

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* DIETHYLAMINE \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for DIETHYLAMINE

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 DIETHYLAMINE.

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 diethylamine not in excess of 25 parts per million (ppm) (75 milligrams per cubic meter, mg/m<sup>3</sup>) 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 diethylamine.

(b) Exposure determination and measurement. (1) Each employer who has a place of employment in which diethylamine is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of diethylamine 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 diethylamine.

(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 diethylamine;

(ii) Any measurements of diethylamine taken;

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

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Concentration

Required Accuracy

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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 diethylamine above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of diethylamine 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. 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 diethylamine.

(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

(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 diethylamine to at or below the permissible exposure; or

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(iv) 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 DIETHYLAMINE

| CONDITION                                                             | PERMISSIBLE RESPIRATORY PROTECTION                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vapor Concentration                                                   |                                                                                                                                                                                                                                                                                                |
| 1250 ppm or less                                                      | A chemical cartridge respirator with a full facepiece and cartridge(s) which provide protection against diethylamine.                                                                                                                                                                          |
|                                                                       | A gas mask with a chin-style or a front- or back-mounted canister which provide 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 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                                                                                                                                                                                                                                                              |

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against diethylamine.

Any escape self-contained breathing  
apparatus.

(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 diethylamine.

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

(3) For the purpose of compliance with § 1910.157, diethylamine is classified as a Class B fire hazard except that loaded stream or foam fire extinguishing media shall not be used.

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

(5) For the purpose of compliance with § 1910.106, liquid diethylamine is classified as a 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 §§ 1910.107 and 1910.94(c).

(8) Where a fan is located in ductwork and where diethylamine is present in the ductwork in concentrations greater than 4500 ppm (approximately 25% 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 diethylamine presents a fire or explosion hazard.

(10) Diethylamine 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 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. 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 diethylamine is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of diethylamine from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the diethylamine, the employer shall inform the person performing the operation of the hazardous properties of diethylamine.

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

(4) 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 diethylamine or solutions containing more than 0.5 percent by weight of diethylamine contacting the eyes.

(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 solutions containing 0.5 percent or less of diethylamine by weight may contact the eyes.

(6) Where there is any possibility that an employee's eyes may be exposed to liquid diethylamine or solutions containing more than 0.5 percent by weight of diethylamine, employers shall provide an eye-wash fountain within the immediate work area for emergency use.

(g) Spills and disposal. In the event that diethylamine is inadvertently released the employer shall immediately eliminate potential sources of ignition, provide available ventilation to disperse the gas and then clean up the spill.

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

(i) Training and information. (1) Each employer who has a workplace in which diethylamine 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 diethylamine above the action level or employees who may have skin or eye contact with liquid diethylamine, or employees who work where diethylamine presents a fire or explosion hazard, shall annually:

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

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

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to diethylamine 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 diethylamine.

(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 diethylamine or airborne concentrations of diethylamine at or above the action level, without regard to the use of

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respirators, information as to whether such employee has a history of any of the following medical conditions:

- (i) Chronic lung disease
- (ii) Skin disease
- (iii) Chronic eye disease

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

(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 diethylamine which are listed in Appendix A which the employee suspects are caused by exposure to diethylamine.

(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 diethylamine;

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

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

(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 diethylamine or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to diethylamine 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 diethylamine.

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

(7) No employee shall be exposed to liquid diethylamine or airborne concentrations of diethylamine 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 diethylamine.

(9) If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such

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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.

(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) The 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 diethylamine.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to diethylamine 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) The 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 diethylamine;

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(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.

(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 diethylamine which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to diethylamine 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 diethylamine 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.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET  
FOR DIETHYLAMINE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Diethylamine
- B. Permissible Exposure: 25 parts of diethylamine per million parts of air (ppm) (75 milligrams of diethylamine per cubic meter of air, mg/cu m) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless liquid with a fishy odor, like an

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Diethylamine can affect your body if you inhale it or if it comes in contact with your eyes or skin or if you swallow it. It may be absorbed through the skin.
- B. Effects of Overexposure:
  - 1. Short-Term Exposure: Diethylamine vapor 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: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to diethylamine.

III. EMERGENCY FIRST AID PROCEDURES

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

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- C. Breathing: If you or any other 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.
- D. Swallowing: When diethylamine has been swallowed give the person large quantities of water immediately. 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 diethylamine. 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. 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 there use is required. If you can smell diethylamine 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. Protective Clothing: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing where skin contact with liquid diethylamine may occur. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) if there is any possibility of liquid diethylamine or solutions containing more than 0.5 per cent by weight of diethylamine contacting your eyes or where eye contact to liquid solutions containing 0.5 per cent or less of diethylamine by weight may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Diethylamine is a flammable liquid and its vapors easily form explosive mixtures with air.
- B. Diethylamine must be stored in tightly closed containers in a cool, well ventilated area away from heat, sparks, flames, strong oxidizers, and strong acids.

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- C. Sources of ignition such as smoking and open flames are prohibited wherever diethylamine 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 diethylamine, and containers must be bonded and grounded when pouring or transferring liquid diethylamine.
- E. If your skin becomes contaminated with liquid diethylamine, you must immediately wash or shower to remove any diethylamine from the skin.
- F. You must immediately remove any non-impervious clothing that becomes contaminated with liquid diethylamine and this clothing must not be reworn until the diethylamine is removed from the clothing.
- G. Clothing wet with liquid diethylamine can be easily ignited. You must immediately remove this clothing and it must not be reworn until the diethylamine is removed from the clothing.
- 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.
- I. Ask your supervisor where diethylamine 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 diethylamine. In addition, your employer must instruct you in the safe use of diethylamine, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to diethylamine. 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.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES  
FOR DIETHYLAMINE

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: None
  2. Formula:  $(C_2H_5)_2NH$
  3. Molecular weight: 73.14
- B. Physical Data
1. Boiling point (760 mm Hg): 55.5 C (132 F)
  2. Specific gravity (Water = 1): 0.71
  3. Vapor density (air = 1 at boiling point of diethylamine): 2.
  4. Melting point: -50 C (-58 F)
  5. Vapor pressure at 20 C (68 F): 195 mm Hg
  6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
  7. Evaporation rate (butyl acetate = 1): 16.9
  8. Appearance and odor: Colorless liquid with a fishy odor, like ammonia
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
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. Extinguishing media: Dry chemical, alcohol foam, carbon dioxide
  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: Diethylamine is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where diethylamine is handled, used or stored in a manner that could create a potential fire or explosion hazard. Diethylamine 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 diethylamine is handled.
  7. For purposes of conforming with the requirements of 29 CFR 1910.106, diethylamine is classified as a Class IB flammable liquid. For example, above 4500 ppm, one-fourth of the lower flammable limit, is one situation in which diethylamine is considered to be a potential fire and explosion hazard.

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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 diethylamine shall be Class I Group C.

B. 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.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If diethylamine is spilled or leaked, the following steps should be taken:
  1. Remove all ignition sources.
  2. Ventilate area of spill or leak to disperse the vapors.
  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. Diethylamine may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods: Diethylamine 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 diethylamine to plus or minus 35%.
- B. Exposure Above the Permissible Exposure: The monitoring and measurements under this section should be essentially the

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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 diethylamine to plus or minus 25%.

- C. Methods: Methods meeting the above accuracy requirements are available from NIOSH.
- 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 diethylamine in tightly closed containers in a cool, well ventilated area.
- B. High exposures to diethylamine can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal diethylamine containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Employers should advise employees of all areas and operations where exposure to diethylamine could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to diethylamine is likely to occur are: during its production and its use as an intermediate in the manufacture of pharmaceuticals, salts of 2,4-D and 2,4,5-T, surfactants, textile finishing agents, dyestuffs, corrosion inhibitors and rubber processing chemicals; and during its use as a polymer inhibitor and as a catalyst.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation

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

III. SIGNS AND SYMPTOMS

Severe eye and skin irritation; possible respiratory irritation.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes and skin with water. Give artificial resuscitation if indicated. The possibility of delayed pulmonary edema should be considered. Recovery may be delayed.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of diethylamine are caused by its irritant properties. It is important that the physician become familiar with plant operating conditions in which exposure to diethylamine 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 diethylamine exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

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1. 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.
2. Skin disease -- Diethylamine is a primary skin irritant. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
3. Eye disease -- Diethylamine is a severe eye irritant and may cause tissue damage. Those with preexisting eye problems may be at increased risk from exposure.

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.

References

1. American Conference of Governmental Industrial Hygienists: "Diethylamine," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 84.
2. Hygienic Guide Series: "Diethylamine," American Industrial Hygiene Association Journal, 21:266-267, 1960.
3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 2038, 2040, 2043, 2044, 2049-2053.
4. Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles C. Thomas, Illinois, 1974, p. 380.
5. Brieger, H. and W. A. Hodes: "Toxic Effects of Exposure to Vapors of Aliphatic Amines," Archives of Industrial Hygiene and Occupational Medicine, 3:287-291, 1951.

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REFERENCES AND SOURCES  
DIETHYLAMINE  
1910.93

- (d) Compliance - Based on relative evaporation rate of "fast" from boiling point 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. 11.
- (f) Personal Protective Equipment, and, (h) Sanitation
  - Eye: Grant, "Toxicology of the Eye;" "Diethylamine," Manufacturing Chemists' Association
  - Skin: Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" "Diethylamine," Manufacturing Chemists' Association; "Diethylamine," Hygienic Guide Series; "Diethylamine," Hazard Process Index
  - Ingestion: Sax, "Dangerous Properties of Industrial Materials;" Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" "Diethylamine," Hazard Process Index

COMMENTS

Eye - Classification: 1 and 2

Output statement numbers: 9, 10, 13

Exceptions: None

Grant states "diethylamine, a strongly alkaline liquid, is severely damaging to rabbit eyes when applied as a drop." He continued, "a squirt in one eye caused immediate intense pain (and) in spite of emergency irrigation and treatment with a local corticosteroid the cornea became swollen, with wrinkling of the posterior surface, clouding and infiltration of the stroma and appearance of a number of small perfectly spherical bullae on the posterior surface of the cornea . . . After one month vision was correctible to no better than 3/10." The Manufacturing Chemists' Association reports "serious eye injury results from the undiluted fluid and from dilutions as low as one percent." MCA data suggest that a classification of 2 should be safe for solutions containing 0.5% or less of the substance. Higher concentrations clearly warrant a classification of 1.

Skin - Classification: 2

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

Exceptions: See Below

The Manufacturing Chemists' Association states "contact of the liquid with the bare skin causes pronounced irritation . . . covered contact as from clothing wet with the chemical may result in destructive skin burns." The Hygienic Guide Series note "repeated contact causes skin blistering and necrosis of the skin." Deichmann and Gerarde list LD50 rabbit skin penetration of 0.82 ml/kg. Hazard Process Index reports "Absorption through the skin can cause both irreversible and reversible changes not severe enough to cause death or permanent injury." Since MCA's recommended first aid procedures include the necessity for an affected employee

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to get under a shower immediately, it is evident that the chemical acts rapidly. A classification of 2 is concluded to be appropriate if statement 2 is modified to prevent contact where it may occur, statement 8b is specified, and statements 14g and 14i are used instead of those numbered 16 or 17. The substance is miscible in all proportions with water and has a flash point less than -18 C. Statement 6 is not used because of its considerable volatility. Statement 7b is used, however, because of its flammability. Statement 20a is not felt necessary because of its high vapor pressure.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Deichmann and Gerarde note a rat LD50 of 0.54 g/kg. Sax rates the acute local hazard of ingestion as severe. Similarly, the Hazard Process Index states "ingestion may cause death or permanent injury after very short exposure to small quantities." Given its high vapor pressure and corrosive action, ingestion of harmful quantities in industry is not concluded to pose a hazard.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)

Manufacturing Chemists Association, Chemical Safety Data Sheet SD-97 (MCA)

Virginia Chemicals, Inc., Bulletin 1003 (Va)

E. I. duPont de Nemours and Co., "Diethylamine" (duP)

Union Carbide Corp., Material Safety Data Sheet (UCC)

Sources of data items used:

- I. A. 1. Synonyms: none
- 2. Formula: NFPA-325M; MCA
- 3. Molecular weight: duP
- B. 1. Boiling point: MCA; duP
- 2. Specific gravity: NFPA-325M; MCA
- 3. Vapor density: NFPA-325M; UCC
- 4. Melting point: duP; UCC
- 5. Vapor pressure: MCA; duP
- 6. Solubility in water: MCA; Va; NFPA-49
- 7. Evaporation rate: UCC
- 8. Appearance and odor: MCA; Va; UCC
- II. A. 1. Flash point: NFPA-325M; duP
- 2. Autoignition temperature: NFPA-325M; MCA; duP
- 3. Flammable limits: NFPA-325M; MCA; duP
- 4. Extinguishing media: NFPA-49; MCA
- 5. Special fire fighting procedures: NFPA-325M; NFPA-49; Va
- 6. Unusual fire and explosion hazards: NFPA-325M; NFPA-49; Va
- B. 1. Conditions contributing to instability: ADL
- 2. Incompatibilities: NFPA-49
- 3. Hazardous decomposition products: ADL
- 4. Special precautions: ADL

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- III. A. Steps if released or spilled: NFPA-49; MCA  
C. Waste disposal method: MCA; UCC  
V. Miscellaneous precautions: MCA; ADL  
VI. Common operations: duP

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

"Chemical Abstracts," American Chemical Society, Vol. 66 - 77, 1967 - 1972  
(CA)

"Diethylamine," E. I. duPont de Nemours and Co., 8/69 (duPont)

"Diethylamine," American Conference of Government Industrial Hygienists,  
Hygienic Guide Series, June 1960 (Hygienic Guides)

Hawley, G. G., "The Condensed Chemical Dictionary," Van Nostrand-Reinhold  
Co., 8th edition, 1971 (Hawley)

Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience  
Publishers, 2nd edition, 1972 (K-O)

"Pennsalt Amines," Pennsalt Chemicals Corp., 1967 (Pennsalt)

Stanford Research Institute, "Chemical Economics Handbook" (SRI)

References for specific Use/Exposure

1. CA, K-O, SRI
2. CA, duPont, Pennsalt
3. CA, K-O, Pennsalt
4. CA, K-O, Pennsalt
5. duPont, SRI
6. duPont, K-O, Pennsalt
7. Hawley
8. CA, K-O
9. CA, Pennsalt
10. CA, Pennsalt
11. ADL estimate

References for Specific Control Methods

Hygienic Guide was the reference used in numbers 1 - 3.

4. duPont

Hygienic Guide was the reference used in numbers 5 - 9.

10. duPont

11. ADL estimate, duPont, Hygienic Guide

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RESPIRATOR TABLE DOCUMENTATION

Substance: Diethylamine

D. O. L. Standard: 25 ppm

WARNING PROPERTIES:

Odor Threshold: The Manufacturing Chemists Association'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.

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 as reported in Industrial Hygiene and Occupational Medicine Vol. 3 page 287, 1951.

Other Information: The Manufacturing Chemists Association's Material Safety Data Sheet states that diethylamine is a respiratory tract irritant, and the AIHA Hygienic Guides report that this compound irritates mucous membranes. No quantitative information is given.

Evaluation of Warning Properties: Since the odor threshold of diethylamine (0.14 ppm) is well below the permissible exposure limit, diethylamine is treated as a substance with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 2000 ppm

Basis for IDLH Value: This IDLH concentration is based upon the report in Patty that a 4-hour exposure to a concentration of 4000 ppm diethylamine killed 3 out of 6 rats. Since 3 of 6 rats were killed at 4000 ppm, and because of the severe eye and lung irritation which occurs as a result of exposure to high concentrations of diethylamine, an IDLH of 2000 is used.

Other Toxicological Information: The Manufacturing Chemists Association reports that "the vapors of diethylamine are so irritating that a person will not willingly tolerate exposure long enough to cause systemic illness." Exposure to high concentrations of the vapor may "cause severe coughing and chest pain due to the irritant action on the air passages." Severe eye irritation and pulmonary edema may also result.

The AIHA Hygienic Guides state that diethylamine is irritating to the eyes, skin, and mucous membranes. The Hygienic Guides state that the IDLH concentration for humans is not known, but that an exposure to a saturated concentration for 5 minutes kills all exposed rats.

Patty reports that "lung irritation, liver and kidney damage" have been observed in rabbits exposed to 100 ppm diethylamine 7 hours per day, 5 days per week, for 6 weeks. "Lung irritation, slight liver and kidney changes, eye irritation,

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corneal erosions, and edema" have been observed in rabbits exposed to 50 ppm for the same exposure periods.

Patty reports also that 3 out of 6 rats died from an exposure to 4000 ppm diethylamine for 4 hours.

LFL: 18,000 ppm

VAPOR PRESSURE: 195 mm Hg at 20 deg. C.

SATURATED CONCENTRATION AT 20 DEG. C.: approximately 256,000 ppm

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

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USE/EXPOSURE AND CONTROL DOCUMENT

DIETHYLAMINE

Principal Route  
of Entry

Currently Used  
Control Methods

- | Use/Exposure                                                                                                                                                                                                                                                                         | Principal Route of Entry | Currently Used Control Methods                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1. Inhalation of vapor during the preparation of textile finishing agents (dimethylformamide and dimethylacetamide - spinning solvents for acrylic fibers)                                                                                                                           | A                        | Process enclosure; local exhaust ventilation; general dilution ventilation                                                    |
| 2. Inhalation of vapor during the preparation of surfactants (emulsifiers, deemulsifiers, softeners, wetting agents for soaps, lubricating oils, detergents, photographic emulsions, textile emulsions, flotation agents)                                                            | A                        | Process enclosure; local exhaust ventilation; general dilution ventilation                                                    |
| 3. Inhalation of vapor during the preparation of rubber processing chemicals (accelerators or vulcanizing agents for natural and synthetic rubbers, stabilizers for scorch prevention, curing agents)                                                                                | A                        | Process enclosure; local exhaust ventilation; general dilution ventilation                                                    |
| 4. Inhalation of vapor and skin contact with liquid during use as a corrosion inhibitor (antioxidant for lubricating oils, metals wrapped in paper, metal surface neutralizer). Diethylamine is also used to synthesize corrosion inhibitors for the petroleum and steel industries. | A, B                     | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles, protective clothing) |
| 5. Inhalation of vapor during the preparation of chemicals used in the agricultural industry (insecticides, herbicides - 2,4-D, 2,4,5-T, insect repellants - N,N-diethyl - m-toluamide)                                                                                              | A                        | Process enclosure; local exhaust ventilation; general dilution ventilation                                                    |
| 6. Inhalation of vapor during                                                                                                                                                                                                                                                        | A                        | Process enclosure; local                                                                                                      |

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the preparation of chemicals used in the pharmaceutical industry (respiratory stimulants, local anesthetics, antimalarials, vitamins, antihistamines)

exhaust ventilation; general dilution ventilation

7. Inhalation of vapor during the preparation and processing of diethylamine (ethyl chloride and ammonia under heat and pressure)

A

Process enclosure; local exhaust ventilation; general dilution ventilation

8. Inhalation of vapor during use in the polymer industry (polymerization inhibitors, chain terminators) and the dye industry (intermediates for dyestuffs)

A

Process enclosure; local exhaust ventilation; general dilution ventilation

9. Inhalation of vapor during use as a catalyst - alone or as part of a catalyst system (polymerization of ethylene and acrylonitrile, hydrolyzing lactams to amino acids)

A

Process enclosure; local exhaust ventilation; general dilution ventilation

10. Inhalation of vapor and skin contact with liquid during exposure in miscellaneous application (accelerates depilation of animal skins by lime liquor, in electroplating solutions to improve brightness and lower internal stresses of deposition)

A,B

Local exhaust ventilation; General dilution ventilation; personal protective equipment (goggles, gloves, protective clothing)

11. Inhalation of vapor and skin contact with liquid during the cleaning and maintenance of storage vessels and during clean up of accidental spills

A,B

Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, goggles, gloves, protective clothing)

A -- Inhalation  
B -- Skin and eye contact  
resulting in localized  
irritation  
C -- Ingestion

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D -- Skin contact resulting in  
absorption and subsequent  
systemic poisoning