NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND

SUPPORTING DOCUMENTATION FOR

*** TERT-BUTYL ACETATE ***

NIOSH/OSHA Draft Technical Standard and Supporting Documentation for TERT-BUTYL 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 TERT-BUTYL 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.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for TERT-BUTYL ACETATE

(a) DEFINITIONS

(1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of tert-butyl acetate in concentrations not in excess of 200 parts per million (ppm) (950 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 tert-butyl acetate.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which tert-butyl 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 TERT-BUTYL ACETATE - Inform affected employees of the quantity, location, and manner of use or storage of tert-butyl acetate.

(c) EXPOSURE MEASUREMENT

(1) INITIAL DETERMINATION - Each employer who has a place of employment in which tert-butyl acetate is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of tert-butyl 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 tert-butyl 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 tert-butyl acetate;

(ii) Any measurements of airborne concentrations of tert-butyl acetat taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to tert-butyl 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 tert-butyl 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) INDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of tert-butyl 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 tert-butyl 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.

(5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of tert-butyl 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 tert-butyl 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 tert-butyl 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 tert-butyl 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 compliance with section 1910.94 (d), operations involving tert-butyl acetate shall be classified as B-2 at 70 F.

(iii) Where a fan is located in duct work and where tert-butyl acetate is present in concentrations greater than 3750 ppm, the fan rotating element 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.

(2) Respirators

(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),(f) and (g).

TABLE 2. RESPIRATORY PROTECTION FOR tert-BUTYL ACETATE

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or Less than 1000 ppm	organic vapor cartridge(s).
Equal to or Less than 5000 ppm	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Equal to or Less than 10000 ppm	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than	Self-contained breathing apparatus with a full face-

10000 ppm or, Entry and Escape from Unknown Concentrations	piece operated in pressure-demand (positive pressure) A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand (positive pressure) or continuous flow mode and an auxiliary self-contained air supply operated in pressure-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 tert-butyl acetate which is contained in Appendix B in order to ensure the safe handling and use of tert-butyl acetate.

(1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of tert-butyl acetate shall be Class I Group D.

(2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, tert-butyl 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 tert-butyl acetate shall be Class I Group D.

(4) Flammable liquids - For the purposes of compliance with section 1910.106, liquid tert-butyl acetate 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 or open flames are prohibited where tert-butyl acetate is used, handled or stored in a manner so as to create a potential fire or explosion hazard.

(6) Storage - Tert-butyl acetate shall be stored so as not to come in contact with nitrates, strong oxidizers, strong acids and 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 tert-butyl acetate. Face shields shall comply with section 1910.133(a)(6).

(ii) Employers shall ensure that clothing which becomes wet with liquid tert-butyl acetate be removed immediately and not reworn until the tert-butyl acetate 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 tert-butyl acetate may occur.

(h) Spills

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

(2) Tert-butyl acetate liquid 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 tert-butyl acetate promptly wash or shower as necessary to remove any tert-butyl acetate from the skin.

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

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

(2) Medical -

(I) Advise employees as to the signs and symptoms of exposure to tert-butyl acetate.

(II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to tert-butyl 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 tert-butyl 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.

(2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to liquid tert-butyl acetate, or

airborne concentrations of tert-butyl acetate at or above the action level, a written statement as to whether such employee has a history of any of the following:

(I) Kidney disease
(II) Chronic lung disease
(III) Liver 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 tert-butyl 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 tert-butyl 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 tert-butyl 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 tert-bu
(II) A description of the employee's duties as they relate to his exposure to tert-butyl acetate;
(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 tertbutyl 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 tert-butyl 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 tert-butyl 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.

(l) 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 tert-butyl 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;

(c) Operations involving exposure to tert-butyl 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 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;

(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 ter

(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.

(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 tert-butyl 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 tert-butyl 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 tert-butyl 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 tert-butyl 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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Butyl Acetate

APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: tert-Butyl acetate

PERMISSIBLE EXPOSURE: 200 parts of tert-butyl acetate vapor per million parts of air (ppm) or 950 milligrams of tert-butyl acetate vapor per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with a fruity odor.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: tert-Butyl 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 tert-butyl acetate may cause irritation of eyes, nose and throat. Severe overexposure may cause weakness, drowsiness and unconsciousness.

2. Long-Term Overexposure: Prolonged overexposure 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 tert-butyl acetate exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If tert-butyl 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 clothing becomes wet with tert-butyl acetate immediately remove and clean the clothing before wearing again. If tert-butyl acetate gets on your skin, flush the contaminated skin with water promptly. If there is skin irritation, get medical attention.

C. Breathing: If you or any other person breathes in large amounts of tert-butyl acetate remove the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

D. Swallowing: When tert-butyl 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 his 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 tert-butyl 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 tert-butyl 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 clothin, gloves, face shields and other appropriate protective clothing to prevent repeated or prolonged skin contact with liquid tert-butyl acetate .

C. EYE PROTECTION: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid tert-butyl acetate may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

tert-Butyl 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 and flames. Store tert-butyl acetate away from nitrates, strong oxidizers, strong alkalies, and strong acids. Sources of ignition such as smoking and open flames are prohibited wherever tert-butyl 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 tert-butyl acetate, and containers must be bonded and grounded when pouring or transferring liquid tert-butyl acetate. If your skin becomes wet with liquid tert-butyl acetate, you must promptly wash or shower as necessary to remove the tert-butyl acetate from your skin. You must immediately remove any clothing that becomes wet with liquid tert-butyl acetate and this clothing must not be

reworn until the tert-butyl acetate is removed from the clothing. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where tert-butyl acetate is used in your work area and for any additional plant safety rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
TERT-BUTYL ACETATE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Acetic acid tert-butyl ester
2. Formula: $CH_3COOC(CH_3)_3$
3. Molecular weight: 116

B. Physical Data

1. Boiling point (760 mm Hg): 98 C (208 F)
2. Specific gravity (Water=1): 0.87
3. Vapor density (air=1 at boiling point of tert-butyl acetate): 4.0
4. Melting point: data not available
5. Vapor pressure at 20 C (68 F): Data not available
6. Solubility in water, % by weight at 20 C (68 F): Data not available
7. Evaporation rate (butyl acetate=1): Data not available
8. Appearance and odor: Colorless liquid with a fruity odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: between 17 - 22 C (62 - 72 F) (estimated)
2. Autoignition temperature: data not available
3. Flammable limits in air, % by volume: Lower 1.5 (estimated)
4. Extinguishing media: Dry chemical, foam, 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: tert-Butyl acetate is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where tert-butyl acetate is used, handled or stored. tert-Butyl 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 tert-butyl acetate is handled.
7. For purposes of conforming to the requirements of 29 CFR 1910.106, tert-butyl acetate is classified as a Class IB flammable liquid. (At 3750 ppm, tert-butyl 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 tert-butyl acetate shall be Class I, Group D.

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalies, and 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 tert-butyl acetate.
4. Special Precautions: Tert-butyl acetate may soften or dissolve plastics.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If tert-butyl 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. Tert-butyl 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:
tert-Butyl acetate 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.

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 tert-Butyl 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 tert-Butyl acetate to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

A. Store tert-butyl acetate in tightly closed containers in a cool, well-ventilated area.

B. High exposures to tert-butyl acetate can occur when transferring the liquid from one container to another.

C. Non-sparking tools must be used to open and close metal tert-butyl 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 tert-butyl acetate could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to tert-butyl acetate is likely to occur are: operations involved in its manufacture and in the preparation and use of paint systems containing tert-butyl acetate.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Central nervous system depression may occur on exposure to high concentrations of tert-butyl acetate, producing narcosis. Irritation of the eyes, skin and upper respiratory tract may occur.

III. SIGNS AND SYMPTOMS

Itching and inflammation of the eyes, irritation of the upper respiratory tract; headache. Narcosis may also occur at sustained high levels. Dermatitis may occur from prolonged skin exposure.

IV. SPECIAL TESTS

None is 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 tert-butyl acetate are caused by its irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to tert-butyl 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 tert-butyl acetate exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Kidney disease -- Although tert-butyl 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.

2. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of tert-butyl acetate might cause exacerbation of symptoms due to its irritant properties.

3. Liver disease -- Although tert-butyl acetate is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

4. Skin disease -- tert-Butyl acetate 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 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. 1847-1864.

2. Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles C. Thomas, Illinois, 1974, pp. 210-211.

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REFERENCES AND SOURCES
TERT-BUTYL ACETATE
1910.93

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

Eye: Documentation of TLV's
Grant, "Toxicology of the Eye"

Skin: Patty, "Industrial Hygiene and Toxicology"
Sax, "Dangerous Properties of Industrial Materials"
"Butyl Acetate," Union Carbide Toxicology Study

Ingestion: Spector, "Handbook of Toxicology"

COMMENTS

Eye - Classification: 2
Output statement numbers: 10
Exceptions: None

The Documentation of TLV's reports that the vapor of sec-butyl acetate "is less irritating than that of n-butyl acetate, the secondary isomer appears less objectio In the TLV documentation for tert-butyl acetate, it states "the irritative and narcotic effects of the acetates appear be related to their physical properties, the higher boiling members being the more toxic." Since sec-butyl acetate has the same molecular weight as butyl acetate and has a lower boiling point, and Grant notes that butyl acetate applied t rabbit eyes causes "superficial reversible injury," a classification of 2 is concluded to be appropriate for this substance.

Skin - Classification: 2
Output statement numbers: 2, 7b, 21, 16i
Exceptions: None

Patty notes in general for esters that "the local effects o the skin are about the same as for other volatile solvents; defatting and cracking may occur. Specific sensitization dermatitis is negligible." Sax considers it to be an acute and chronic local irritant and allergen of slight toxic haz He also considers its acute and chronic systemic effects by skin absorption to be of slight hazard. Since sec-butyl ac can be expected to be less toxic than butyl acetate for rea noted above, and since Union Carbide reports that the rabbi skin penetration LD50 for butyl acetate is greater than 20 it is likely that the LD50 for sec-amyl acetate is similar greater.

Sec-butyl acetate has a vapor pressure of 10 mm Hg at 2 degrees C. It is 0.8% soluble in water and has a flash poi of 62 degrees F.

A classification of 2 is concluded to be appropriate.

Ingestion - Classification: 0
Output statement numbers: None
Exceptions: None

According to Spector, butyl acetate has an acute oral dose LD50 of 14.13 gm/kg in rats. Since, for reasons given abov it can be expected that sec-butyl acetate is less toxic tha butyl acetate, it can be concluded that ingestion would not

pose a hazard in the industrial environment.

SUBSTANCE TECHNICAL GUIDELINES
TERT-BUTYL ACETATE

I. PHYSICAL AND CHEMICAL DATA

A Substance Identification

1. Synonyms: 1-Methylpropyl acetate
2. Formula: $CH_3COOCH(CH_3)C_2H_5$
3. Molecular weight: 116

B. Physical Data

1. Boiling point (760 mm Hg): 112 C (234 F)
2. Specific gravity (water=1): 0.86
3. Vapor density (air=1 at boiling point of sec-butyl acetate): 4.0
4. Melting point: -99 C (-146 F)
5. Vapor pressure at 20 C (68 F): 10 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.8
7. Evaporation rate (butyl acetate=1): 2.0
8. Appearance and odor: Colorless liquid with a pleasant odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 16.7 C (62 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 1.7; Upper 9.8
4. Extinguishing media: Dry chemical, carbon dioxide, foam
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: sec-Butyl acetate is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where sec-butyl acetate is used, handled or stored in a manner that could create a potential fire or explosion hazard. sec-Butyl 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 sec-butyl acetate is handled.
7. For purposes of conforming to the requirements of 29 CFR 1910.106, sec-butyl acetate is classified as a Class IB flammable liquid. For example, 4300 ppm, approximately one-fourth of the lower flammable limit, is one situation in which sec-butyl 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 sec-butyl acetate shall be Class I, Group D.

B. Reactivity

1. Conditions contributing to instability: Heat

2. Incompatibilities: Contact with nitrates, strong oxidizers, strong alkalies, and 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 sec-butyl acetate.
4. Special precautions: Sec-butyl acetate will soften and dissolve many plastics.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If sec-butyl 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. Sec-butyl 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: Sec-butyl 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 sec-Butyl 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 sec-Butyl acetate to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

A. Store sec-butyl acetate in tightly closed containers in a cool, well-ventilated area.
B. High exposures to sec-butyl acetate can occur when transferring the liquid from one container to another.
C. Non-sparking tools must be used to open and close metal sec-butyl 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 sec-butyl acetate could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to sec-butyl acetate is likely to occur are: operations involved in its manufacture and in its use as a solvent for lacquers in films, coatings, adhesives.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: sec-Butyl acetate

D. O. L. STANDARD: 200 ppm

WARNING PROPERTIES:

Odor Threshold: Both Staub and Summer report odor thresholds for isobutyl acetate and for butyl acetate of 4 ppm and 7 ppm respectively. Although no quantitative information is available concerning the odor threshold of sec-butyl acetate, by analogy to isobutyl acetate and to butyl acetate, the odor of sec-butyl acetate is assumed to be detectable below the TLV (200 ppm). According to the Documentation of TLV's, however, "the odor of sec-butyl acetate is reportedly milder than that of the primary isomers."

Eye Irritation Level: The TLV was recommended to prevent eye and respiratory tract irritation. No quantitative information is available, however, concerning the air concentrations of sec-butyl acetate which produce this irritation.

Evaluation of Warning Properties: Since by analogy with isobutyl acetate and butyl acetate, the odor threshold of sec-butyl acetate is assumed to be below the TLV (200 ppm), sec-butyl acetate is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 10,000 ppm

Basis for IDLH Value: This IDLH is based upon an analogy with butyl acetate for which an IDLH of 10,000 ppm was chosen. There are no other acute inhalation toxicity data available upon which to base the IDLH concentration for sec-butyl acetate.

Other Toxicological Information: According to the Documentation of TLV's, "the threshold limits of the higher acetates are based primarily on the irritative effects on the eyes and respiratory passages. In comparison with n-butyl acetate, the secondary isomer appears less objectionable, hence a slightly higher limit is recommended."

There is no acute inhalation toxicity information concerning the physiological effects produced specifically by sec-butyl acetate. Patty, however, reports the following information for butyl acetate and for isobutyl acetate:

Compound	Species	Concentration ppm	Concentration mg/liter	Duration of exposure	Results

n-Butyl acetate	Guinea pig	14,000	67	4 hr.	Eye irrita narcosis;
	Guinea pig	7,000	33	13 hr.	Eye irrita deep narc recovery
	Guinea pig	3,300	16	13 hr.	Eye irrita no other
	Mouse	7,400	35	3 hrs.	Narcosis; recovery
	Cat	17,500	83	30 min.	Narcosis; lethal to
	Cat	12,000	55	30 min.	Narcosis; recovered
	Cat	900		65 daily exposures	Weakness
	Cat	4,200	20	6 hr. for 6 days	Weakness; of weight; minor bloo
	Man	3,300	16	Brief	Marked irr to eyes a
		200-300		Brief	Mild irri on eyes a
Isobutyl acetate	Rat	21,000	150	150 min.	Narcosis; 6/6
		3,000		6 hr.	No symptor

The Documentation of TLV's states that a 4-hour exposure to 10,000 ppm butyl acetate killed no rats, but an 8-hour exposure to 10,0 ppm killed all of 6 rats.

LFL: 17,000 ppm
VAPOR PRESSURE AT 20 C: 10 mm Hg
SATURATED CONCENTRATION AT 20 C: 13,200 ppm

USE/EXPOSURE AND CONTROL DOCUMENT
SECONDARY BUTYL ACETATE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapors during use as solvent coating for paper or leather	A	Local exhaust ventilation; general dilution ventilation
2.	Inhalation of vapors and skin contact with liquid during use as a solvent for artificial leather material	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, aprons, and barrier creams)
3.	Inhalation of vapors during spray application of lacquers	A	Local exhaust ventilation; general dilution ventilation
4.	Inhalation of vapors during dip and brush application of lacquers	A	Process enclosure; general
5.	Inhalation of vapors during the preparation of celluloid products	A	Process enclosure; general dilution ventilation
6.	Inhalation of vapors during the preparation of lacquers	A	Process enclosure; local exhaust ventilation
7.	Inhalation of vapors during the application of adhesives containing sec-butyl acetate	A	Local exhaust ventilation; general dilution ventilation
8.	Inhalation of vapors during the manufacture of adhesive containing sec-butyl acetate	A	Process enclosure; local exhaust ventilation; general dilution ventilation
9.	Inhalation of vapors during application of textile size	A	Local exhaust ventilation; general dilution ventila-
10.	Inhalation of vapor during manufacture of photographic film	A	General dilution ventilation

A -- Inhalation
B -- Skin contact resulting in localized irritation
C -- Ingestion
D -- Skin contact resulting in

absorption and subsequent
systemic poisoning

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

1,264 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

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