

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** 2-PENTANONE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for 2-PENTANONE

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 2-PENTANONE.

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

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

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(a) DEFINITIONS

- (1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of 2-pentanone in concentrations not in excess of 200 parts per million (ppm) (700 milligrams per cubic meter, mg/cu.m.) averaged over an 8-hour work shift, as stated in section 1910.93, Table G-1.
- (2) ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for 2-pentanone.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which 2-pentanone is present shall:

- (1) STANDARD AVAILABILITY - Keep a copy of this section with its appendices at the workplace. This material shall be made readily available to affected employees; and
- (2) PRESENCE OF 2-PENTANONE - Inform affected employees of the quantity, location, and manner of use or storage of 2-pentanone.

(c) EXPOSURE MEASUREMENT

- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which 2-pentanone is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of 2-pentanone at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of 2-pentanone. A written determination shall be made and it shall contain at least the following information:
 - (i) Any information, observations, or calculations which would indicate employee exposure to 2-pentanone;
 - (ii) Any measurements of airborne concentrations of 2-pentanone taken;
 - (iii) Any employee complaints of symptoms which may be attributable to exposure to 2-pentanone; and
 - (iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.
- (2) INITIAL EXPOSURE MEASUREMENT - If the employer determines that any employee may be exposed to airborne concentrations of 2-pentanone at or above the action level, the exposure of the employee believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum exposure of the employee.
- (3) IDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of 2-pentanone at or above the action level, the employer shall:
 - (i) Identify all employees who may be exposed at or above the action level; and
 - (ii) Measure the exposure of the employees so identified.
- (4) EXPOSURE ABOVE THE ACTION LEVEL - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of 2-pentanone at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.
- (5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne

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concentrations of 2-pentanone above the permissible exposure, the employer shall:

- (i) Inform the employee of the exposure as required by paragraph (N)(1) of this section; and
- (ii) Measure the exposure of the employee at least monthly; and
- (iii) Institute control measures as required by paragraph (E) of this section.

(6) **TERMINATION OF EXPOSURE MEASUREMENT** - If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to airborne concentrations of 2-pentanone below the action level, the employer may terminate measurement for the employee. For purposes of this subparagraph, use of respirators shall not constitute reduction of employee exposure below the action level.

(d) **METHODS OF MEASUREMENT** - 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 (Appendix B (iv)). The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1 below.

Table 1

Concentration	Required Accuracy
Above permissible exposure	Plus or Minus 25%
At or below permissible exposure and above the action level	Plus or Minus 35%
At or below the action level	Plus or Minus 50%

(e) **Methods of Compliance**

(1) **Engineering controls** - No employee shall be exposed to 2-Pentanone above the permissible limit as defined in paragraph (a)(1) of this section. Engineering and work practice controls shall be used to reduce exposure to 2-Pentanone to at or below the permissible exposure.

(i) When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (for example: air velocity, static pressure, or air volume) shall be made at least every three months. Measurements of system efficiency shall also be made within five work days of any change in production, process, or control which might result in a reduction in control.

(ii) Where a fan is located in duct work and where 2-Pentanone is present in concentrations greater than 3750 ppm, one fourth 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.

(iii) In the design of open surface tank ventilation for the purposes of compliance with section 1910.94(d), operations involving 2-Pentanone shall be classified as B-1 at 70 F.

(2) **Respirators**

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

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- (a) During the time period necessary to install engineering controls; or
- (b) In work situations in which engineering controls are technically not feasible; or
- (c) In work situations in which feasible engineering and work practice controls are insufficient to reduce employee exposure to at or below the permissible exposure. Where technically feasible engineering and work practice controls are not sufficient to reduce exposure to at or below permissible exposure, they shall be used to reduce exposure to the lowest level feasible; or
- (d) For operations not exceeding 40 hours per year; or
- (e) In emergencies.
- (ii) Respirators shall be jointly approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.
- (iii) Employers shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.
- (iv) Employers shall institute a respiratory protection program in accordance with sections 1910.134(b), (d), (e), (f) and (g).

TABLE 2 RESPIRATORY PROTECTION FOR 2-PENTANONE

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 1000 ppm	vapor cartridge(s).
Equal to or less than 2000 ppm	
Equal to or less than 5000 ppm	
Equal to or less than 10 000 ppm	Any supplied-air respirator with a full facepiece. Any self-contained breathing apparatus with a full facepiece.
Greater than	Self-contained breathing apparatus with a full face-

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10 000 ppm or Escape & Entry from Unknown Concentrations	piece operated in pressure-demand (positive pressure) A combination respirator which includes a Type C ated in pressure-demand (positive pressure) or continuous flow mode and an auxiliary self-contained air supply operated in pressure-demand (positive pressure) mode.
Fire Fighting	Self-contained breathing apparatus with a full face- piece operated in pressure-demand (positive pressure) mode.
Escape	Any escape self-contained breathing apparatus. Any gas mask providing protection against organic vapors.

(f) Fire and Safety

Employers shall familiarize themselves with the information contained in the Substance Technical Guidelines for 2-Pentanone which is contained in Appendix B in order to ensure the safe handling and use of 2-Pentanone.

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of 2-Pentanone shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, 2-Pentanone is classified as a Class B fire hazard.
- (3) Powered industrial trucks - For the purposes of compliance with section 1910.178, locations classified as hazardous locations due to the presence of 2-Pentanone shall be Class I group D.
- (4) Flammable liquids - For the purposes of compliance with section 1910.106, liquid 2-Pentanone is classified as a Class IB flammable liquid. Spray finishing operations shall be performed in accordance with sections 1910.107 and 1910.94(c). Dip tank operations shall be performed in accordance with sections 1910.108 and 1910.94(d).
- (5) Sources of ignition - Sources of ignition such as smoking and open flames are prohibited where 2-Pentanone is used, handled or stored in a manner so as to create a potential fire or explosion hazard.

(g) Personal Protective Equipment

(1) Skin Contact

- (i) Employers shall provide, and require employees to use, impervious clothing, gloves, face shields (8 inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact to 2-pentanone. Face shields shall comply with section 1910.133(a)(6).
- (ii) Employers shall ensure that clothing contaminated with 2-pentanone is placed in closed containers. Employers shall provide for the cleaning or disposal of such clothing and if the clothing is to be laundered or otherwise cleaned, shall

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inform the person performing this operation of the hazardous properties of 2-pentanone.

(iii) Employers shall ensure that non-impervious clothing which becomes wet with 2-pentanone be removed promptly and not reworn until the 2-pentanone is removed from the clothing.

(iv) Employers shall ensure that clothing which becomes wet with 2-pentanone be removed immediately and not reworn until the 2-pentanone is removed from the clothing.

(2) Eye Contact

(i) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133(a)(6), where eye contact to liquid 2-pentanone may occur.

(h) Spills

(1) Spills of 2-pentanone shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.

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

(i) Sanitation

(1) Employers shall ensure that employees whose skin becomes wet with 2-pentanone promptly wash or shower as necessary to remove any 2-pentanone from the skin.

(2) Where skin contamination may occur and showers are required for adequate cleaning of the body, employers shall provide showers as described in section 1910.141(d)(3).

(j) Training and Information - Each employer who has employees exposed to 2-pentanone in excess of the action level, or employees who may have skin or eye contact with liquid 2-pentanone, or employees who work where accidental release, spill, fire, or explosion of 2-pentanone may occur, shall annually:

(1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for 2-pentanone, which is contained in Appendix A; and

(2) Medical -

(I) Advise employees as to the signs and symptoms of exposure to 2-pentanone.

(II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to 2-pentanone which are listed in Appendix A.

(III) Instruct the employees to inform the employer if they develop any of the medical conditions listed in (k)(2) of this section; and

(3) Procedures -

(I) Provide training to insure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to 2-pentanone.

(II) The procedures required by (j)(1), (2), and (3)(I) shall be provided to employees at the expense of the employer during the employee's normal working hours. (k) Medical Surveillance.

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(1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.

(2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to liquid 2-pentanone, or airborne concentrations of 2-pentanone at or above the action level, a written statement as to whether such employee has a history of any of the following:

- (i) Liver disease
- (ii) Chronic lung disease
- (iii) Skin disease
- (iv) Kidney disease

(3) Preplacement Medical Examination - The employer shall provide a medical examination for an employee if the employee provides a history of any of the conditions named in paragraph (k)(2).

(4) Results of Preplacement Examination - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(3).

(5) Periodic Medical Examinations - The employer shall provide a medical examination for an employee if the employee advises the employer of the development of:

- (i) any of the medical conditions listed in (k)(2),
- (ii) signs and symptoms listed in appendix A which the employee suspects may be caused by exposure to 2-pentanone.

(6) Results of Periodic Examinations - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).

(7) Exclusion or Removal from Exposure - No employee shall be exposed to 2-pentanone if such exposure could place the employee at increased risk of material impairment of his health.

(8) Emergency Procedures - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to 2-pentanone.

(9) Informing the Physician - The employer shall provide to the examining physician the following information:

- (i) A copy of this regulation for 2-pentanone;
- (ii) A description of the employee's duties as they relate to his exposure to 2-pentanone;
- (iii) A description of any personal protective equipment required to be used;
- (iv) The results of any employee's exposure measurement, if available;
- (v) The employee's anticipated exposure level; and
- (vi) Upon request of the physician, information from previous medical examination of the employee.

(10) Physician's Written Opinion -

(i) The physician's written opinion shall be a signed statement by the examining physician specifically stating:

(a) Whether the employee has any detected medical conditions which could be directly or indirectly aggravated by exposure to 2-pentanone or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.

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(b) Any recommended limitations upon the employee's exposure to 2-pentanone.

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

(ii) The written opinion shall not reveal medical information unrelated to exposure to 2-pentanone.

(11) Refusal to be Medically Examined - 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 risks involved by refusing to be examined.

(1) Recordkeeping.

(1) Initial determination.

(i) The employer shall keep an accurate record of all initial determinations required to be made pursuant to paragraph (c)(1) of this section.

(ii) The record shall include the written determination and any supporting documentation as required in paragraph (c)(1) of this section.

(iii) This record shall be maintained for at least one year.

(2) Exposure measurements.

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

(ii) This record shall include:

(a) The date of measurement;

(b) A reference to the subparagraph of this regulation which required the measurement, if any;

(c) Operations involving exposure to 2-pentanone which are being monitored;

(d) Sampling and analytical methods used and evidence of their accuracy;

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

(f) Name, Social Security number, and exposure of the employee monitored.

(iii) This record shall be maintained for one year.

(3) Mechanical ventilation.

(i) When mechanical ventilation is used as an engineering control, the employer shall maintain a record of measurements demonstrating the effectiveness of such ventilation as required by paragraph (e)(1)(i) of this section.

(ii) This record shall include:

(a) Date of measurement;

(b) Type of measurement taken;

(c) Result of measurement.

(iii) This record shall be maintained for one year.

(4) Training and information.

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

(ii) The record shall include:

(a) Date of training;

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- (b) Name and Social Security number of employees trained;
 - (c) Substance of training provided.
- (iii) This record shall be maintained for at least one year.
- (5) Medical records.
 - (i) The employer shall keep an accurate medical record for each employee.
 - (ii) The record shall include:
 - (a) Physician's written opinion;
 - (b) Preplacement questionnaire;
 - (c) Any employee medical complaints relative to exposure to 2-pe
 - (d) A signed statement of any refusal to be examined;
 - (e) A copy of information provided to the physician pursuant to paragraph (k)(9) of this section.
 - (iii) This record shall be maintained for the duration of the employment of the affected employee.
- (6) Access to records.
 - (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary and the Director.
 - (ii) Employee exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
 - (iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
- (m) Observation of monitoring.
 - (1) Duty.

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to 2-pentanone which is conducted pursuant to this section.
 - (2) Exercise of opportunity to observe monitoring.
 - (i) When observation of the monitoring of employee exposure to 2-pentanone requires entry into an area where the use of personal protective devices is required, the observer shall use such equipment and comply with all other applicable safety procedures.
 - (ii) Without interfering with the measurement, observers shall be entitled to:
 - (a) Receive an explanation of the measurement procedures;
 - (b) Visually observe all steps related to the measurement of exposure to 2-pentanone that are being performed at the place of exposure.
 - (c) Record the results obtained.
- (n) Employee notification.
 - (1) The employer shall notify in writing, within five work days, every employee who is found to be exposed to 2-pentanone above the permissible exposure. The employee shall also be notified of the level of his exposure and the corrective action being taken to reduce the exposure to at or below the permissible exposure.

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- (2) Pursuant to paragraph (k) of this Section, when an employee is medically examined the employer shall provide the employee with a copy of the physician's written opinion.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: 2-pentanone

PERMISSIBLE EXPOSURE: 200 parts of 2-pentanone vapor per million parts of air or 700 milligrams of 2-pentanone vapor per cubic meter of air (mg/cu m).

APPEARANCE AND ODOR: Colorless liquid with a characteristic ketone odor.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: 2-Pentanone can affect your body if you inhale it, swallow it, or if it comes in contact with your skin or eyes.

B. Effects of Overexposure:

1. Short-Term Effects: 2-pentanone may cause irritation of the eyes and nose. The exposed person may become drowsy and lose consciousness.
2. Long-Term Effects: Prolonged or repeated exposure to 2-pentanone may cause rash.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with 2-pentanone exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If 2-pentanone gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

B. Skin Exposure: If 2-pentanone gets on your non-impervious clothing or skin remove and clean the contaminated clothing and flush the contaminated skin with water. When there is skin irritation, get medical attention.

C. Breathing: If you or any other person breathes in large amounts of 2-pentanone remove the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the

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affected person warm and at rest. Get medical attention as soon as possible.

D. Swallowing: If the person is not unconscious and 2-pentanone has been swallowed, do not cause vomiting. Get medical attention immediately.

E. Rescue:

Move affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

A. RESPIRATORS: Respirators are not the best way to control exposure to 2-pentanone. You can only be required to wear them for routine use if your employer is in the process of installing controls or other 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)/National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.)

If you can smell 2-pentanone while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

B. PROTECTIVE CLOTHING: You must wear impervious clothing, gloves, face shields, and other appropriate protective clothing over any parts of your body that could repeatedly be exposed to 2-pentanone liquid.

C. EYE PROTECTION: You must wear splash-proof safety goggles if it is possible that 2-pentanone may get into your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING, AND STORAGE

2-Pentanone is a flammable liquid and must be stored in tightly closed containers, in a cool, well-ventilated area away from ignition sources, oxidizing agents, acids, alkalies, and ammonia. You must comply with the manufacturers recommended storage practices to prevent self-reaction. Metal 2-pentanone storage containers must be bonded and grounded when transferring liquids and must be opened and closed with non-sparking tools. You must not smoke in areas where 2-pentanone is used, stored or handled. If your non-impervious clothing becomes wet with 2-pentanone, you must promptly remove the clothing and not wear it again until the 2-pentanone has been removed. If your skin becomes wet with 2-pentanone, you must wash or shower promptly. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where 2-pentanone is used in your work area and for any additional plant safety rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
2-PENTANONE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Methyl propyl ketone; ethyl acetone; MPK
2. Formula: CH3COC3H7

B. Physical Data

1. Boiling point (760 mm Hg): 102.3 C (216 F)
2. Specific gravity (water=1): 0.8
3. Vapor density (air=1): 3.0
4. Melting point: -77.5 C (-108 F)
5. Vapor pressure at 20 C (68 F): 27 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 4.3
7. Evaporation rate (butyl acetate=1): 2.69
8. Appearance and odor: Water-white liquid with a characteristic ketone odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 7.2 C (45 F) (closed cup)
2. Autoignition temperature: 505 C (941 F)
3. Flammable limits in air, % by volume: Lower: 1.5; Upper: 8.2
4. Extinguishing media: Carbon dioxide, dry chemical or alcohol foam.
5. Special fire fighting procedures: Do not use solid stream of water because stream will scatter and spread fire. Use water spray to cool containers.
6. Unusual fire and explosion hazards: 2-pentanone is a flammable liquid. Its vapors can easily form explosive mixtures in air. All ignition sources must be controlled when 2-pentanone is used, handled, and stored. 2-pentanone vapors are heavier than air; thus the vapors may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which the 2-pentanone is handled.
7. For purposes of conforming to the requirements of 29 CFR 1910.106, 2-pentanone is classified as a Class IB flammable liquid. At 3750 ppm, one fourth of the lower flammable limit, 2-pentanone is considered a potential fire and explosion hazard.
8. For the purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article

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500 of the National Electrical Code for 2-pentanone shall be Class I, Group D.

B. Reactivity

1. Conditions contributing to instability: heat
2. Incompatibilities: Contact with oxidizing agents may cause fire and explosions.
3. Hazardous Decomposition Products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving 2-pentanone.
4. Special Precautions: 2-pentanone attacks many plastics and rubbers.

III. SPILL AND LEAK PROCEDURES

A. If 2-pentanone is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources
2. Ventilate area of spill or leak
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood) and burn the paper. For large quantities can be collected and atomized in a suitable combustion chamber. Combustion may be improved by mixing with a more flammable liquid. 2-Pentanone may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

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

C. Waste Disposal Methods:

2-Pentanone may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a sanitary land fill.
2. By atomizing in a suitable combustion chamber. Combustion may be improved by mixing with a more flammable liquid.

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 in a fashion such that the average 8-hour exposure may be determined from a single sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. 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, gas and vapor adsorption tubes with subsequent chemical analyses, or dosimeters. The method of measurement must determine the concentration of 2-pentanone to plus or minus 35%.

- b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph

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VI. A. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of 2-pentanone to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

- A. High exposures to 2-pentanone can occur when transferring the liquid from one container to another.
- B. Non-sparking tools must be used to open and close metal 2-pentanone containers which must then be effectively grounded and bonded prior to pouring.
- C. Store 2-pentanone in tightly closed containers in a cool, well-ventilated area away from ignition sources, oxidizing agents, acids, alkalies, and ammonia.
- D. Employers must advise employees of all plant areas and operations where exposure to 2-pentanone could occur.

VI. COMMON OPERATIONS

Some common operations in which exposure to 2-pentanone is likely to occur are during its use as a solvent for inks, varnishes, lacquers and coatings.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. Route of Entry

Inhalation; insignificant skin absorption

II. Toxicology

The main toxic effect of overexposure to 2-pentanone is irritation of the eyes, skin, and upper respiratory tract. Removal of lipids and irritation of the skin occurs when there is prolonged contact or repeated exposure to the liquid. Systemic absorption of high doses causes central nervous system depression. No chronic systemic effects are reported.

III. Signs and Symptoms

Irritation of eyes and mucous membranes of upper respiratory tract; headache; excessive skin contact may produce a dermatitis. At sustained high levels, narcosis leading to coma may occur.

IV. Special Tests

None in common usage.

V. Treatment

None specific. Remove from exposure, give artificial resuscitation if indicated, and wash eyes and contaminated skin. Recovery is usually rapid and complete.

VI. Surveillance and Preventive Considerations

A. General

Most reported effects of 2-pentanone are caused by its irritant properties. It is important that the physician become familiar with plant operating conditions in which exposure to 2-pentanone 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 2-pentanone exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Kidney disease - Although 2-pentanone is not known as a kidney toxin, the importance of the organ in the elimination of

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toxic substances justifies special consideration in those with possible impairment of renal function.

2. Chronic respiratory disease - In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 2-pentanone might cause exacerbation of symptoms due to its irritant properties or psychic reflex bronchospasm.
3. Liver disease - Although 2-pentanone 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 functions.
4. Skin disease - 2-Pentanone is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of 2-pentanone.

C. Periodic Examinations

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

References

1. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 425-427.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II. Toxicology (2d ed. revised), Interscience Publishers, New York, 1963, pp. 1734-1735.
3. American Conference of Governmental Industrial Hygienists, Documentation of the Threshold Limit Values (3d ed.), 1971, p. 700.

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REFERENCES AND SOURCES

2-PENTANONE

1910.93

- (f) Personal Protective Equipment, and (h) Sanitation
- Eye: "2-Pentanone," Union Carbide Corp.; Grant, "Toxicology of the Eye;" Carpenter and Smyth, "Chemical Burns of the Rabbit Cornea," Am. J. Ophth. vol. 29, pp.1363-72 (1946)
- Skin: Patty, "Industrial Hygiene and Toxicology;" "2-Pentanone," Union Carbide Corp.
- Ingestion: NIOSH Toxic Substances List (1973); Patty, "Industrial Hygiene and Toxicology"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Patty notes that it can "cause moderate transient irritation and perhaps corneal injury when in contact with the eye." Union Carb reports eye injury to rabbits as "minor." Grant notes "tested in liquid form on rabbit eyes, it caused only moderate injury, grade on a scale of 10 after 24 hours." According to Smyth and Carpent grade 3 indicates that 0.1 ml undiluted produces less than severe injury while 0.5 ml causes severe injury after a 24-hour contact. Since the injury caused is moderate in nature, a classification o concluded to be appropriate.

Skin: Classification: 2

Output statement numbers: 2, 17g, 7b, 21, 17i

Exceptions: 20a deleted

Patty reports that 2-pentanone "causes moderate transient irritat and dermatitis if skin contact is prolonged and frequently repeat Union Carbide reports no primary skin irritation in rabbits. It a rabbit single skin penetration LD50 of 8 ml/kg. The vapor pres 2-pentanone at 20 degrees C is 27 mm Hg. It is 4.3% soluble in w and has a flash point of 45 degrees F.

A classification of 2 is concluded to be appropriate to prev repeated or prolonged contact which can cause dermatitis or other irritation. The vapor pressure of the substance and its rather i cuous acute effects lead to the conclusion that statement 20a nee be specified.

Ingestion: Classification: 0

Output statement numbers: None

Exceptions: None

The NIOSH Toxic Substances List gives an oral rat LD50 of 3.73 g/ Patty states that its oral toxicity has not been studied but "pro will be low." The moderate toxicity and vapor pressure of the su lead to the conclusion that ingestion would not be a problem in t industrial environment.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: 2-Pentanone

D. O. L. STANDARD: 200 ppm

WARNING PROPERTIES:

Odor Threshold: Staub reports an odor threshold for 2-pentanone of 8 ppm. In addition, Patty reports that at 1500 ppm, 2-pentanone

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has a strong odor.

Eye Irritation Level: Grant reports that "men exposed to 1,300 to 1,500 ppm in air found even brief exposure was severely irritating to the eyes . . . but this produced no damage."

Other Information: Both Grant and Patty report that a concentration of 1500 ppm 2-pentanone is extremely irritating to the eyes.

Evaluation of Warning Properties: Because of its low odor threshold and its irritant effects, 2-pentanone is treated as a material with adequate warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 5000 ppm

Basis for IDLH Value: Patty reports that Yant, Patty, and Schrenk, while studying the acute effects on guinea pigs of exposure to 2-pentanone vapors, found that "the maximum concentration that caused no serious disturbances in 1 hour was 5000 ppm."

Other Toxicological Information: Patty reports that "Yant, Patty, and Schrenk studied the acute effects on guinea pigs of exposure to the vapors of methyl n-propyl ketone (2-pentanone). They report that 30,000 to 50,000 ppm of this material was dangerous to the life of the guinea pigs after exposures of 30 to 60 minutes. The maximum concentration that caused no serious disturbances in 1 hour was 5000 ppm; for 8 hours without serious disturbances, 2000 ppm, and for several hours with but slight or no symptoms, 1500 ppm . . . Smyth observed that a 4-hour exposure to 2000 ppm of methyl n-propyl ketone killed part of a group of rats, thus indicating that rats may be more susceptible than guinea pigs to the vapors."

Patty further states that "Yant and co-workers showed that 1500 ppm of this ketone caused complaints of irritation of the nasal passages and that this level was strongly odorous to humans . . . methyl n-propyl ketone is irritating to the mucous membrane and has a pronounced narcotic effect. Excessive exposure results in depression of such functions as rectal temperature, respiration and heart rate."

Other sources confirm this information which is given in Patty.

LFL: 15,000 ppm

VAPOR PRESSURE AT 20 C: 27 mm Hg

SATURATED CONCENTRATION AT 20 C: 35,500 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
2-PENTANONE

Principal Route
of Entry

Currently Used
Control Methods

Use/Exposure

- | | Use/Exposure | Principal Route of Entry | Currently Used Control Methods |
|----|--|--------------------------|--|
| 1. | Inhalation of vapor during spray application of lacquer, varnish, epoxy, acrylic, vinyl, and other cellulosic- or resin-based coatings, finishes, and adhesives | A | Local exhaust ventilation
personal protective equip
(respiratory protective devices) |
| 2. | Inhalation of vapor during application of lacquer, varnish, epoxy, acrylic, vinyl, and other cellulosic- or resin-based coatings, finishes, and adhesives by dipping, roller coating, tumbling, knifing, or brushing | A | Local exhaust ventilation
general dilution ventilat |
| 3. | Inhalation of vapor during oven or air drying of coatings, finishes, and adhesives | A | General dilution ventilat |
| 4. | Inhalation of vapor and contact with liquid during manual application of cellulose, acetate, acrylic, and rubber adhesives in shoe manufacturing, bookbinding, packaging, and furniture making | A, B | Local exhaust ventilation
general dilution ventilat
personal protective equip
(gloves and aprons) |
| 5. | Inhalation of vapor in use of cellulosic household cements | A | General dilution ventilat |
| 6. | Inhalation of vapor and skin contact with liquid during blending of raw materials for molded plastics, such as polystyrene, acrylate, and vinyl | A, B | Local exhaust ventilation
general dilution ventilat
personal protective equip
(gloves and aprons) |
| 7. | Inhalation of vapor when used as an intermediate in manufacture of pharmaceuticals and some flavorings | A | General dilution ventilat |
| 8. | Inhalation of vapor when | A | General dilution ventilat |

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used as an extractant in
dewaxing petroleum products

- | | | | |
|----|--|-----|---|
| 9. | Inhalation of vapor and skin contact with liquid during cleaning and maintenance of ketone processing equipment, such as distillation columns, reactors, mixers, and storage vessels | A,B | Personal protective equip (respiratory protective d self-contained breathing or organic vapor mask -- aprons, barrier creams) |
|----|--|-----|---|

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

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

1,078 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

