spilled the employer shall immediately eliminate potential sources of ignition, provide available ventilation and then clean up the spill.

(2) Liquid triethylamine shall not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

(h) Sanitation. Employers shall ensure that employees whose skin becomes contaminated with triethylamine immediately wash or shower to remove any triethylamine from the skin.

(i) Training and information. (1) Each employer who has a workplace in which triethylamine is present shall keep a copy of this regulation with Appendixes A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to triethylamine above the action level or employees who may have skin or eye contact with liquid triethylamine or liquids containing triethylamine, or employees who work where triethylamine presents a fire or explosion hazard, shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for triethylamine (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to triethylamine.

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to triethylamine which are listed in Appendix A of the section;

(iv) Instruct affected employees to inform the employer if they develop any of the medical conditions listed in paragraph (j)(2) of this section; and

(v) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to triethylamine.

(j) Medical surveillance. (1) The employer shall provide medical procedures as required by this paragraph. All medical procedures shall be performed by or under the supervision of a physician at no cost to the employee.

(2) The employer shall obtain from each employee who is exposed, or will be exposed, to liquid triethylamine or airborne concentrations of triethylamine at or above the action level, information as to whether such employee has a history of any of the following medical conditions:

(i) Chronic lung disease

(ii) Heart disease

(iii) Liver disease

(iv) Kidney disease

(v) Eye disease

(3) The employer shall provide a medical examination for the employee if:

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(i) The employee provides a history of any of the medical conditions listed in paragraph (j)(2) of this section; or

(ii) The employee informs the employer of the development of any of the medical conditions listed in paragraph (j)(2) of this section or any of the signs or symptoms of exposure to triethylamine which are listed in Appendix A which the employee suspects are caused by exposure to triethylamine.

(4) The employer shall provide to the examining physician the following information:

(i) A copy of this regulation with Appendixes A, B and C for triethylamine;

(ii) A description of the affected employee's duties as they relate to his exposure to triethylamine;

(iii) A description of any personal protective equipment and respirators required to be used;

(iv) The results of any measurements which may indicate the affected employee's exposure;

(v) The affected employee's anticipated exposure; and

(vi) Upon request of the physician, any available information from previous medical examinations of the affected employee.

(5) Where a medical examination is required by paragraph (j)(3) of this section, following such examination the employer shall obtain a written opinion from the examining physician which conforms with paragraph (j)(6) of this section.

(6)(i) The physician's written opinion shall be a signed statement by the examining physician specifically stating: (A) Whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to triethylamine or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to triethylamine including limitations upon the use of personal protective equipment and respirators;

(C) That the employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(ii) The physician's written opinion shall not reveal specific medical findings or diagnoses unrelated to exposure to triethylamine.

(iii) The employer shall provide the employee with a copy of the physician's written opinion.

(7) No employee shall be exposed to liquid triethylamine or airborne concentrations of triethylamine in such a way as would put the employee at increased risk of material impairment of his health from such exposure. This determination may be based on the physician's written opinion.

(8) The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to triethylamine.

(9) If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risk involved by refusal to be examined.

(10) No medical procedure which would be performed pursuant to this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

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(k) Recordkeeping. (1) Exposure determination. (i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) This record shall include the written determination required in paragraph (b)(2) of this section.

(iii) This record shall be maintained until replaced by a more recent record.

(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to triethylamine.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to triethylamine which are being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy, including the method, results and date of calibration of sampling equipment;

(D) Number, duration, and results of samples taken; and

(E) Name, social security number and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;

(C) Content or scope of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(ii) This record shall include:

(A) Information concerning medical conditions obtained from the employee pursuant to paragraph (j)(2) of this section;

(B) Any employee medical complaints relative to exposure to triethylamine;

(C) A copy of information provided to the physician pursuant to paragraph (j)(4)(ii), (iii), (iv), (v), and (vi) of this section.

(D) Physician's written opinion; and

(E) A signed statement of any refusal to be examined.

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(iii) This record shall be maintained for the duration of the employment of the affected employee.

(6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

(ii) Employee exposure determination and exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.

(iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.

(1) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to triethylamine which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to triethylamine requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and required to use such equipment and comply with all other applicable safety procedures.

(3) Without interfering with the measurement, observers shall be entitled to:

(i) Receive an explanation of the measurement procedure.

(ii) Visually observe all steps related to the measurement of the airborne concentration of triethylamine that are being performed at the place of exposure; and

(iii) Record the results obtained.

NOTE: The information contained in the following appendixes is advisory in nature and is not intended, by itself, to create any additional obligations not otherwise imposed or detract from any existing obligation.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR TRIETHYLAMINE

I. SUBSTANCE IDENTIFICATION

A. Substance: Triethylamine

B. Permissible Exposure: 25 parts of triethylamine per million parts of air (ppm) (100 milligrams of triethylamine per cubic meter of air, (mg/m³)) averaged over an eight-hour work shift.

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C. Appearance and Odor: Colorless liquid with a fishy odor.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Triethylamine can affect your body if you inhale it, if it comes in contact with your eyes or skin, or if you swallow it. It may enter your body through your skin.

B. Effects of Overexposure:

1. Short-Term Exposure: Triethylamine causes irritation of the eyes, nose and throat. If the liquid is splashed in the eyes, it may cause severe eye damage.

2. Long-Term Exposure: Repeated or prolonged exposure to triethylamine may cause skin and lung irritation. Heart, liver and kidney damage have been reported in animal experiments.

3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to triethylamine.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If triethylamine or liquids containing triethylamine get into your eyes, wash the 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.

B. Skin Exposure: If triethylamine gets on your skin, immediately wash the contaminated skin using soap or mild detergent and water. If triethylamine soaks through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

C. Breathing: If you or any other person breathes in large amounts of triethylamine 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.

D. Swallowing: When triethylamine 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.

E. Rescue: Move 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 yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

A. Respirators: Respirators are not the best way to control exposure to triethylamine. You can only be required to wear them for routine use if your employer is in the process of installing controls or control measures prove inadequate.

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You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you can smell triethylamine while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

- B. Supplied-air suits: in some work situations the wearing of supplied-air suits may be necessary. Your employer should instruct you in their proper use and operation.
- C. Protective Clothing: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent repeated or prolonged skin contact with liquid triethylamine. Replace or repair impervious clothing that has developed leaks.
- D. Eye Protection: You must wear splash-proof safety goggles where there is any possibility of liquid triethylamine or liquids containing triethylamine contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Triethylamine is a flammable liquid and its vapors can easily form explosive mixtures in air.
- B. Triethylamine must be stored in tightly closed containers in a cool, well ventilated area away from heat, sparks, flames, strong oxidizers, and strong acids.
- C. Sources of ignition such as smoking and open flames are prohibited wherever triethylamine is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. You must use non-sparking tools when opening or closing metal containers of triethylamine, and containers must be bonded and grounded when pouring or transferring liquid triethylamine.
- E. You must immediately remove any non-impervious clothing that becomes contaminated with triethylamine and this clothing must not be reworn until the triethylamine is removed from the clothing.
- F. Clothing wet with liquid triethylamine can be easily ignited. You must immediately remove this clothing and it must not be reworn until the triethylamine is removed from the clothing.
- F. If your skin becomes contaminated with triethylamine, you must immediately wash or shower to remove the triethylamine from your skin.
- H. Fire extinguishers, eye flushing facilities and quick drenching facilities, where provided, must be readily available and you should know where they are and how to operate them.

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- I. Ask your supervisor where triethylamine is used in your work area and for any additional plant safety and health rules.
- VI. ACCESS TO INFORMATION
- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for triethylamine. In addition, your employer must instruct you in the safe use of triethylamine, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to triethylamine. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and of the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of exposure determinations, exposure measurements, and medical surveillance. Your employer is required to make records of exposure determinations and your exposure measurements available to you or your representative upon your request. Your employer is required to release your medical records to your physician upon your written request.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR TRIETHYLAMINE

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: None
 2. Formula: $(C_2H_5)_3N$
 3. Molecular weight: 101.2
- B. Physical Data
1. Boiling point (760 mm Hg): 89.5 C (193 F)
 2. Specific gravity (water = 1): 0.73
 3. Vapor density (air = 1 at boiling point of triethylamine): 3.5
 4. Melting point: -115 C (-175 F)
 5. Vapor pressure at 20 C (68 F): 54 mm Hg
 6. Solubility in water, % by weight at 20 C (68 F): 5.5
 7. Evaporation rate (butyl acetate = 1): 5.6
 8. Appearance and odor: Colorless liquid with a fishy odor
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Flash point: -6.7 C (20 F) (open cup)
 2. Autoignition temperature: 450 C (842 F)

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3. Flammable limits in air, % by volume: Lower: 1.2; Upper: 8.0
4. Extinguishing media: Alcohol foam, carbon dioxide, dry chemical
5. Special fire-fighting procedures: Do not use a solid stream of water since the stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Triethylamine is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where triethylamine is handled, used or stored in a manner that could create a potential fire or explosion hazard. Triethylamine vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which triethylamine is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, triethylamine is classified as a Class IB flammable liquid. For example, 3000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which triethylamine is considered to be a potential fire and explosion hazard.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for triethylamine shall be Class I Group C.

B. Reactivity

1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact strong oxidizers may cause fire and explosion. Contact with strong acids may cause violent spattering.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving triethylamine.
4. Special precautions: Liquid triethylamine will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If triethylamine 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 vapors to completely clear hood ductwork, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Triethylamine may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

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- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods: Triethylamine may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

IV. MONITORING AND MEASUREMENT PROCEDURES

- A. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two (2) 4-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). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84, portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analyses. The method of measurement must determine the concentration of triethylamine to plus or minus 35%.
- B. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring and measurements under this section should be essentially the same as described under paragraph IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of triethylamine to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set K" (Order number XXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

- A. Store triethylamine in tightly closed containers in a cool, well ventilated area.
- B. High exposures to triethylamine can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal triethylamine containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Use of supplied-air suits or other impervious coverings may be necessary to prevent skin contact with triethylamine where the concentration of triethylamine is unknown or is greater

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than 1000 ppm. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied-air suits.

- E. Employers should advise employees of all areas and operations where exposure to triethylamine could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to triethylamine is likely to occur are: during its production and its use as a corrosion inhibitor and stabilizer in paint removers and chlorinated solvents in general; as an anti-liverng agent for urea- and melamine-based enamels; in polymer production; for extraction and purification of antibiotics; in the preparation of herbicides; in organic synthesis; and as a dye assist.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Triethylamine vapor is a primary irritant to mucous membranes and eyes. Exposure to 1000 ppm for 4 hours was lethal to rats. Rabbits survived exposures to 100 ppm daily for 6 weeks but showed pulmonary irritation, myocardial degeneration, and cellular necrosis of liver and kidney; at 50 ppm the effects on lung, liver and kidney were less severe, but there was also damage to the cornea. In the eye of a rabbit, 1 drop of liquid triethylamine caused severe injury. Eye irritation and corneal edema in humans have been reported from industrial exposure. Closely related amines cause skin irritation.

III. SIGNS AND SYMPTOMS

Severe eye irritation; possible respiratory irritation; possible skin irritation. Myocardial damage reported in animals.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If swallowed and the person is conscious, immediately administer water by mouth and induce vomiting. Give artificial resuscitation if indicated. Recovery may be delayed. Consideration should be given to hospitalization and observation for delayed onset of pulmonary edema.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

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A. GENERAL

Most reported effects of triethylamine are caused by its irritant properties. It is important that the physician become familiar with plant operating conditions in which exposure to triethylamine occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

Routine medical histories and physical examination are not required. However, the employer must screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from triethylamine exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Chronic respiratory disease -- Triethylamine causes lung irritation in animals. In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of triethylamine might cause exacerbation of symptoms due to its irritant properties.
2. Cardiovascular disease -- Triethylamine causes myocardial degeneration in animals. In persons with impaired cardiovascular function, the inhalation of triethylamine might cause exacerbation of preexisting disorders.
3. Liver disease -- Triethylamine causes liver damage in animals. The importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.
4. Kidney disease -- Triethylamine causes kidney damage in animals. The importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.
5. Eye disease -- Triethylamine is an eye irritant and has caused corneal edema in workers. Persons with preexisting eye disorders may be more susceptible to the effects of this agent.

C. PERIODIC EXAMINATIONS

Routine periodic examinations are not required. However, if the employer becomes aware of an employee with the above listed conditions, he must refer such employee for further medical examination.

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VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Triethylamine," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 268.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 2038-2040, 2044, 2045, 2051-2053.
3. Brieger, H. and W.A. Hodes: "Toxic Effects of Exposure to Vapors of Aliphatic Amines," AMA Archives of Industrial Hygiene and Occupational Medicine, 3:287-291, 1951.
4. Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles C. Thomas, Illinois, 1974, p. 1050.

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REFERENCES AND SOURCES
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1910.93

- (d) Methods of Compliance - Open surface tank classification based on relative evaporation rate of fast based on the boiling point and the guidelines in ANSI Z9.1.
- (e) Fire and Safety
- (1) Electrical - Classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," H. Carhart et al., National Academy of Sciences, 1973, report to U. S. Coast Guard, report No. CG-D-92-74, p. 21.
- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Patty, "Industrial Hygiene and Toxicology;" "Triethylamine," Union Carbide; Smyth et al., "Range - Finding Toxicity Data: List VI," AIHA Journal 23:2, 1962, p. 95 - 107
- Skin: Patty, "Industrial Hygiene and Toxicology;" "Triethylamine," Union Carbide; Smyth et al., "Range - Finding Toxicity Data: List VI," AIHA Journal 23:2, 1962, p. 95 - 107
- Ingestion: Sax, "Dangerous Properties of Industrial Materials;" "Triethylamine," Union Carbide; "Merck Index;" Patty, "Industrial Hygiene and Toxicology"

COMMENTS

Eye - Classification: 1 and 2

Output statement numbers: 9, 13

Exceptions: Statement 10 is deleted and statement 9 is used to require eye protection for all situations involving potential eye exposure to triethylamine.

According to Patty, a drop of the undiluted chemical in rabbit eyes causes injury graded 9 on a scale of 10 after 24 hours. Smyth et al. indicate this means a 5% solution gives severe and that an excess of 1% solution gives less than severe injury. Carbide, apparently interpreting these data, reports "a 1% solution the least concentration causing significant injury in rabbit eyes. Since there are definitive data, the substance is given a classification of 1 when present in solutions in concentrations of 1% or more and a classification of 2 for lesser concentrations.

Skin - Classification: 2

Output statement numbers: 2, 7b, 8b, 14g and 21 combined, 14i

Exceptions: 20a deleted because of vapor pressure

Patty records a rabbit skin penetration LD50 of 0.57 ml/kg.

Smyth et al. grade rabbit skin irritation a 2 on a scale of 10, indicating "least visible capillary injection from the undiluted chemical." Union Carbide reports "an uncovered application on the rabbit belly caused slight redness of short duration." They continue "skin penetration in harmful amounts may occur after moderate contact in terms of skin area involved and duration of contact." The vapor pressure of triethylamine is 54 mm Hg at 20 deg. C. Its open cup flashpoint is 44 F and it is 5.5% soluble in water.

A classification of 2 is concluded appropriate for skin absorption of harmful amounts if statements 14 are used

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instead of statements 16 or 17 and statement 8b is used where "extensive" exposures may occur. Statement 20a is not used because of the volatility of the substance.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Sax records that the acute local, acute systemic and chronic systemic reactions to ingestion of triethylamine are all severe. Amines are well absorbed from the gut and present a hazard from their local corrosive action on the gastrointestinal tract. Merck also reports that "experimental animals have shown kidney and liver damage." Union Carbide gives an oral rat LD50 of 0.46 g/kg as does Patty. The relatively high vapor pressure of the liquid, however, indicates that ingestion of harmful amounts should not be a problem in industry.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

- National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)
- Union Carbide Corp., Material Safety Data Sheet (UCC)
- Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 2, p. 123 (K-O)

Sources of data items used:

- I. A. 1. Synonyms: None
- 2. Formula: NFPA-325M
- 3. Molecular weight: UCC
- B. 1. Boiling point: NFPA-325M; UCC
- 2. Specific gravity: UCC
- 3. Vapor density: NFPA-325M; UCC
- 4. Melting point: UCC
- 5. Vapor pressure: UCC
- 6. Solubility in water: UCC
- 7. Evaporation rate: UCC
- 8. Appearance and odor: UCC
- II. A. 1. Flash point: NFPA-325M; UCC
- 2. Autoignition temperature: UCC
- 3. Flammable limits: NFPA-325M; UCC
- 4. Extinguishing media: NFPA-325M; UCC
- 5. Special fire fighting procedures: ADL
- 6. Unusual fire and explosion hazards: ADL
- B. 1. Conditions contributing to instability: ADL
- 2. Incompatibilities: UCC; ADL
- 3. Hazardous decomposition products: ADL
- 4. Special precautions: ADL
- III. A. Steps if released or spilled: ADL; UCC
- C. Waste disposal method: UCC; ADL
- V. Miscellaneous precautions: UCC; ADL

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- "Chemical Abstracts," 79 (1973); 80 (1974), Chemical Abstracts Service (CA)
- Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw

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Hill, 1974 (Considine)
Hamilton, A. and Hardy, H. L., "Industrial Toxicology," Publishing Sciences Group, Inc., 3rd edition, 1974 (H/H)
Hawley, G. G., "The Condensed Chemical Dictionary," 8th edition, Van Nostrand Reinhold, 1971 (Hawley)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, 1st edition, 1954 (Chem Tech); 2nd edition, 1972 (K-O)
Mark, H. F., Gaylord, N. G. and Bikales, N. M., "Encyclopedia of Polymer Science and Technology," Interscience, 1964 (Polymer Sci)
Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience, 1962 (Patty)
Pennsalt Chemicals Corp., "Pennsalt Amines," 1967 (Pennsalt)
Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)

"Triethylamine," Union Carbide, Material Safety Data Sheet (Carbide)
References for Specific Use/Exposure

1. Pennsalt, Considine, H/H, K-O, CA, Polymer Sci
2. Pennsalt, SRI
3. Chem Tech, SRI, Pennsalt
4. Chem Tech, SRI, K-O, CA, Pennsalt
5. Chem Tech, K-O, CA, Pennsalt
6. K-O, SRI
7. Chem Tech, K-O, Pennsalt
8. CA, Pennsalt
9. CA, Pennsalt

References for Specific Control Methods

Patty, Chem Tech, Hawley, Pennsalt, Carbide MSDS, and K-O were the references used in numbers 1 - 9.

RESPIRATORY TABLE DOCUMENTATION

SUBSTANCE: Triethylamine

D. O. L. STANDARD: 25 ppm

WARNING PROPERTIES:

Odor Threshold: Grant reports that triethylamine has a "strong ammoniacal odor," but no quantitative information concerning the odor threshold is available.

Eye Irritation Level: Grant reports that "chronic exposure of rabbits to triethylamine vapors at concentrations as low as 50 ppm in air causes multiple erosions of the cornea and conjunctiva . . . in the course of 6 weeks."

Other Information: Patty reports that rabbits repeatedly exposed to 50 ppm triethylamine over a 6-week period experienced lung irritation.

Evaluation of Warning Properties: Since information concerning the odor threshold of triethylamine is not available, and since the only quantitative information concerning the irritant effects of triethylamine is from chronic exposures, triethylamine is treated as a material with poor warning properties. Gas sorbent respiratory equipment is not permitted.

IDLH: 1000 ppm

Basis for IDLH Value: This IDLH is based upon the statement in the Chemical Company Guides of Union Carbide Corporation that a 4-hour exposure to 1000 ppm triethylamine killed 1 out of 6 rats.

Other Toxicological Information: Patty reports that rabbits exposed

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to 100 ppm triethylamine 7 hours per day, 5 days per week, for 6 weeks experienced "lung irritation liver and kidney damage, heart muscle degeneration, and edema." Rabbits exposed to 50 ppm for the same period experienced "lung irritation, slight liver damage, eye irritation, corneal erosions, and edema.

The Chemical Company Guides of Union Carbide Corporation note that "breathing the vapors in a concentration of 500 parts per million was not fatal to animals (rats) in a four-hour exposure. A similar exposure to 1000 parts per million was fatal to one of six; and 2000 parts per million killed all of six animals."

Union Carbide Corporation's Chemical Company Guides report a single skin penetration LD50 in rabbits of 0.57 ml/kg for triethylamine.

LFL: 12,000 ppm

VAPOR PRESSURE: 54 mm Hg at 20 deg. C.

SATURATED CONCENTRATION AT 20 deg. C.: 71,000 ppm

NOE: Since all organic vapor cartridges may not be efficient in removing triethylamine, only those cartridges and canisters which provide protection against triethylamine are permitted.

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USE/EXPOSURE AND CONTROL DOCUMENT
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	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during use in polymer technology (catalyst for curing epoxy resins, for polyurethane foams, and for thermosetting polymers; stabilizing agent; chain-transfer agent; used in preparation of film-forming resins; as solvent; pH stabilizer; added to polymers for improved water solubility)	A,B	Local exhaust ventilation; general dilution ventilation
2.	Inhalation of vapor and skin contact with liquid during use for extraction and purification of antibiotics (penicillin and tetracyclines)	A,B	Local exhaust ventilation; general dilution ventilation
3.	Inhalation of vapor and skin contact with liquid during use for herbicides and pesticides (used with phytotoxicants as pre-emergence herbicide; solubilizer for 2,4-D and 2,4,5-T; used to prepare pesticides and emulsifiers for pesticides)	A,B	Local exhaust ventilation; general dilution ventilation
4.	Inhalation of vapor and skin contact with liquid during use in organic synthesis (for preparation of quarternary ammonium compounds used as textile treating chemicals, emulsifiers, surface-active agents, in paper manufacture; preparation of polymethine and merocyanine dyes, non-nutritive sweeteners, ketenes, salts with many uses, esters of penicillin	A,B	Local exhaust ventilation; general dilution ventilation

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| 5. | Inhalation of vapor and skin contact with liquid during use as a corrosion inhibitor and chemical stabilizer (for chlorinated solvents, in transmission fluids, oil well piping, engine parts, gum inhibitor for gasoline) | A,B | Local exhaust ventilation; general dilution ventilation |
| 6. | Inhalation of vapor and skin contact with liquid during manufacture and distribution of triethylamine | A,B | Local exhaust ventilation; general dilution ventilation |
| 7. | Inhalation of vapor and skin contact with liquid during use in paints and coatings (to control viscosity and prevent livering in paints; to develop water resistance in resins; as a pH stabilizer; to improve gloss of appliance finishes | A,B | Local exhaust ventilation; general dilution ventilation |
| 8. | Inhalation of vapor and skin contact with liquid during use as a dye assist (for polymeric acrylonitrile fibers, for phenolic resins and fibers) | A,B | Local exhaust ventilation; general dilution ventilation |
| 9. | Inhalation of vapor and skin contact with liquid during miscellaneous uses (in rocket fuels to shorten ignition delays, ingredient of photographic development accelerator, for drying of printing inks, in carpet cleaners) | A,B | Local exhaust ventilation; general dilution ventilation |

- A -- Inhalation
- B -- Skin and eye contact resulting in localized irritation
- C -- Ingestion
- D -- Skin contact resulting in absorption and subsequent systemic poisoning

----- JES2 JOB STATISTICS -----

1,260 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

[illegible]