

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** DIISOBUTYL KETONE ***

11

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

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 DIISOBUTYL KETONE.

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 DIISOBUTYL KETONE

(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of diisobutyl ketone not in excess of 50 parts per million (ppm) (290 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 diisobutyl ketone averaged over an eight-hour work shift.

(b) Initial determination and exposure measurement. (1) Each employer who has a place of employment in which diisobutyl ketone is released into the workplace air shall determine if there is any possibility that any employee may be exposed to airborne concentrations of diisobutyl ketone 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 diisobutyl ketone.

(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 diisobutyl ketone;

(ii) Any measurements of diisobutyl ketone taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to diisobutyl ketone; 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 diisobutyl ketone 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 diisobutyl ketone 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 diisobutyl ketone 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 diisobutyl ketone 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 diisobutyl ketone 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 DIISOBUTYL KETONE

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to diisobutyl ketone 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 (Percent of True Value)
Above permissible exposure	± 25
At or below permissible exposure and above the action level	± 35
At or below the action level	± 50

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

(2) Employee exposures to airborne concentrations of diisobutyl ketone 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 diisobutyl ketone.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving diisobutyl ketone shall be classified as B-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 DIISOBUTYL KETONE

- (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 diisobutyl ketone to at or below the permissible exposure; or
 - (iv) For operations which require entry into tanks or closed vessels; or
 - (v) In emergencies.
- (5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR DIISOBUTYL KETONE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION

Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
2000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 2000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

(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 diisobutyl ketone.

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

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

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

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

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

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

(8) Where a fan is located in ductwork and where diisobutyl ketone is present in the ductwork in concentrations greater than 2000 ppm (approximately 25% of the lower flammable limit), the fan rotating element shall be of nonsparking material or the casing shall consist of, or be lined with, nonsparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

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

(10) Diisobutyl ketone shall be stored so as not to come in contact with strong oxidizers.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use appropriate protective clothing and equipment necessary to prevent repeated or prolonged skin contact with liquid diisobutyl ketone. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

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

(3) Employers shall ensure that non-impervious clothing which becomes wet with liquid diisobutyl ketone be removed promptly and not reworn until the diisobutyl ketone is removed from the clothing.

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

(h) Sanitation. Employers shall ensure that employees whose skin becomes wet with liquid diisobutyl ketone promptly wash or shower with

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

soap or mild detergent and water to remove any diisobutyl ketone from the skin.

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

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

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

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to diisobutyl ketone 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 diisobutyl ketone.

(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) Each employer who has employees exposed to airborne concentrations of diisobutyl ketone above the action level, without regard to the use of respirators, or employees who may have repeated or prolonged skin contact with liquid diisobutyl ketone shall obtain information as to whether such employee has a history of any of the following medical conditions:

(i) Kidney disease;

(ii) Liver disease;

(iii) Chronic lung disease; and

(iv) Skin 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 diisobutyl ketone which are listed in Appendix A which the employee suspects are caused by exposure to diisobutyl ketone.

(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 diisobutyl ketone;

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

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

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

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

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

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

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

(6)(i) The physician's written opinion 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 diisobutyl ketone;

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

(7) No employee shall be exposed to diisobutyl ketone 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.

(8) The employer shall provide emergency medical treatment for any employee injured through exposure to diisobutyl ketone.

(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) 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 diisobutyl ketone.

(ii) This record shall include:

(A) The date of measurement;

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

(C) Sampling and analytical method used and evidence of their accuracy;

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

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

(E) Name 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 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 of the employee;

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

(C) Any employee medical complaints relative to exposure to diisobutyl ketone;

(D) A copy of information provided to the physician pursuant to paragraph (j)(4)(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 one year 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 diisobutyl ketone.

(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 his exposure to diisobutyl ketone which is conducted pursuant to this section.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

(2) When observation of measurement of employee exposure to diisobutyl ketone 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 diisobutyl ketone that are being performed at the place of exposure; and

(iii) Record the results obtained.

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

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR DIISOBUTYL KETONE

I. SUBSTANCE IDENTIFICATION

A. Substance: Diisobutyl ketone

B. Permissible Exposure: 50 parts of diisobutyl ketone per million parts of air (ppm) (290 milligrams of diisobutyl ketone per cubic meter of air (mg/M3)) averaged over an eight-hour work shift.

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

II. HEALTH HAZARD DATA

A. Ways in which the chemical affects your body: Diisobutyl ketone 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: Liquid diisobutyl ketone may cause irritation of the eyes, nose and throat, headache, dizziness, drowsiness and unconsciousness.

2. Long-term Exposure: Repeated or prolonged exposure to liquid diisobutyl ketone may cause drying and irritation of the skin.

3. 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 DIISOBUTYL KETONE

suspect that they are caused by exposure to diisobutyl ketone.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If liquid diisobutyl ketone 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 diisobutyl ketone gets on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid diisobutyl ketone soaks through your clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation is present after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of diisobutyl ketone 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 diisobutyl ketone 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.
- 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 emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to diisobutyl ketone. 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 diisobutyl ketone 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 appropriate protective clothing and equipment to prevent repeated or prolonged skin

11

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

contact with liquid diisobutyl ketone. Replace or repair impervious clothing that has developed leaks.

- C. Eye Protection: The respiratory equipment that is provided by your employer for exposures to high concentrations of diisobutyl ketone will protect your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Diisobutyl ketone is a combustible liquid. Its vapors can form explosive mixtures with air at elevated temperatures.
- B. Diisobutyl ketone must be stored in tightly closed containers in a cool, well ventilated area away from strong oxidizers.
- C. Sources of ignition such as smoking and open flames are prohibited wherever diisobutyl ketone is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. You must promptly remove any non-impervious clothing that becomes wet with liquid diisobutyl ketone and this clothing must not be reworn until the diisobutyl ketone is removed from the clothing.
- E. If your skin becomes wet with liquid diisobutyl ketone, you must promptly wash or shower with soap or mild detergent and water to remove any diisobutyl ketone from your skin.
- F. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- G. Ask your supervisor where diisobutyl ketone 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 diisobutyl ketone. In addition, your employer must instruct you in the safe use of diisobutyl ketone, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to diisobutyl ketone. 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 one year 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 DIISOBUTYL KETONE

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

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR DIISOBUTYL KETONE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 2,6-Dimethyl-4-heptanone; sym-diisopropylacetone; ISOVALERONE; valerone
2. Formula: $((CH_3)_2CHCH_2)_2CO$
3. Molecular weight: 142.2

B. Physical Data

1. Boiling point (760 mm Hg): 169.4 C (335 F)
2. Specific gravity (water = 1): 0.81
3. Vapor density (air = 1 at boiling point of diisobutyl ketone): 4.9
4. Melting point: -41.5 C (-43 F)
5. Vapor pressure at 20 C (68 F): 1.7 mm Hg
6. Solubility in water, grams of diisobutyl ketone per 100 grams of water (68 F): 0.05
7. Evaporation rate (butyl acetate = 1): 0.17
8. Appearance and odor: Colorless liquid with a mild odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 60 C (140 F) (closed cup)
2. Autoignition temperature: 396 C (745 F)
3. Flammable limits in air, % by volume (at 100 C):
Lower: 0.8; Upper: 6.2
4. Extinguishing media: Dry chemical, carbon dioxide, foam
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: Diisobutyl ketone is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where diisobutyl ketone 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, diisobutyl ketone is classified as a Class

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

IIIA combustible liquid. For example, 2000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which diisobutyl ketone 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 diisobutyl ketone shall be Class I, Group D.

B. Reactivity

1. Conditions contributing to instability: Containers may burst at elevated temperatures.
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving diisobutyl ketone.
4. Special precautions: Diisobutyl ketone will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If diisobutyl ketone 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 reclaimed or collected and atomized in a suitable combustion chamber.

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

- C. Waste disposal methods: Diisobutyl ketone may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber.

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 with subsequent chemical analysis. The method of measurement must determine the concentration of diisobutyl ketone to plus or minus 35%.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

- 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 diisobutyl ketone 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 V" (Order number XXXXXXXXXXXX).
- 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 diisobutyl ketone in tightly closed containers in a cool, well ventilated area.
- B. Employers should advise employees of all areas and operations where their exposure to diisobutyl ketone could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to diisobutyl ketone is likely to occur are: During its production and its use as a solvent and viscosity modifier for a wide variety of resins, plastics, lacquers, etc.; as an intermediate in organic synthesis; as a solvent in synthetic coatings, in synthetic dyes, and in the textile industry; and in the manufacture of miller crepe rubber.

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

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Diisobutyl ketone vapor is an irritant of the eyes and mucous membranes; at high concentrations it causes narcosis in animals. Exposure of female rats, which are more susceptible than male rats, to 2000 ppm for 8 hours caused narcosis and death in 7 of 12 animals. Human subjects exposed to 100 ppm for 3 hours noted slight lacrimation and throat irritation, and slight headache and dizziness on returning to fresh air. In another

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

study, the majority of subjects experienced eye irritation at 50 ppm and nose and throat irritation between 25 and 50 ppm within 15 minutes. The liquid is a defatting agent and prolonged or repeated skin contact may cause dermatitis.

III. SIGNS AND SYMPTOMS

Irritation of eyes, nose, and throat; headache, dizziness; dermatitis from prolonged or repeated skin exposure.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes with water and wash the skin with soap or mild detergent and water. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation and administer oxygen if indicated. Recovery is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

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

B. PREPLACEMENT

Routine medical histories and physical 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 diisobutyl ketone 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 diisobutyl ketone might cause exacerbation of symptoms due to its irritant properties.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

2. Liver disease -- Although diisobutyl ketone is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.
3. Kidney disease -- Although diisobutyl ketone is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.
4. Skin disease -- Diisobutyl ketone is a defatting agent and can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.

C. PERIODIC EXAMINATIONS

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

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Diisobutyl Ketone," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 313-314.
2. Hygienic Guide Series: "Diisobutyl Ketone," American Industrial Hygiene Association Journal, 23:514-515, 1962.
3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1719-1726, 1745-1747.
4. Carpenter, C.P., et al: "Toxicity and Hazard of Diisobutyl Ketone Vapors," A.M.A. Archives of Industrial Hygiene and Occupational Medicine, 8:377-381, 1953.
5. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 435-437.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

REFERENCES AND SOURCES
DIISOBUTYL KETONE
1910.1000

- (d) Compliance - Open surface tank classification based on relative evaporation rate of 44 hours (from Doolittle)
- (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: Union Carbide Corp., "Toxicology Studies;" Patty, "Industrial Hygiene and Toxicology;" Grant, "Toxicology of the Eye"
Skin: Sax, "Dangerous Properties of Industrial Materials;" Union Carbide Corp., "Toxicology Studies;" Patty, "Industrial Hygiene and Toxicology"
Ingestion: Union Carbide Corp., "Toxicology Studies;" Spector, "Handbook of Toxicology;" Patty, "Industrial Hygiene and Toxicology"

COMMENTS

Eye - Classification: 0

Output statement numbers: None

Exceptions: None

According to Union Carbide, "flooding the rabbit eye with an excess of the chemical caused a reaction no more severe than moderate inflammation."

Patty reports, "when in contact with the eyes, it should cause no more than mild irritation . . . When the undiluted liquid was instilled into the eyes of rabbits, essentially no irritation developed."

Grant reports that "diisobutyl ketone causes no significant injury when tested on rabbit eyes by the application of a drop . . ."

Based upon the comments of Grant and Patty, it is concluded that mandatory eye protection to this substance is not warranted.

Skin - Classification: 2

Output statement numbers: 2, 7b, 16g, 16i

Exceptions: See below

Sax rates this substance as being an acute and chronic local irritant of slight toxic hazard. Union Carbide reports that "the undiluted chemical caused redness of short duration on the tender skin of the rabbit belly." Patty states that "skin contact with the liquid may result in mild irritation or even a dermatitis depending upon the type and duration of contact. . . Because of its high fat solvency it is suspected that frequently repeated skin contacts may cause a dermatitis."

Union Carbide gives a cutaneous LD50 of 20 ml/kg for the rabbit. It adds that "this result suggests that skin absorption is minimal." Patty agrees completely with the above.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

Diisobutyl ketone has a boiling point of 335 degree F and a melting point of -43 degrees F. It has a vapor pressure at 20 degrees C of 1.7 mm Hg and a 0.05% solubility in water. The flash point of the substance is 140 degrees F.

A classification of 2 is concluded to be fully adequate for this substance. Indeed, the hazards of skin contact are such that statements 16g and 16i are considered to be acceptable in place of statements 17g and 17i, and specification of statement 20a is deemed to be unnecessary.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

The oral dose LD50 for rats is given as 5.75 gm/kg by Union Carbide and Spector. Patty states that the substance has a low acute oral toxicity.

There are no data in the literature concerning the effects of repeated oral doses. By analogy with other ketones, it is concluded that the hazard is slight and that a classification of zero is most appropriate.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)

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

Eastman Kodak Co., Material Safety Data Sheet and Publication No. M-135A (EK)

Sources of data items used:

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

USE/EXPOSURE AND CONTROL DOCUMENT

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

References used in the preparation of this document include:

- Browning, E., "Toxicity of Metabolism of Industrial Solvents," Elsevier Publishing Company, New York, 1965 (Browning)
- "Diisobutyl Ketone," Hygienic Guide Series, American Industrial Hygiene Association (Hygienic Guides)
- "Diisobutyl Ketone - Toxicology Studies," Union Carbide Corporation, Industrial Medicine and Toxicology Dept., New York, 1975 (Union Carbide)
- Doolittle, Arthur K., "The Technology of Solvents and Plasticizers," John Wiley and Sons, Inc., New York, 1954 (Doolittle)
- Gleason, Marion N., Gosselin, R. E., Hodge, H. C. and Smith, R. P., "Clinical Toxicology of Commercial Products," The Williams and Wilkins Co., Baltimore, 1969 (Gleason)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," vol. 1, McGraw-Hill Book Company, New York, 1972 (ILO)
- Kirk, R. and Othmer, D. F., "Encyclopedia of Chemical Technology," vol. 8, The Interscience Publishers, Inc., New York, 1952 (K-O)
- Patty, F. A., "Industrial Hygiene and Toxicology," vol. 2, second revised edition, Interscience Publishers, New York, 1963 (Patty)
- Plunkett, E. R., "Handbook of Industrial Toxicology," Chemical Publishing Company, Inc., New York, 1966 (Plunkett)
- Silverman, L., Schulte, H. F. and First, M. W., "Further Studies on Sensory Response to Certain Industrial Solvent Vapors," Journal of Industrial Hygiene and Toxicology, vol. 28, no. 6, 1946 (Silverman)
- Sheinbaum, M., "Some Health Hazards Associated with the Building Trades," American Industrial Hygiene Association Journal, vol. 23, no. 5, September - October, 1962 (Sheinbaum)

References for Specific Use/Exposures

1. Sheinbaum, K-O, Gleason, Silverman, Union Carbide
2. Patty, K-O, Union Carbide
3. Browning, Hygienic Guides, K-O, Doolittle, Union Carbide, Plunkett, Silverman
4. Browning, Patty, Hygienic Guides, Plunkett, Doolittle, K-O, Union Carbide, Silverman
5. Browning, Patty
6. Hygienic Guides, K-O
7. K-O, Patty, Plunkett, Browning
8. K-O, Gleason

References for Specific Control Methods

ILO, Sheinbaum, Hygienic Guides, Plunkett and Doolittle were the references used in all the Specific Control Methods.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Diisobutyl ketone

D. O. L. STANDARD: 50 ppm

WARNING PROPERTIES:

Odor Threshold: Patty reports that Silverman et al. reported "that concentrations higher than 25 ppm were found to have an objectionable odor . . ."

Eye Irritation Level: Grant notes that "the vapor at a concentration of 25 ppm in air causes a sensation of eye irritation." For the purposes of this standard, only full facepiece respirators are permitted.

Other Information: Patty reports that "Carpenter, Pozzani, and Nail in studies on 3 human volunteers found that, at levels of 50 and

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

100 ppm, a 3-hour exposure caused slight irritation of the eyes, nose, and throat."

Evaluation of Warning Properties: Through its odor and irritant effects, diisobutyl ketone can be detected below the permissible exposure limit. For the purposes of this standard, therefore, diisobutyl ketone is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 2000 ppm

Basis for IDLH Value: The chosen IDLH is based upon the following information given by Union Carbide Corporation in the Chemical Company Guide for diisobutyl ketone: "Breathing saturated vapors in air killed one of six animals in eight hours.

"Breathing 2,000 parts per million for eight hours killed five of six animals. Breathing 1,000 parts per million for eight hours produced illness but no deaths."

This is the only useful information available upon which to base the IDLH for this substance.

Other Toxicological Information: The Documentation of TLV's states that "Carpenter reported results of exposures of rats at concentrations of the vapor ranging from 125 to 1650 ppm for seven hours daily for 30 days. Exposure at 125 ppm caused no adverse physiologic effects in rats or guinea pigs, although guinea pigs exposed at 250 ppm showed a decrease in liver weight.

"Exposure of human subjects at 50 and 100 ppm for three hours indicated that daily exposure at 100 ppm would be uncomfortable, whereas it was felt that exposure at 20 ppm would be comfortable for an eight-hour exposure. On the other hand, Silverman et al. reported eye irritation and an unpleasant odor at levels above 25 ppm.

"A TLV of 50 ppm is recommended as a concentration at which no toxic effects will occur and irritation should be minimal."

Patty states that "McOmie and Anderson reported that rats and guinea pigs survived single exposures of from 7 1/2 to 16 hours to essentially saturated vapors of diisobutyl ketone. Smyth et al. reported a higher degree of toxicity to rats. They found that an 8-hour exposure to a concentration of 2000 ppm (essentially a saturated atmosphere) caused the deaths of 5 of the 6 animals tested." In addition, Patty states that "diisobutyl ketone is an irritant and causes narcosis at high concentrations. The cause of death, while not established, was probably due to respiratory failure induced by narcotic action on the respiratory center. Lower concentrations of vapors are primarily irritating to the eye and upper respiratory passages. Repeated exposures to concentrations that may be irritating may cause nausea and dizziness. In addition, such exposures may cause liver and kidney effects but it does not seem likely that any such effects would be serious. . . . There are no records in the literature of human illnesses due to the handling of diisobutyl ketone."

-LFL AT 100 C: 8,000 ppm

VAPOR PRESSURE AT 20 C: 1.7 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 2,240 ppm

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

USE/EXPOSURE AND CONTROL DOCUMENT
DIISOBUTYL KETONE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during spray paint operations in construction industry (used as thinner); during spray lacquer operations (thinner)	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene
2.	Inhalation of vapor and skin contact with liquid during manufacture - by hydrogenation of phorone; as by-products of isobutyl ketone; from isovaleric acid or its alkaline salts	A,B	Process enclosure; general dilution ventilation; local exhaust ventilation (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene
3.	Inhalation of vapor and skin contact with liquid during use as an intermediate in synthesis of inhibitors; in synthesis of insecticides; and as solvent for nitrocellulose; in chemical industry	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene
4.	Inhalation of vapor and skin contact with liquid during use as a solvent (vinyl chloride - acetate copolymers); in synthetic coatings; in synthesis of dyes (intermediate); as dispersant for vinyl chloride and organosol type resins; in the textile industry	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene
5.	Inhalation of vapor and skin contact of liquid during use in manufacture of milled crepe rubber; in rubber industry	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIISOBUTYL KETONE

- | | | | |
|----|--|-----|--|
| 6. | Inhalation of vapor and skin contact with liquid during use as a coupler for soap solvent systems; in the soap industry | A,B | General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene |
| 7. | Inhalation of vapor and skin contact with liquid during use as an extractant and in synthesis; in the pharmaceutical industry | A,B | General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene |
| 8. | Inhalation of vapor and skin contact with liquid during separation of tantalum and niobium; as dewaxing agent for lubricating oils; used in solvent systems; for use as an aid in controlling evaporation rate and in improving blush resistance | A,B | General dilution ventilation; local exhaust ventilation; personal protective equipment (protective clothing, gloves, goggles, respiratory protective devices); good personal hygiene |

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