

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* DIMETHYLAMINE \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for DIMETHYLAMINE

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 DIMETHYLAMINE.

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 dimethylamine not in excess of 10 parts per million (ppm) (18 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 dimethylamine.

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

(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 dimethylamine;

(ii) Any measurements of dimethylamine taken;

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

$\pm 25\%$

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At or below permissible exposure

and above the action level

$\pm 35\%$

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At or below the action level

$\pm 50\%$

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

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

(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

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

(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 DIMETHYLAMINE

| CONDITION                                                             | PERMISSIBLE RESPIRATORY PROTECTION                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gas Concentration                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 500 ppm or less                                                       | <p>A chemical cartridge respirator with a full facepiece and cartridge(s) which provide(s) protection against dimethylamine.</p> <p>-----</p> <p>A gas mask with a chin-style or a front- or back-mounted canister which provides protection against dimethylamine.</p> <p>-----</p> <p>Any supplied-air respirator with a full facepiece, helmet or hood.</p> <p>-----</p> <p>Any self-contained breathing apparatus with a full facepiece.</p> <p>-----</p> |
| 2000 ppm or less                                                      | <p>A type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode.</p> <p>-----</p>                                                                                                                                                                                                                                             |
| Greater than 2000 ppm or entry and escape from unknown concentrations | <p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p> <p>-----</p> <p>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.</p> <p>-----</p>  |
| Fire Fighting                                                         | <p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive</p>                                                                                                                                                                                                                                                                                                                                                 |

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pressure mode.

Escape

Any gas mask providing protection  
against dimethylamine.

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 dimethylamine.

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

(3) For the purpose of compliance with § 1910.157, dimethylamine 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 dimethylamine shall be Class I, Group C.

(5) Where a fan is located in ductwork and where dimethylamine is present in the ductwork in concentrations greater than 7000 ppm (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.

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

(7) Dimethylamine shall be stored so as not to come in contact with strong oxidizers, chlorine and mercury.

(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 any possibility of skin contact with liquid dimethylamine. Face shields shall comply with § 1910.133 (a)(2), (a)(4), (a)(5), and (a)(6).

(2) 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 solutions containing dimethylamine. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

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

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(4) Where there is any possibility of exposure of an employee's body to liquid dimethylamine, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(5) Employers shall ensure that non-impervious clothing which becomes contaminated with liquid solutions of dimethylamine be removed promptly and not reworn until the dimethylamine is removed from the clothing.

(6) Employers shall ensure that clothing which becomes wet with liquid dimethylamine or liquid solutions of dimethylamine be removed immediately and not reworn until the dimethylamine is removed from the clothing.

(7) 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 dimethylamine or solutions containing dimethylamine contacting the eyes.

(8) Where there is any possibility that an employee's eyes may be exposed to liquid dimethylamine or solutions containing dimethylamine, employers shall provide an eye-wash fountain within the immediate work area for emergency use.

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

(h) Sanitation. (1) Employers shall ensure that employees whose skin becomes contaminated with liquid dimethylamine immediately wash or shower to remove any dimethylamine from the skin.

(2) Employers shall ensure that employees whose skin becomes contaminated with solutions containing dimethylamine promptly wash or shower to remove any dimethylamine from the skin.

(3) Employers shall ensure that employees who handle dimethylamine or solutions containing dimethylamine wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

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

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

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

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

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(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 dimethylamine or airborne concentrations of dimethylamine at or above the action level, without regard to the use of 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) 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 dimethylamine which are listed in Appendix A which the employee suspects are caused by exposure to dimethylamine.

(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 dimethylamine;

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

(iii) A description of any personal protective equipment including 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 dimethylamine or would directly or indirectly aggravate any detected medical condition;

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

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

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

(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.

(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 dimethylamine.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to dimethylamine 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.

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(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 dimethylamine;

(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 dimethylamine which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to dimethylamine 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 dimethylamine 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 DIMETHYLAMINE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Dimethylamine
- B. Permissible Exposure: 10 parts of dimethylamine per million parts of air (ppm) (18 milligrams of dimethylamine per cubic meter of air, mg/cu m) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless liquid or gas with a pungent, fishy or ammonia-like odor.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Dimethylamine can affect your body if you inhale it or if it comes in contact with your eyes or skin. It may also affect your body if you swallow it.
- B. Effects of Overexposure:
  - 1. Short-Term Exposure: Dimethylamine vapor may cause irritation of the lungs, nose, throat and eyes. It may cause coughing and sneezing. Contact with the liquid may cause skin and eye burns.
  - 2. Long-Term Exposure: None known.
  - 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 dimethylamine.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If dimethylamine 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 dimethylamine gets on your skin, immediately flush the contaminated skin with water. If dimethylamine soaks through your clothing, remove the clothing immediately and wash the skin with water. If irritation persists after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of dimethylamine 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 dimethylamine 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.

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- 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 dimethylamine. 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 dimethylamine 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 to prevent any possibility of skin contact with liquid dimethylamine or to prevent repeated or prolonged skin contact with solutions containing dimethylamine. Replace or repair impervious clothing that had 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 dimethylamine or solutions containing dimethylamine contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Dimethylamine is a flammable gas and it easily forms explosive mixtures with air.
- B. Dimethylamine must be stored in tightly closed containers in a cool, well ventilated area away from heat, sparks, flames, strong oxidizers, chlorine, and mercury.
- C. Sources of ignition such as smoking and open flames are prohibited wherever dimethylamine is handled, used or stored.
- D. If your skin becomes contaminated with liquid dimethylamine, you must immediately wash or shower to remove any dimethylamine from the skin.
- E. If your skin becomes contaminated with solutions containing dimethylamine, you must promptly wash or shower to remove the dimethylamine from your skin.
- F. You must immediately remove any clothing that becomes wet with liquid dimethylamine and this clothing must not be reworn until the dimethylamine is removed from the clothing.

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- G. You must promptly remove any non-impervious clothing that becomes contaminated with solutions containing dimethylamine and this clothing must not be reworn until the dimethylamine has been removed.
- 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. If you handle liquid dimethylamine or solutions containing dimethylamine, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- J. Ask your supervisor where dimethylamine 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 dimethylamine. In addition, your employer must instruct you in the safe use of dimethylamine, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to dimethylamine. 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 DIMETHYLAMINE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Dimethylamine, anhydrous
2. Formula:  $(CH_3)_2NH$
3. Molecular weight: 45.1

B. Physical Data

1. Boiling point (760 mm Hg): 6.9 C (44.4 F)
2. Specific gravity (Water = 1): 0.68 (liquid at 0 C)
3. Vapor density (air = 1 at boiling point of dimethylamine): 1.6
4. Melting point: -92 C (-134 F)
5. Vapor pressure at 20 C (68 F): 1.72 atm.
6. Solubility in water, % by weight at 20 C (68 F): very soluble
7. Evaporation rate (butyl acetate = 1): greater than 1
8. Appearance and odor: Colorless liquid or gas with a pungent, fishy or ammonia-like odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: not pertinent (gas).
2. Autoignition temperature: 402 C (755 F)
3. Flammable limits in air, % by volume: Lower: 2.8; Upper: 14.4
4. Extinguishing media: Stop flow of gas.
5. Special fire-fighting procedures: Use water spray to keep fire-exposed containers cool and to protect men fighting fire. Do not extinguish flame in an enclosed area since unburnt gas may form explosive mixtures with air.
6. Unusual fire and explosion hazards: Dimethylamine is a flammable gas. It can readily form explosive mixtures with air. Its vapors are heavier than air and can travel along the ground and be ignited at locations remote from the site where dimethylamine is handled and stored. All ignition sources must be controlled where dimethylamine is used, handled and stored in a manner that may create a potential fire or explosion hazard. See 29 CFR 1910.101 for specific regulations on storage of compressed gas cylinders.
7. Above 7000 ppm, one-fourth of the lower flammable limit, is one situation in which dimethylamine 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

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Article 500 of the National Electrical Code for dimethylamine shall be Class I, Group C.

B. Reactivity

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

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If dimethylamine is leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of leak or spill.
3. Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
4. If in the liquid form, allow to vaporize.

B. Persons not wearing protective equipment should be restricted from areas of leaks until cleanup has been completed.

C. Waste disposal methods: Dimethylamine may be disposed of by burning at a safe location or 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 dimethylamine 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 dimethylamine to plus or minus 25%.

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- 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 dimethylamine in tightly closed containers in a cool, well ventilated area.
- B. Employers should advise employees of all areas and operations where exposure to dimethylamine could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to dimethylamine is likely to occur are: during its production and its use as an intermediate in the manufacture of rubber accelerators, pesticides, fungicides, herbicides, spinning solvents, cationic surfactants, long-chain quaternary ammonium compounds, synthetic detergents and soaps, pharmaceuticals and dimethylhydrazine rocket fuel; as a catalyst during the manufacture of phenol-formaldehyde resins; as a gas absorbent; as a dehairing agent for hides; and as a stabilizer for resins and natural rubber latex.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Dimethylamine gas is a severe respiratory, eye, and mucous membrane irritant in animals. Animals repeatedly exposed to concentrations of approximately 100 to 200 ppm for 18-20 weeks showed marked irritation of the respiratory tract with pulmonary edema as well as hepatic injury, including centrilobular necrosis; corneal injury was observed in guinea pigs and rabbits after 9 days of exposure. Various species survived 5 ppm of continuous exposure for 90 days without signs of toxicity, but at autopsy some showed mild inflammatory changes in the lungs. A drop of undiluted dimethylamine placed on a rabbit's cornea caused the cornea to become as white as the sclera in one minute. Both the liquid and the vapor are highly irritating to the eyes and may result in loss of visual acuity. Dermatitis and conjunctivitis are occasionally observed in chemical workers after prolonged exposure to the gas. No systemic effects from industrial exposure have been reported.

III. SIGNS AND SYMPTOMS

May produce irritation of the nose and throat, sneezing, cough and dyspnea; pulmonary congestion and edema; conjunctivitis; direct contact with skin and mucous membranes may cause burns; dermatitis may result from prolonged exposure.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes and skin with water. Give artificial resuscitation if indicated. Consideration should be given to hospitalization and observation for delayed onset of pulmonary edema.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Dimethylamine is irritating to the upper respiratory tract, skin, and lungs. If a solution is splashed in the eye, loss of vision may result. It is important that the physician become familiar with plant operating conditions in which exposure to dimethylamine 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.

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B. PREPLACEMENT

Routine medical histories and physical examinations 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 dimethylamine exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of dimethylamine might cause exacerbation of symptoms due to its irritant properties.
2. Skin disease -- Dimethylamine is a primary skin irritant. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
3. Eye disease -- Dimethylamine 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 above listed conditions, he must refer such employee for further medical examination.

References

1. American Conference of Governmental Industrial Hygienists: "Dimethylamine," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 88-89.
2. Manufacturing Chemists Association, Inc.: Chemical Safety Data Sheet SD-57, Methylamines, Washington, D.C., 1955, pp. 17-19.
3. Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles Thomas, Illinois, 1974, p. 400.

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REFERENCES AND SOURCES  
DIMETHYLAMINE  
1910.93

- (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. 12.
- (f) Personal Protective Equipment, and, (h) Sanitation  
Eye: ACGIH, "Documentation of the Threshold Limit Values;" Grant, "Toxicology of the Eye;" and Patty, "Industrial Hygiene and Toxicology"  
Skin: ACGIH, "Documentation of the Threshold Limit Values;" Spector "Handbook of Toxicology;" Patty, "Industrial Hygiene and Toxicology;" and "Documentation of the Threshold Limit Values"  
Ingestion: ACGIH, "Documentation of the Threshold Limit Values;" "Dimethylamine," Manufacturing Chemists' Association

COMMENTS

- Eye - Classification: 1  
Output statement numbers: 9, 13  
Exceptions: None  
According to the Documentation of TLV's, "a drop in the eye may result in severe corneal damage, even permanent corneal opacity." Grant reports work in which "a 5% solution dropped once on a rabbit eye caused hemorrhages in the conjunctiva, corneal edema and superficial opacities." He continues, "a drop of undiluted dimethylamine placed on a rabbit's cornea, with the lids then closed and no irrigation performed, caused the cornea to become whitish blue and translucent within a few seconds, then white as the sclera in a minute - a very severe injury." The substance is given a classification of 1 for the pure substance and specifically for liquid solutions containing it since the methylamines are supplied commercially as aqueous solutions in concentrations from 25 to 40 percent, as noted in Patty.
- Skin - Classification: 1 and 2  
Output statement numbers: 1, 2, 7b, 8a, 17g, 21, 14i, 17i, 20a  
Exceptions: 14g deleted due to extremely high vapor pressure  
The Documentation of TLV's states "skin contact with the liquid causes necrosis." The Documentation of TLV's states "dimethylamine resembles ammonia in its chemical and toxicologic properties." The pure substance is, therefore, concluded to be immediately and highly corrosive to the skin and is given a classification of 1. By analogy to the effects of liquid solutions of ammonia, contact with such solutions is prevented where it is repeated and prolonged. Statement 6 is not used for the pure substance because of its low boiling point. Statement 7b is specified instead of 7a because of the considerable vapor pressure the substance can be expected to have in

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solution and because Patty notes that the flashpoint of a 25% solution is 54 F.

Ingestion - Classification: 2

Output statement numbers: 20a

Exceptions: None

The Documentation of TLV's states "dimethylamine resembles ammonia in its chemical and toxicologic properties." In studies done on this latter chemical, the Manufacturing Chemists' Association notes, "when liquid ammonia is ingested in large quantities, there is corrosive destruction of the mucosa of the pharynx, esophagus and stomach, frequently with signs and symptoms of nausea; vomiting; pain in the throat and upper abdomen; rapid, weak pulse; convulsions and collapse." They continue, "The swallowing of as little as one teaspoonful of concentrated ammonium hydroxide has caused death; on the other hand, recovery has followed the taking of as much as a fluid ounce." The boiling point of the pure substance is too low for ingestion to be a problem in industry. Statement 20a is specified to ensure that small amounts of liquid solutions of the substance are not ingested.

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-57 (MCA)

E. I. duPont de Nemours and Co., "Methylamines Product Data Sheet" (duP)

Commercial Solvents Corp., Technical Data Sheet IC Series, TDS No. 12 and "CSC Methylamines" (CSC)

"Matheson Gas Data Book," 5th edition, p. 215 (Math)

Sources of data items used:

- I.
  - A.
    - 1. Synonyms: MCA
    - 2. Formula: NFPA-49; MCA
    - 3. Molecular weight: duP; CSC
  - B.
    - 1. Boiling point: Math; duP
    - 2. Specific gravity: Math
    - 3. Vapor density: NFPA-49
    - 4. Melting point: duP; Math; CSC
    - 5. Vapor pressure: duP
    - 6. Solubility in water: Math; CSC; MCA
    - 7. Evaporation rate: ADL
    - 8. Appearance and odor: NFPA-49; MCA
- II.
  - A.
    - 1. Flash point: not applicable
    - 2. Autoignition temperature: NFPA-49; duP
    - 3. Flammable limits: NFPA-49; MCA; duP
    - 4. Extinguishing media: NFPA-49
    - 5. Special fire fighting procedures: NFPA-49; MCA
    - 6. Unusual fire and explosion hazards: NFPA-49
  - B.
    - 1. Conditions contributing to instability: ADL
    - 2. Incompatibilities: NFPA-49; MCA; Math

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- 3. Hazardous decomposition products: ADL
- 4. Special precautions: ADL
- III. A. Steps if released or spilled: NFPA-49; ADL
- C. Waste disposal method: Math
- V. Miscellaneous precautions: MCA

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- Byrd, J. F. et al., "Solving a Major Odor Problem in a Chemical Process," Journal of the Air Pollution Control Association, Vol. 14, No. 12, 1964 (Byrd)
- "Chemical Origins and Markets," 4th edition, Stanford Research Institute, Menlo Park, California, 1967 (Origins)
- Considine, D. M. - editor, "Chemical and Process Technology Encyclopedia," McGraw Hill Book Company, New York, 1974 (Considine)
- Faith, W. L., Keyes, D. P. and Clark, R. L., "Industrial Chemicals," John Wiley and Sons, Inc., 1965 (Faith)
- Hawley, G. G. - editor, "The Condensed Chemical Dictionary," Van Nostrand - Reinhold Company, 8th edition, 1971 (Hawley)
- International Labour Organization, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley and Sons, Inc., 2nd edition, 1968 (K-O)
- Levina, M. M. et al., "Industrial Hygiene Problems and Worker Health in the Monurone Industry," Labor Hygiene and Occupational Diseases, Vol. II, 1965 (Levina)
- "Merck Index of Chemicals and Drugs," Merck and Company, Rahway, New Jersey, 8th edition, 1968 (Merck)
- "Methylamines," Product Data Sheet, Commercial Solvents Corporation, 1965 (CSC)
- "Methylamine," Product Data Sheet, E. I. duPont de Nemours and Company, Wilmington, Delaware, 1961 (DuPont)
- "Methylamines," Chemical Safety Data Sheet, SD-57, Manufacturing Chemists Association, 1955 (MCA)
- "Methylamines Have Many Uses," Rohm and Haas Reporter, Rohm and Haas Co., 1963 (Rohm and Haas)
- Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)
- Vekshteyn, M. S. and Khitsenko, I. I., "Zirame - Metabolism in the Organism of Warm - Blooded Animals," Metabolism and Toxicity of Pesticides, USSR, 1971 (Vekshteyn)

References for Specific Use/Exposure

- 1. Origins, SRI, Faith
- 2. Origins, K-O, Hawley
- 3. Origins, SRI, K-O, duPont, CSC, Considine, Merck, Faith, Vekshteyn, Levina, Rohm and Haas
- 4. Origins, SRI
- 5. Origins, K-O, Hawley, CSC
- 6. K-O, CSC
- 7. Origins, SRI, K-O, Hawley, duPont, CSC, Merck, Faith, ILO
- 8. K-O, duPont
- 9. K-O, CSC

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10. Hawley, CSC
11. Origins, SRI, K-O, Hawley, CSC, Faith
12. K-O, Hawley, CSC, Faith
13. Origins, K-O, Hawley, CSC
14. K-O
15. Merck, Byrd
16. CSC

References for Specific Control Methods

CSC and MCA were the references used in numbers 1 - 16.

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RESPIRATOR TABLE DOCUMENTATION

Substance: Dimethylamine

D. O. L. Standard: 10 ppm

WARNING PROPERTIES:

Odor Threshold: Summer reports that the odor threshold of dimethylamine is 6 ppm, and Staub reports 2 odor thresholds for dimethylamine: .021 and 23 ppm.

Eye Irritation Level: The Documentation of TLV's reports that dimethylamine irritates mucous membranes. Repeated exposures of guinea pigs and rabbits to concentrations of 183 to 97 ppm dimethylamine have resulted in corneal injury. There is no available information on the threshold of eye irritation.

Other Information: The Documentation of TLV's states that dimethylamine is a mucous membrane irritant and a respiratory tract irritant. The thresholds of irritation are not given.

Evaluation of Warning Properties: Since the odor threshold ranges between the permissible exposure limit and approximately 2 times higher than the permissible exposure limit, dimethylamine is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 2000 ppm

Basis for IDLH Value: Since no acute inhalation toxicity data concerning the effects of dimethylamine are available, the IDLH concentration of 2000 ppm is based upon an analogy to diethylamine, for which an IDLH of 2000 ppm was used.

Other Toxicological Information: The Documentation of TLV's states that dimethylamine is similar to ammonia both chemically and toxicologically. According to the Documentation, however, dimethylamine is "a stronger local irritant than ammonia." Irritation of the respiratory tract and mucous membranes has been observed in animals exposed to dimethylamine. "Exposures at sublethal concentrations may result in tracheitis, bronchitis, pneumonitis and pulmonary edema."

The Documentation reports that several species of animals were exposed to concentrations of 183 and 97 ppm dimethylamine for 7 hours per day, 5 days per week, for 18 to 20 weeks. On the ninth day of exposure, guinea pigs and rabbits began to exhibit corneal injury. "Central lobular fatty degeneration and necrosis of the parenchymal cells of the liver was found in rats, guinea pigs, rabbits, and mice. Tubular degeneration of the testes was observed in the male rabbit at the higher concentration and in the male monkey at the lower concentration."

LFL: 28,000 ppm

NOTE: Toxicological information needs to be obtained on which to base an IDLH for this substance.

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

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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 as a raw material in the preparation of spinning solvents for acrylic and other polymeric fibers.                                                                                                                                                                                                                           | A,B                      | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons and goggles)            |
| 2. Inhalation of vapor and skin contact with liquid during use as a depilatory on skins and hides in leather manufacture                                                                                                                                                                                                                                                                   | A,B                      | Process enclosure; general dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, aprons and goggles) |
| 3. Inhalation of vapor and skin contact with liquid during use as a raw material in the synthesis of fungicides, insecticides, herbicides and other agricultural chemicals. Such substances include ferric and zinc salts of dimethyldithiocarbamic acid (fungicides), octamethylpyrophosphoramide (insecticides) and the dimethylamine salt of 2,4 dichlorophenoxyacetic acid (herbicide) | A,B                      | Process enclosure; general dilution ventilation; local exhaust ventilation                                                                                     |
| 4. Inhalation of vapor and skin contact with liquid during manufacture of dimethylamine and maintenance of processing equipment. Dimethylamine is manufactured either from methane and synthesis gas or by catalytically reacting ammonia and methanol at high temperatures and pressures.                                                                                                 | A,B                      | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, and goggles)           |
| 5. Inhalation of vapor and skin contact with liquid                                                                                                                                                                                                                                                                                                                                        | A,B                      | Process enclosure; general dilution ventilation; local                                                                                                         |

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during use as a general solvent, as an antioxidant, as an acid gas absorbent, as a flotation agent, in manufacturing dyes and in electroplating

exhaust ventilation

- |     |                                                                                                                                                                                                                                                                 |     |                                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------------------------------|
| 6.  | Inhalation of vapor and skin contact with liquid during use as a photographic chemical, plasticizer or ion exchange agent                                                                                                                                       | A,B | General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles) |
| 7.  | Inhalation of vapor and skin contact with liquid during use as a raw material in the synthesis of vulcanization accelerators for all sulfur cured rubbers. Such accelerators include tetramethylthiuran monosulfide and sodium or zinc dimethyldithiocarbamate. | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation                                          |
| 8.  | Inhalation of vapor and skin contact with liquid during use as a stabilizer in natural rubber latex                                                                                                                                                             | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation                                          |
| 9.  | Inhalation of vapor and skin contact with liquid during use as a catalyst. DMA supplies alkaline conditions needed for polymerization of phenol with formaldehyde                                                                                               | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation                                          |
| 10. | Inhalation of vapor and skin contact with liquid during use as a raw material in the synthesis of long chain quaternary ammonium compounds used as softeners, lubricants and waterproofing agents in textiles                                                   | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation                                          |
| 11. | Inhalation of vapor and skin contact with liquid during use in the                                                                                                                                                                                              | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation                                          |

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synthesis of cationic  
surfactants

- |     |                                                                                                                                                                                                                                                                 |     |                                                                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 12. | Inhalation of vapor and skin contact with liquid during use as a component in rocket propellants and as an antiknocking agent in other fuels                                                                                                                    | A,B | General dilution ventilation; local exhaust ventilation                                                                                             |
| 13. | Inhalation of vapor and skin contact with liquid during use in the synthesis of pharmaceuticals such as "pontocaine" hydrochloride (a local anesthetic), quaternary ammonium compounds (antiseptics, bactericides), antimalerials and a number of tranquilizers | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation                                                                          |
| 14. | Inhalation of vapor and skin contact with liquid during use as a retarder in the spinning bath of rayon (for tire cord)                                                                                                                                         | A,B | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons and goggles) |
| 15. | Inhalation of vapor and skin contact with liquid during use in the manufacture of synthetic detergents and soaps                                                                                                                                                | A,B | Process enclosure; general dilution ventilation; local exhaust ventilation; personal protective equipment                                           |
| 16. | Inhalation of vapor and skin contact with liquid during use as a stabilizer for certain types of resins (polymerization inhibitor).                                                                                                                             | A,B | General dilution ventilation; local exhaust ventilation                                                                                             |

A -- Inhalation

B -- Skin and eye contact resulting in localized irritation

C -- Ingestion

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