

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** DIMETHYL ACETAMIDE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

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 DIMETHYL ACETAMIDE.

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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of dimethyl acetamide not in excess of 10 parts per million (ppm) (35 milligrams per cubic meter (mg/M3)) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one-half of the permissible exposure for dimethyl acetamide averaged over an eight-hour work shift.

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

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

(i) Any information, observations, or calculations which may indicate employee exposure to dimethyl acetamide;

(ii) Any measurements of dimethyl acetamide taken;

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

(iv) Date of initial determination, work being performed at the time, location within work site, and employees considered.

(3) If the employer determines that any employee may be exposed to dimethyl acetamide above the permissible exposure, 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 dimethyl acetamide above the action level, the employer shall:

(i) Identify all employees who may be exposed above the permissible level; and

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

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

(6) If an employee exposure measurement reveals that an employee is exposed to dimethyl acetamide 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 dimethyl acetamide above the permissible exposure. The employee shall also be notified of the results of the exposure measurements and of the corrective action being taken to reduce the exposure to below the permissible exposure.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

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

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

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

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

Table 1

Concentration	Required Accuracy
Above permissible exposure	$\pm 25\%$
At or below permissible exposure and above the action level	$\pm 35\%$
At or below the action level	$\pm 50\%$

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

(2) Employee exposures to airborne concentrations of dimethyl acetamide 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 feasible.

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

(3) Engineering controls. (i) When local exhaust is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity or static pressure, 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 dimethyl acetamide.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving dimethyl acetamide shall be classified as A-3 at 21 degrees C (70 degrees F).

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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

- (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 not feasible; or
- (iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of dimethyl acetamide to at or below the permissible exposure; or
- (iv) For operations which require entry into tanks or closed vessels; or
- (v) In emergencies.

(5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided. When an employee informs his employer that he is experiencing eye irritation from dimethyl acetamide while wearing a respirator allowed in Table 2, the employer shall provide and ensure that the employee use an equivalent respirator with a full facepiece, helmet or hood.

TABLE 2 RESPIRATORY PROTECTION FOR DIMETHYL ACETAMIDE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION*

Vapor Concentration	
100 ppm or less	Any supplied-air respirator.

	Any self-contained breathing apparatus.

400 ppm or less	Any supplied-air respirator with a full facepiece, helmet or hood.

	A Type C supplied-air respirator operated in pressure - demand or other positive pressure or continuous-flow mode.

	Any self-contained breathing apparatus with a full facepiece.

Greater than 400 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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

Escape Any gas mask providing protection against organic vapors.

Any escape self-contained breathing apparatus.

*Use of supplied-air suits may be necessary to prevent skin contact and respiratory exposure from airborne concentrations of dimethyl acetamide. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied-air suits. Where supplied-air suits are used above a concentration which may be immediately dangerous to life and health (400 ppm), an auxiliary positive-pressure self-contained breathing apparatus must also be worn.

(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 dimethyl acetamide.

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

(3) For the purpose of compliance with § 1910.157, dimethyl acetamide is classified as a Class B fire hazard except that halogenated 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 dimethyl acetamide shall be Class I, Group D.

(5) For the purpose of compliance with § 1910.106, liquid dimethyl acetamide is classified as a Class IIIA combustible liquid.

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

(7) Where a fan is located in ductwork and where dimethyl acetamide 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.

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

(9) Dimethyl acetamide shall be stored so as not to come in contact with halogenated compounds.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use appropriate protective clothing and equipment necessary to prevent any possibility of skin contact with liquid dimethyl acetamide. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

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

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

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

(5) Employers shall provide and ensure that employees use splash-proof safety goggles which comply with § 1910.133(a)(2)-(a)(6) where liquid dimethyl acetamide may contact the eyes.

(g) Spills and disposal. In the event that liquid dimethyl acetamide is spilled the employer shall immediately provide available ventilation and then clean up the spill.

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

(2) Employers shall ensure that employees do not eat or smoke in areas where liquid dimethyl acetamide is handled, processed or stored.

(3) Employers shall ensure that employees who handle liquid dimethyl acetamide wash their hands thoroughly before eating, smoking or using toilet facilities.

(i) Training and information. (1) Each employer who has a workplace in which dimethyl acetamide 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 dimethyl acetamide above the action level without regard to the use of respirators, or employees who may have any possibility of skin contact or who may have eye contact with liquid dimethyl acetamide, or employees who work where dimethyl acetamide presents a fire or explosion hazard, shall annually:

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

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

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

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

(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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

(2) Preplacement medical examination. The employer shall make available to each employee who is exposed, or will be exposed, to airborne concentrations of dimethyl acetamide above the action level, without regard to the use of respirators, or employees who may have any possibility of skin contact, or who may have eye contact with liquid dimethyl acetamide a preplacement medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the liver;

(ii) A profile of liver function.

(3) Periodic medical examination. The employer shall make available to each employee exposed to airborne concentrations of dimethyl acetamide above the action level, without regard to the use of respirators, or employees who may have any possibility of skin contact, or who may have eye contact with liquid dimethyl acetamide twelve months from the date of the employee's first exposure, and every twelve months thereafter, a periodic medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the liver;

(ii) A profile of liver function.

(4) Alternative medical procedures. If the examining physician chooses to use alternative medical procedures to those specified in paragraphs (j)(2) and (j)(3) of this section, the employer may accept such alternative medical procedures as meeting the requirements of this section provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical procedures, the rationale for substitution, and evidence that they will be equally effective;

(ii) Informs each exposed worker of the fact that alternative medical procedures to those required in paragraphs (j)(2) and (j)(3) of this section are to be made available.

(5) Interim medical examination. The employer shall provide an interim medical examination employee if the employee informs the employer of any of the signs or symptoms of exposure to dimethyl acetamide which are listed in Appendix A which the employee suspects are caused by exposure to dimethyl acetamide.

(6) Informing the physician. The employer shall provide to the physician performing any medical examination required by this section the following information:

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

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

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

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

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

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

(7) Where a medical examination is required by paragraphs (j)(2), (j)(3), or (j)(5) of this section, following such examination the employer shall

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

obtain from the examining physician a written opinion which conforms with paragraph (j)(8) of this section.

(8) Physician's written opinion. (i) The physician's written opinion by the examining physician shall specifically state:

(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 dimethyl acetamide;

(B) Any recommended limitations upon the employee's exposure to dimethyl acetamide, 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 the employee's employment.

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

(9) Results of tests. Where a preplacement or periodic medical examination is required by paragraphs (j)(2) or (j)(3) of this section, following such examination the employer shall obtain from the examining physician for inclusion in the employee's medical record:

(i) A recording of the results of the liver function tests;

(ii) Where alternative medical procedures have been performed in accordance with paragraph (j)(4) of this section, a recording of such alternative procedures.

(10) No employee shall be exposed to dimethyl acetamide in such a way as would put the employee at increased risk of material impairment of his health from such exposure. The employer shall base this decision on any information available including the physician's written opinion.

(11) No medical procedure which would be performed pursuant to paragraphs (j)(2) or (j)(3) of this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

(12) 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.

(13) The employer shall provide emergency medical treatment for any employee injured through exposure to dimethyl acetamide.

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

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

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

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

(ii) This record shall include:

(A) The date of measurement;

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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

(C) Sampling and analytical method used and evidence of their accuracy;
(D) Number, duration, and results of samples taken; and

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

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

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

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

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

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

(ii) This record shall include:

(A) Date of training;

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

(C) Content or scope of training provided.

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

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

(ii) This record shall include:

(A) The name and social security number of the employee;

(B) Results of tests required by paragraph (j)(2) and (j)(3) of this section and results of any tests conducted pursuant to paragraphs (j)(4) of this section;

(C) Any employee medical complaints relative to exposure to dimethyl acetamide;

(D) A copy of information provided to the physician pursuant to paragraph (j)(6)(ii), (iii), (iv), (v), and (vi) of this section.

(E) Physician's written opinion; and

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

(iii) This record shall be maintained for the duration of and for five years after termination 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) Each employee or former employee shall have access to the exposure determination and exposure measurement records required to be maintained by this section which indicate his own exposure to dimethyl acetamide.

(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 each employee or his representative an opportunity to observe any measurement of

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

his exposure to dimethyl acetamide which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to dimethyl acetamide 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 dimethyl acetamide that are being performed at the place of exposure; and
- (iii) Record the results obtained.

NOTE: The information contained in the following appendix for dimethyl acetamide is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent that the information supplements this regulation for dimethyl acetamide, it is advisory in nature.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR DIMETHYL ACETAMIDE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Dimethyl acetamide
- B. Permissible Exposure: 10 parts of dimethyl acetamide per million parts of air (ppm) (35 milligrams of dimethyl acetamide per cubic meter of air (mg/M3)) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless liquid with a faint ammonia-like odor

II. HEALTH HAZARD DATA

- A. Ways in which the chemical affects your body: Dimethyl acetamide 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 enter your body through your skin.
- B. Effects of Overexposure:
 - 1. Repeated or prolonged exposure to dimethyl acetamide may cause liver damage with yellow jaundice. Repeated exposure at high concentrations may cause depression, drowsiness, confusion and hallucinations.
 - 2. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

suspect that they are caused by exposure to dimethyl acetamide.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If dimethyl acetamide gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If liquid dimethyl acetamide gets on your skin, immediately flush the skin with water. If liquid dimethyl acetamide soaks through your clothing, remove the clothing immediately and flush the skin with water. If irritation is present after washing, get medical attention promptly.
- C. Swallowing: When liquid dimethyl acetamide has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to dimethyl acetamide. 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 dimethyl acetamide 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 Suits: In some work situations the wearing of supplied-air suits or other impervious coverings such as acid suits may be necessary. Your employer should instruct you in their proper use and operation.
- C. Protective Clothing: You must wear appropriate protective clothing and equipment to prevent any possibility of skin contact with liquid dimethyl acetamide. Replace or repair impervious clothing that has developed leaks.
- D. Eye Protection: You must wear splash-proof safety goggles where liquid dimethyl acetamide may contact your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Dimethyl acetamide is a combustible liquid and its vapors can form explosive mixtures with air at elevated temperatures.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

- B. Dimethyl acetamide must be stored in tightly closed containers in a cool, well ventilated area away from halogenated compounds.
- C. Sources of ignition such as smoking and open flames are prohibited wherever dimethyl acetamide is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. You must immediately remove any non-impervious clothing that becomes contaminated with dimethyl acetamide and this clothing must not be reworn until the dimethyl acetamide is removed from the clothing.
- E. If your skin becomes contaminated with dimethyl acetamide, you must immediately wash or shower to remove the dimethyl acetamide from your skin.
- F. You must not eat or smoke in areas where liquid dimethyl acetamide is handled, processed or stored.
- G. If you handle liquid dimethyl acetamide, you must wash your hands thoroughly before eating, smoking or using toilet facilities.
- H. Fire extinguishers 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 dimethyl acetamide is used in your work area and for any additional 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 dimethyl acetamide. In addition, your employer must instruct you in the safe use of dimethyl acetamide, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to dimethyl acetamide. 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 the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure data for at least one year and to keep medical data during your employment, and for a period of five years following your termination of employment. Your employer is required to make the exposure data available to you upon your request. Your employer is also required to release your medical records to your physician upon your written request.
- D. Your employer must give you a copy of the physicians written opinion for any physical examination required by this standard.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

NOTE: The information contained in the following appendix for dimethyl acetamide is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent that the information supplements this regulation for dimethyl acetamide, it is advisory in nature.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR DIMETHYL ACETAMIDE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: N,N-Dimethyl acetamide; DMAC
2. Formula: CH3CON(CH3)2
3. Molecular weight: 87.1

B. Physical Data

1. Boiling point (760 mm Hg): 166 C (331 F)
2. Specific gravity (water = 1): 0.94
3. Vapor density (air = 1 at boiling point of dimethyl acetamide): 3.0
4. Melting point: -20 C (-4 F)
5. Vapor pressure at 20 C (68 F): 1.5 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
7. Evaporation rate (butyl acetate = 1): Less than 0.17
8. Appearance and odor: Colorless liquid with a faint ammonia-like odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 70 C (158 F) (open cup)
2. Autoignition temperature: 490 C (914 F)
3. Flammable limits in air, % by volume: Lower: 1.8 (at 212 F); Upper: 11.5 (at 320 F)
4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide. Do not use halogenated extinguishing media.
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Dimethyl acetamide is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where dimethyl acetamide is used, handled or stored in a manner that could create a potential fire or explosion hazard.
7. For purposes of complying with the requirements of 29 CFR 1910.106, dimethyl acetamide is classified as a

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

Class IIIA combustible liquid. For example, 4500 ppm, approximately one-fourth of the lower flammable limit, is one situation in which dimethyl acetamide is considered to be a potential fire and explosion hazard.

8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for dimethyl acetamide shall be Class I, Group D.

B. Reactivity

1. Conditions contributing to instability: Temperatures above 350 C (662 F) cause decomposition and development of pressure in closed containers.
2. Incompatibilities: Contact with carbon tetrachloride and other halogenated compounds, particularly when in contact with iron, may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as dimethylamine and carbon monoxide) may be released in a fire involving dimethyl acetamide.
4. Special precautions: Dimethyl acetamide will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If dimethyl acetamide is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. For small quantities, absorb on paper towels. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be collected and reclaimed or atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

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

- C. Waste disposal methods: Dimethyl acetamide may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in sealed containers in a secured sanitary landfill.
2. 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 eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). 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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

with subsequent chemical analysis. The method of measurement must determine the concentration of dimethyl acetamide 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 dimethyl acetamide to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set R" (Order number XXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

- A. Store dimethyl acetamide in tightly closed containers in a cool, well ventilated area.
- B. All containers, piping, and gaskets must be made from approved material because of the high solvent action of dimethyl acetamide on many substances.
- C. Use of supplied-air suits or other impervious coverings (such as acid suits) may be necessary to prevent skin absorption from dimethyl acetamide. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied-air suits.
- D. Employers should advise employees of all areas and operations where their exposure to dimethyl acetamide could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to dimethyl acetamide is likely to occur are: During its production and its use as a solvent for resins, polymers (as a spinning solvent for some synthetic fibers), paint removers, and chemical reactions; as a catalyst; as a reaction medium; and as a crystallization and purification solvent.

NOTE: The information contained in the following appendix is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent the information supplements this regulation for dimethyl acetamide, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

Dimethyl acetamide absorption, either by inhalation of the vapor or by skin absorption of the liquid, causes liver damage. Repeated dermal application of the liquid to dogs at a dosage level of 4.0 ml/kg for 6 weeks caused severe fatty infiltration of the liver. Repeated exposure of rats to a concentration of 195 ppm for 6 months resulted in focal necrosis of the liver; exposure to 40 ppm for the same period of time caused no adverse effects. Workers repeatedly exposed to 20 to 25 ppm developed jaundice; appreciable skin absorption was thought to have occurred. Dimethyl acetamide has a significant antitumor effect in animals. Nine patients with neoplastic disease were given daily doses of 400 mg/kg by an unspecified route for 3 or more days as a therapeutic trial; they experienced depression, lethargy, confusion, and disorientation; on the last (4th or 5th) day of therapy or within 24 hours thereafter, the patients had visual and auditory hallucinations, perceptual distortions, and at times delusions; after 24 hours these gradually subsided.

III. SIGNS AND SYMPTOMS

Jaundice and other signs of liver damage; very high doses given orally have caused depression, lethargy, hallucinations, and delusions. Irritation of the skin may occur.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes and skin with water. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation and administer oxygen if indicated.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of dimethyl acetamide are caused by its capability to produce liver injury. The skin absorption factor is considered to be so significant that even very low levels are not safe if skin contact with the liquid is permitted. It is important that the physician become familiar with plant operating conditions in which exposure to dimethyl acetamide occurs. Those with skin disease may not tolerate the wearing of protective clothing and

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

The following medical procedures must be made available to each employee who is exposed to dimethyl acetamide:

1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the liver should be stressed.
2. Liver function tests -- Since liver damage has been observed in humans exposed to dimethyl acetamide, a profile of liver function shall be obtained by using a medically acceptable array of biochemical tests.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Dimethyl Acetamide," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 88.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1775, 1830, 1834-1835.
3. Weiss, A.J., et al: "Dimethylacetamide: A Hitherto Unrecognized Hallucinogenic Agent," Science, 136:151-152, 1962.
4. Horn, H.J.: "Toxicology of Dimethylacetamide," Toxicology and Applied Pharmacology, 3:12-24, 1961.
5. Davis, K.J. and P.M. Jenner: "Toxicity of Three Drug Solvents," Toxicology and Applied Pharmacology, 1:576-578, 1959.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

REFERENCES AND SOURCES
DIMETHYL ACETAMIDE
1910.1000

- (d) Compliance - Open surface tank classification based on relative evaporation assumed to be "slow" based on boiling point and guidelines in ANSI Z9.1
- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Grant, "Toxicology of the Eye"
- Skin: American Conference of Governmental Industrial Hygienists, "Documentation of Threshold Limit Values of Substances in Workroom Air;" Gleason, "Clinical Toxicology of Commercial Products;" Patty, "Industrial Hygiene and Toxicology;" Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" Christensen, "NIOSH Toxic Substances List;" American Mutual Insurance Alliance, "Handbook of Industrial Solvents"
- Ingestion: Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" Sax, "Dangerous Properties of Industrial Materials"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Grant reports that "tested on rabbit eyes it has caused mild reversible injury, graded 3 on a scale of 10" after 24 hours.

A classification of 2 is concluded to be most appropriate for this substance.

Skin - Classification: 1

Output statement numbers: 1, 7a, 8b, 14g, 14i, 20a

Exceptions: Statements 7a and 8b used

According to the ACGIH, "dermal absorption from cutaneously applied DMA . . . , resulted in injury at levels above 0.1 mg/kg/day. The dermal factor is considered in practice to be so significant that no air concentration, however low, will provide protection if skin contact with DMA liquid is permitted." Gleason points out that "liver damage in dogs and rats occurred during chronic exposures above 0.1 ml/kg on the skin."

Patty reports that the substance is readily absorbed through the skin and has some tendency to cumulative effects.

The dermal LD50 for rabbits is given by Deichmann and Gerarde as from 2.5 to 3.6 ml/kg. "Both acute and repeated dermal applications show that the material produces skin irritation and is readily absorbed through the skin. Sublethal doses produce degeneration of the heart, liver, and kidneys." Christensen gives the LD50 for rabbit skin as 2240 mg/kg.

According to the AMIA, "animal experiments indicate that single exposures to DMAC are not particularly hazardous. DMAC possesses a low order of acute toxicity. On the other hand, repeated animal exposures have disclosed that DMAC is capable of producing systemic injury when . . . absorbed through the skin in sufficient quantities.

Dimethyl acetamide has a vapor pressure at 20 degrees

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

C of 1.5 mm of Hg and a boiling point of 331 degrees F. It is miscible in water in all proportions and has a flash point of 158 degrees F.

From the above data, it is obvious that skin contact with this substance must be avoided. A classification of 1 is concluded to be necessary for accomplishment of this objective. Statement 7a is considered adequate since the substance is a liquid and significant contamination should be readily apparent. Since dimethyl acetamide is classified as a 1 due to its absorption potential rather than its corrosive properties, statement 8b is considered adequate.

Ingestion - Classification: 1

Output statement numbers: 19, 20a

Exceptions: None

According to Sax, the compound is of moderate toxic hazard by ingestion for both acute and chronic exposures.

Deichmann and Gerarde say that the "LD50 values range from 2.0 to 5.0 gm/kg depending on the species (mice or rats)."

Since the permissible exposure limit for inhalation does not appear to contain a sufficient margin of safety to allow additional dosages by other routes of entry, it is concluded that a classification of 1 is most appropriate for this compound.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

E. I. duPont de Nemours and Co., "Properties and Uses of Dimethyl Acetamide" (duP)

Sources of data items used:

- I. A. 1. Synonyms: duP
2. Formula: duP
3. Molecular weight: duP
- B. 1. Boiling point: duP
2. Specific gravity: duP
3. Vapor density: Calculated
4. Melting point: duP
5. Vapor pressure: duP
6. Solubility in water: duP
7. Evaporation rate: duP, ADL ("less than dimethyl formamide")
8. Appearance and odor: duP
- II. A. 1. Flash point: duP
2. Autoignition temperature: duP
3. Flammable limits: duP
4. Extinguishing media: duP
5. Special fire fighting procedures: ADL, duP
6. Unusual fire and explosion hazards: ADL
- B. 1. Conditions contributing to instability: duP
2. Incompatibilities: duP
3. Hazardous decomposition products: duP
4. Special precautions: duP
- III. A. Steps if released or spilled: duP, ADL

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

C. Waste disposal method: duP, ADL

V. Miscellaneous precautions: duP

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw Hill, 1974 (Considine)
- Corsi, G. C., "Occupational Risks from Dimethyl Acetamide," Medicina Del Lavoro 62(1), p. 28 - 41, 1971 (NIOSH Technical Information Service NIOSH 14195)
- "Dimethyl Acetamide," E. I. duPont de Nemours Co., Industrial Chemicals Department, "Properties and Uses of Dimethyl Acetamide (DMAC)," April 1972 (duPont props and uses)
- "Dimethyl Acetamide," E. I. duPont de Nemours Co., "DMAC," Product Information Bulletin (duPont DMAC)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience, 2nd edition, 1972 (K-O)
- Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience, 1962 (Patty)
- Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)

References For Specific Use/Exposure

1. NIOSH 14195, duPont props and uses, K-O, SRI
2. duPont props and uses, K-O
3. K-O, duPont props and uses
4. Considine, SRI
5. duPont props and uses, SRI
7. K-O, duPont DMAC
8. duPont props and uses

References for Specific Control Methods

duPont props and uses, ILO, Patty, NIOSH 14195, ADL estimate

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Dimethyl acetamide

D. O. L. STANDARD: 10 ppm

WARNING PROPERTIES:

Odor Threshold: There is no quantitative information available concerning the odor threshold of dimethyl acetamide.

Eye Irritation Level: Grant states that "on decomposition it (dimethyl acetamide) is said to emit fumes which are highly irritating to the eyes and mucous membranes." Dimethyl acetamide is reported by Grant to cause mild reversible injury graded 3 on a scale of 10 when tested on rabbit eyes. Half facepiece respirators are permitted up to a concentration of 100 ppm (PF=10). If eye irritation occurs a full facepiece respirator must be worn.

Evaluation of Warning Properties: Since there is no quantitative information available relating warning properties to air concentrations of dimethyl acetamide, this substance is treated as a material with poor warning properties. Gas sorbent respiratory equipment is not permitted except for escape.

IDLH: 400 ppm

Basis for IDLH Value: The chosen IDLH is based upon the report in

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

Deichmann and Gerarde that "acute inhalation at 406 and 575 ppm causes some deaths and degeneration of the liver in several species of laboratory animals." Although no time period is specified for this exposure, this IDLH is probably reasonable, and perhaps even conservative, since Patty states that liver injury was noted only "in some rats and dogs exposed to repeated inhalations of DMA of 100 - 200 ppm."

Other Toxicological Information: The Documentation of TLV's states that "evidence pertaining to the setting of a threshold limit for dimethyl acetamide (DMA) is based on unpublished work of the Kettering Laboratories, chronic animal experimental studies by Horn, and industrial experience covering a period of approximately seven years

"Animal studies showed that 50 ppm DMA inhaled by rabbits and cats for 30 weeks produced no injurious effects according to the criteria used (Kettering Laboratories). The study by Horn showed that 40 ppm DMA by inhalation for six hours per day, five days per week for six months resulted in no liver damage to dogs and rats. Liver injury by DMA consists of cord-cell degeneration, observable by alteration in sulfobromophthalein retention time, and from which recovery with no residual occurs in from four-six months. . .

"On the basis of the above, coupled with industrial experience, an average time-weighted concentration of 10 ppm DMA is considered sufficiently low to prevent liver injury, provided skin contact with DMA is prevented."

Deichmann and Gerarde state that "the dermal LD50 in rabbits is from 2.5 to 3.6 ml/kg. Both acute and repeated dermal applications show that the material produces skin irritation and is readily absorbed through the skin. Acute inhalation at 406 and 575 ppm causes some deaths and degeneration of the liver in several species of laboratory animals."

LFL (at 100 C): 17,500 ppm

VAPOR PRESSURE AT 20 C: 1.5 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 1970 ppm

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

USE/EXPOSURE AND CONTROL DOCUMENT
DIMETHYL ACETAMIDE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during use as spinning solvent for synthetic fibers (readily dissolves acrylics, vinyls, cellulose derivatives, styrenes, and linear polyesters)	A,D	Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice
2.	Inhalation of vapor and skin contact with liquid during use as solvent for film casting and top coating resins (acrylic, epoxy, cellulosic, urea - formaldehyde, melamine - formaldehyde, and vinyl resins)	A,D	Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice
3.	Inhalation of vapor and skin contact with liquid during use as reaction medium and catalyst (preparation of steroids, cyanuric acid, nitriles, alkylations, organic isocyanates, sulfonyl chlorides, phthaloylation. DMAC is a highly polar solvent which forms many crystalline solvates and complexes)	A,D	Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice
4.	Inhalation of vapor and skin contact with liquid during use as an extraction solvent for recovery and purification of butadiene	A,D	Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice
5.	Inhalation of vapor and skin contact with liquid during use as crystallization and purification solvent (forms crystalline complexes - used for aromatic dicarboxylic acids)	A,D	Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIMETHYL ACETAMIDE

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|----|---|-----|---|
| 6. | Inhalation of vapor and skin contact with liquid during manufacture, distribution, and maintenance of equipment and storage containers | A,D | Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing, respiratory protective devices); good personal hygiene practice |
| 7. | Inhalation of vapor and skin contact with liquid during use as a paint stripping solvent (used alone or with methylene chloride) | A,D | Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice |
| 8. | Inhalation of vapor and skin contact with liquid during recovery and purification (can be recovered from top coating, film casting, spinning, and chemical processes) | A,D | Local exhaust ventilation; personal protective equipment (gloves, goggles, protective clothing); good personal hygiene practice |

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