

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** N-AMYL ACETATE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for N-AMYL ACETATE

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 N-AMYL ACETATE.

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 n-amyl acetate in concentrations not in excess of 100 parts per million (ppm) (525 milligrams per cubic meter, mg/cu.m.) averaged over an eight 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 n-amyl acetate.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which n-amyl acetate is present shall:

- (1) STANDARD AVAILABILITY - Keep a copy of this section with its appendices A, B and C, at the workplace. This material shall be made readily available to affected employees; and
- (2) PRESENCE OF N-AMYL ACETATE - Inform affected employees of the quantity, location, and manner of use or storage of n-amyl acetate.

(c) EXPOSURE MEASUREMENT

- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which n-amyl acetate is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of n-amyl acetate 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 n-amyl acetate. 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 n-amyl acetate;
 - (ii) Any measurements of airborne concentrations of n-amyl acetate taken;
 - (iii) Any employee complaints of symptoms which may be attributable to exposure to n-amyl acetate; 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 n-amyl acetate 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 n-amyl acetate 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 n-amyl acetate 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.

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- (5) **EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE** - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of n-amyl acetate 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 n-amyl acetate 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 n-amyl acetate 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 n-amyl acetate 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) In the design of open surface tank ventilation for the purposes of section 1910.94 (d), operations involving n-amyl acetate shall be classified as B-3 at 70 F.
 - (iii) Where a fan is located in duct work and where n-amyl acetate is present in concentrations greater than 2750 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, non-sparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.
- (2) **Respirators**

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- (i) Compliance with the permissible exposure may not be achieved by the use of respirators except:
 - (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 employees 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) and (f).

TABLE 2. RESPIRATORY PROTECTION FOR n-AMYL ACETATE

Condition

Vapor Concentration

Equal to or Less
than 1000 ppm and organic vapor cartridge(s).

Equal to or Less
than 4000 ppm organic vapor canister.
Any supplied-air respirator with a full facepiece, helmet
or hood.
Any self-contained breathing apparatus with a full face-
piece.

Greater than Self-contained breathing apparatus with a full facepiece
4000 ppm & Entry
& Escape from Unknown
Concentrations demand (positive pressure) or continuous flow mode and an
auxiliary self-contained air supply operated in pressure-

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demand mode.

Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

(f) Fire and Safety

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

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of n-amyl acetate shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, n-amyl acetate 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 n-amyl acetate shall be Class I Group D.
- (4) Flammable liquids - For the purposes of compliance with section 1910.106, liquid n-amyl acetate is classified as a Class IC 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 or open flames are prohibited where n-amyl acetate is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
- (6) Storage - n-Amyl acetate shall be stored so as not to come in contact with nitrates, strong oxidizers, strong acids or strong alkalies.

(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 liquid n-amyl acetate. Face shields shall comply with section 1910.133(a)(6).
- (ii) Employers shall ensure that clothing which becomes wet with liquid n-amyl acetate be removed immediately and not reworn until the n-amyl acetate is removed from the clothing.
- (iii) Employers shall ensure that clothing wet with liquid n-amyl acetate is placed in closed containers for storage until it can be discarded or until the employer provides for the

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removal of n-amyl acetate from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the n-amyl acetate, the employer shall inform the person performing the operation of the hazardous properties of n-amyl acetate.

- (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 n-amyl acetate may occur.
- (h) Spills
 - (1) Spills of n-amyl acetate shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.
 - (2) Liquid n-amyl acetate 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 liquid n-amyl acetate promptly wash or shower as necessary to remove any n-amyl acetate from the skin.
 - (2) Employers shall ensure that employees who handle n-amyl acetate wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- (j) Training and Information - Each employer who has employees exposed to n-amyl acetate in excess of the action level, or employees who may have skin or eye contact with liquid n-amyl acetate, or employees who work where accidental release, spill, fire, or explosion of n-amyl acetate may occur, shall annually:
 - (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for n-amyl acetate, which is contained in Appendix A; and
 - (2) Medical -
 - (I) Advise employees as to the signs and symptoms of exposure to n-amyl acetate.
 - (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to n-amyl acetate 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 ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to n-amyl acetate.
 - (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
 - (1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.

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- (2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to liquid n-amyl acetate, or airborne concentrations of n-amyl acetate at or above the action level, a written statement as to whether such employee has a history of any of the following:
 - (I) Chronic lung disease
 - (II) Liver disease
 - (III) Kidney disease
 - (IV) Skin 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 n-amyl acetate.
- (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 continue to be exposed to n-amyl acetate 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 n-amyl acetate.
- (9) Informing the Physician - The employer shall provide to the examining physician the following information:
 - (I) A copy of this section with its Appendices A, B and C for n-amyl acetate;
 - (II) A description of the employee's duties as they relate to his exposure to n-amyl acetate;
 - (III) A description of any personal protective equipment, including respirators, required to be used;
 - (IV) The results of any employee's exposure measurement, if available;
 - (V) The employee's anticipated exposure level; and

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- (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 n-amyl acetate 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.

(B) Any recommended limitations upon the employee's exposure to n-amyl acetate.

(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 n-amyl acetate.

- (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.

- (12) 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.

(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 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 n-amyl acetate.

(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;

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- (c) Operations involving exposure to n-amyl acetate 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 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 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 at least 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;
 - (b) Name and Social Security number of employees trained;
 - (c) Substance of training provided.
 - (iii) This record shall be maintained until replaced by a more recent record.
- (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 n-amyl acetate;
 - (d) A signed statement of any refusal to be examined;
 - (e) A copy of information provided to the physician pursuant to paragraph (k)(9)(ii) through (vi) 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.

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(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 n-amyl acetate which is conducted pursuant to this section.

(2) Exercise of opportunity to observe monitoring.

(i) When observation of the monitoring of employee exposure to n-amyl acetate 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 n-amyl acetate 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 n-amyl acetate 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.

(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: n-Amyl acetate

PERMISSIBLE EXPOSURE: 100 parts of n-amyl acetate vapor per million parts of air (ppm) or 525 milligrams of n-amyl acetate vapor per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with a banana oil odor

II. HEALTH HAZARD DATA

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

B. Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to n-amyl acetate may cause irritation of the eyes, nose, and throat. Severe overexposure may cause weakness, drowsiness, and unconsciousness.
2. Long-Term Overexposure: Prolonged overexposure to n-amyl acetate may produce irritation of the skin.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with n-amyl acetate exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If n-amyl acetate gets into your eyes, wash the 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 n-amyl acetate gets on your skin flush the contaminated skin with water promptly. If n-amyl acetate soaks through your clothing, remove the clothing immediately and flush the skin with water. Do not rewear the clothing until the n-amyl acetate has been removed. Replace or repair impervious clothing that has developed leaks. If there is skin irritation get medical attention.

C. Breathing: If you or any other person breathes in large amounts of n-amyl acetate remove the exposed person to fresh air at once. If

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breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- D. Swallowing: When n-amyl acetate has been swallowed get medical attention immediately. If medical attention is not immediately available get the affected person to vomit by having him touch the back of the throat with his finger or by giving him large amounts (one pint or more) of warm salt water (two tablespoons of salt per pint of water). Do not make an unconscious person vomit.
- 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 n-amyl acetate. 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 n-amyl acetate 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 to prevent repeated or prolonged skin contact with liquid n-amyl acetate.
- C. EYE PROTECTION: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid n-amyl acetate may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

n-Amyl acetate is a flammable liquid and its vapors easily form explosive mixtures with air. It must be stored in tightly closed containers in a cool, well-ventilated area away from heat, sparks, flames, nitrates, strong oxidizers, strong acids and strong alkalies. Sources of ignition such as smoking and open flames are prohibited wherever n-amyl acetate is handled, used or stored in a manner that could create a potential fire or explosion hazard. You must use non-sparking tools when opening or closing metal containers of n-amyl acetate, and containers must be bonded and grounded when pouring or transferring liquid n-amyl acetate. If your skin becomes wet with liquid n-amyl acetate, you must promptly wash or shower as necessary to remove the n-amyl acetate from your skin. You must immediately remove any clothing that becomes wet with liquid n-amyl acetate and this clothing must not be reworn until the n-amyl acetate is removed from the clothing. If you handle liquid n-amyl acetate, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities. Fire extinguishers, where

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provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where n-amyl acetate is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
N-AMYL ACETATE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 1-pentanol acetate; n-amyl acetate (mixed isomers)
2. Formula: CH3COOC5H11
3. Molecular weight: 130

B. Physical Data

1. Boiling point (760 mm Hg): 146 C (295 F)
2. Specific gravity (H2O=1): 0.88
3. Vapor density (air=1 at boiling point of n-amyl acetate): 4.5
4. Melting point: -70.8 C (-95.4 F)
5. Vapor pressure at 20 C (68 F): 4 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.2
7. Evaporation rate (butyl acetate=1): 0.42
8. Appearance and odor: Colorless liquid with a banana oil odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 25 C (77 F) (closed cup)
2. Autoignition temperature: 360 C (680 F)
3. Flammable limits in air, % by volume: Lower: 1.1; Upper: 7.5
4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide
5. Special fire-fighting procedures: Do not use solid stream of water since stream will scatter and spread fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: n-Amyl acetate is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where n-amyl acetate is used, handled or stored. n-Amyl acetate vapors are heavier than air and may travel along the ground and be ignited by sparks or open flames at locations remote from the site at which n-amyl acetate is handled.
7. For purposes of conforming to the requirements of 29 CFR 1910.106, n-amyl acetate is classified as a Class IC flammable liquid. At 2750 ppm, one-fourth of the lower flammable limit, n-amyl acetate 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

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the National Electrical Code for n-amyl acetate shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: heat
2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalies or strong acids may cause fire and explosion.
3. Hazardous decomposition products: Toxic gases and vapors (such as Carbon monoxide) may be released in a fire involving n-amyl acetate.
4. Special precautions: n-Amyl acetate will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If n-amyl acetate 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. Large quantities can be collected and atomized in a suitable combustion chamber. n-Amyl acetate 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:

n-Amyl acetate may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a 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 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 n-amyl acetate 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 IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American

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Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of n-amyl acetate to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

- A. Store n-amyl acetate in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to n-amyl acetate can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal n-amyl acetate containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Employers must advise employees of all plant areas and operations where exposure to n-amyl acetate could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to n-amyl acetate is likely to occur are: its use as a solvent for a wide variety of adhesives, resins, and inks; in the manufacture of photographic film; and in the production of antibiotics.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; minor skin absorption.

II. TOXICOLOGY

Irritation of the upper respiratory tract and the eyes is the first response to exposure to n-amyl acetate vapor. At very high concentrations there may be depression of the central nervous system; narcosis occurred in guinea pigs at 5000 ppm, but not at 2000 ppm. These animals showed injury to the lungs, liver and kidney. This substance is a defatting agent, and prolonged exposure may cause irritation of the skin. No chronic systemic effects have been reported in humans.

III. SIGNS AND SYMPTOMS

Irritation of the eyes and nose; narcosis may occur at sustained high levels; dermatitis may occur from prolonged skin exposure.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Give artificial resuscitation if indicated. Wash eyes and contaminated skin with water. If swallowed and the person is conscious, induce vomiting. Recovery is usually complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

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

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1. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of n-amyl acetate might cause exacerbation of symptoms due to its irritant properties.
2. Liver disease -- Although n-amyl acetate is not known as a liver toxin in humans, the importance of this organ is the biotransformation and detoxification of foreign substances and should be considered before exposing persons with impaired liver function.
3. Kidney disease -- Although n-amyl acetate is not known as a kidney toxin in humans, the importance of the organ in the elimination of toxic substances justifies special consideration in those with possible impairment of renal function.
4. Skin disease -- n-Amyl acetate 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.

References

1. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishers, New York, 1963, pp. 1847-1866.
2. Hygienic Guide Series: "Amyl Acetate," Industrial Hygiene Journal, 26:199-202, 1965.
3. American Conference of Governmental Industrial Hygienists: "n-Amyl Acetate," (3d ed., 2d printing) Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, pp. 12-13.

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REFERENCES AND SOURCES

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1910.93

(f) Personal Protective Equipment, and (h) Sanitation

Eye: Grant, "Toxicology of the Eye"

"Amyl Acetates, Mixed Primary," Union Carbide Corp. Toxicology Study

Skin: Browning, "Toxicity and Metabolism of Industrial Solvents"

Sax, "Dangerous Properties of Industrial Materials"

"Amyl Acetates, Mixed Primary," Union Carbide Corp. Toxicology Study

"Amyl Acetate," AIHA Hygienic Guide Series

Ingestion: "Amyl Acetates, Mixed Primary," Union Carbide Corp. Toxicology Study
COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Grant reports for amyl acetate (iso-amylacetate) that "experimentally, several drops of liquid amyl acetate squirted on the eyes of anesthetized rabbits and washed off with water two minutes later caused temporary corneal epithelial injury, but recovery was complete in a day or two. By standardized testing on rabbit eyes, amyl acetate has been given only 2 (slightly injurious) on a scale of 1 to 10." Union Carbide for "amyl acetates, mixed primary," notes "flooding the rabbit eye with an excess of the chemical caused a reaction no more severe than moderate inflammation."

A classification of 2 is concluded to be appropriate.

Skin - Classification: 2

Output statement numbers: 2, 7b, 21, 16i

Exceptions: None

Browning reports that "amyl acetate is not a predominant producer of dermatitis, but Baldi states that contact with the liquid has a decreasing effect, with a drying action which diminishes the defense reaction and predisposes to dermatitis. Sax lists the acute and chronic local effects to be of slight toxic hazard. Union Carbide states "the undiluted chemical caused redness of short duration at the point of application and gives a rabbit skin penetration LD50 in excess of 20 ml/100 g for "amyl acetates, mixed primary." The Hygienic Guide agrees "it may dry and defat the skin."

The vapor pressure of n-amyl acetate is 4 mm Hg at 20°C. It is 0.2% soluble in water and has a flash point of 77°F.

A classification of 2 is concluded to be appropriate.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Union Carbide gives an acute oral dose to rats of 6.5 gm/kg for "amyl acetates, mixed primary."

Since the substance is only slightly toxic by acute ingestion and there is no indication in the literature that chronic ingestion of small quantities is harmful, it is concluded that ingestion of this substance, in the context of

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this standard, would not present a hazard in the industrial environment.

SUBSTANCE TECHNICAL GUIDELINES
N-AMYL ACETATE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 1-pentanol acetate; n-amyl acetate (mixed isomers)
2. Formula: CH3COOC5H11
3. Molecular weight: 130

B. Physical Data

1. Boiling point (760 mm Hg): 146 C (295 F)
2. Specific gravity (water=1): 0.88
3. Vapor density (air=1 at boiling point of n-amyl acetate): 4.5
4. Melting point: -70.8 C (-95.4 F)
5. Vapor pressure at 20 C (68 F): 4 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.2
7. Evaporation rate (butyl acetate=1): 0.42
8. Appearance and odor: Colorless liquid with a banana oil odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 25 C (77 F) (closed cup)
2. Autoignition temperature: 360 C (680 F)
3. Flammable limits in air, % by volume: Lower: 1.1; Upper: 7.5
4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide
5. Special fire-fighting procedures: Do not use solid stream of water since stream will scatter and spread fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: n-Amyl acetate is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where n-amyl acetate is used, handled or stored in a manner that could create a potential fire or explosion hazard. n-Amyl acetate vapors are heavier than air and may travel along the ground and be ignited by sparks or open flames at locations remote from the site at which n-amyl acetate is handled.
7. For purposes of conforming to the requirements of 29 CFR 1910.106, n-amyl acetate is classified as a Class IC flammable liquid. For example, 2800 ppm, approximately one-fourth of the lower flammable limit, is one situation in which n-amyl acetate 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 n-amyl acetate shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat.

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2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalis or strong acids may cause fire and explosion.
3. Hazardous decomposition products: Toxic gases and vapors (such as Carbon monoxide) may be released in a fire involving n-amyl acetate.
4. Special precautions: n-Amyl acetate will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If n-amyl acetate 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). Allow sufficient time for vapors to completely clear hood ductwork, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber. n-Amyl acetate 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: n-Amyl acetate may be disposed of 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 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 n-amyl acetate 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 IV. 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 n-amyl acetate to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".
- V. MISCELLANEOUS PRECAUTIONS

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- A. Store n-amyl acetate in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to n-amyl acetate can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal n-amyl acetate containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Employers should advise employees of all plant areas and operations where exposure to n-amyl acetate could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to n-amyl acetate is likely to occur are: its use as a solvent for a wide variety of adhesives, resins, and inks; in the manufacture of photographic film; and in the production of antibiotics.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: n-Amyl acetate

D.O.L. STANDARD: 100 ppm

WARNING PROPERTIES:

Odor Threshold: Staub reports an odor threshold for n-amyl acetate of 0.08 ppm.

Eye Irritation Level: Since the AIHA Hygienic Guides state that a "concentration of 200 ppm (amyl acetate) vapor caused mild eye and nose irritation in humans in 3 to 5 minutes," n-amyl acetate is treated as an eye irritant for the purpose of this standard.

Evaluation of Warning Properties: Since the odor threshold of n-amyl acetate is below the permissible exposure limit, n-amyl acetate is treated as a material with warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 4000 ppm

Basis for IDLH Value: This IDLH is based upon the report in Browning that "a concentration of 5000 ppm (amyl acetate) produced complete loss of reflexes in rabbits, within an hour" and upon the report in Sax that "5000 ppm produces deep narcosis in cats in 30 minutes."

Other Toxicological Information: The available toxicological information does not pertain to n-amyl acetate specifically, but rather to amyl acetate, which, in its pure form, "is a mixture of isomers notably n-amyl acetate and isoamyl acetate according to the ILO.

The ILO states that "in man, exposure to concentrations of 950 ppm for 30 min (sic) causes irritation of the nose and eyes, headaches and dizziness."

Browning reports that "most investigators . . . have considered that even high concentrations of amyl acetate are not immediately fatal to animals." Smyth and Smyth found that mice tolerated inhalation of 1000 ppm for 2 hours without ill effects . . . Patty, Yant, and Schrenk (however) considered (amyl acetate) dangerous to life after 5 h exposure to 10,000 ppm . . . Koelsh observed that 4000 ppm produced complete loss of reflexes in rabbits within an hour."

According to Sax, "5000 ppm produces deep narcosis in cats in 30 minutes." The Chemical Company Guides of Union Carbide Corporation report that "birds died from saturated vapors (about 6,000 parts per million) for four hours killed six animals (rats). Loss of consciousness occurred at two hours. Breathing the vapors for eight hours was fatal to all animals."

The Documentation of TLV's states that "a threshold limit of 100 ppm (n-amyl acetate), to prevent significant irritation of the eyes and respiratory tract."

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passages, is recommended."

LFL: 11,000 ppm

VAPOR PRESSURE AT 20 C: 4 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 5260 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT

N-AMYL ACETATE
Principal Route

Use/Exposure	of Entry	Currently Used Control Method
1. Inhalation of vapor and mist and skin contact with vapor during spray application of paints and lacquers (metallic paints, bronzing liquids, automobile lacquers)	A, B	Spray booths with proper ventilation; personal protective equipment (goggles, respirator, protective rubber clothing)
2. Inhalation of vapor during coating application of textile finishing products (waterproofing compounds and sizing compounds for artificial silk, certifiical leather and paper)	A	Local exhaust ventilation; general dilution ventilation
3. Inhalation of vapor and skin contact with liquid during brush and hand application of lacquers, lacquer thinners, paints, film cement, model cement, general purpose cellulose nitrate cements	A, B	General dilution ventilation
4. Inhalation of vapor during the manufacture of cellulose nitrate lacquers, lacquer thinners, adhesives (film cement, model cement), nail enamel, nail enamel removers and paint, particularly metallic. n-Amyl acetate is solvent vehicle.	A	General dilution ventilation
5. Inhalation of vapor during the manufacture of textile finishing compounds	A	General dilution ventilation
6. Inhalation of vapor during the production of antibiotics. n-Amyl acetate is used to extract the antibiotic from the fermentation broth (penicillin)	A	General dilution ventilation
7. Inhalation of vapor and skin contact with liquid during the application of specialty inks-(printing on cellulose ester plastics, tin foil or metal surfaces and relief printing surfaces	A	General dilution ventilation

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| 8. | Inhalation of vapor during the manufacture of specialty inks (quick drying inks, metallic inks, transfer inks) | A | General dilution ventilation |
| 9. | Inhalation of vapor and skin contact with liquid during manufacture of cellulose nitrate plastics (celluloid-buttons, toys, eyeglass frames, combs and novelties). n-Amyl acetate may be used as vehicle solvent during molding operation. | A,B | Local exhaust ventilation; general dilution ventilation |
| 10. | Inhalation of vapor during production of n-amyl acetate, manufactured primarily by oxo method which yields a product of about 60% n-amyl acetate | A | Local exhaust ventilation; general dilution ventilation; process enclosure |
| 11. | Inhalation of vapor during manufacture of photographic film | A | Local exhaust ventilation; general dilution ventilation |
| 12. | Inhalation of vapor during manufacture of furniture polish, leather polish and shoe polish | A | General dilution ventilation |
| 13. | Inhalation of vapors and skin contact with the liquid in dry cleaning industry - used in spotting department and in prespotting for removing fingernail polish | A,B | General dilution ventilation; personal protective equipment (rubber gloves) |
| 14. | Inhalation of vapor during the manufacture of artificial fruit flavoring agents | A | General dilution ventilation |
| 15. | Inhalation of vapor and skin contact with the liquid during the manufacture of straw hats (vehicle solvent of lacquer and stiffening agents) | A,B | Local exhaust ventilation; general dilution ventilation |
| 16. | Inhalation of vapor and skin contact with the liquid during cleaning operation of storage tanks | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respirators, |

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goggles, rubber gloves,
protective clothing)

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