NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND

SUPPORTING DOCUMENTATION FOR

*** METHYL ISOBUTYL CARBINOL ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for METHYL ISOBUTYL CARBINOL

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 METHYL ISOBUTYL CARBINOL.

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 METHYL ISOBUTYL CARBINOL

(a) DEFINITIONS

(1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of methyl isobutyl carbinol in concentrations not in excess of 25 parts per million (ppm) (100 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 methyl isobutyl carbinol.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which methyl isobutyl carbinol 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 METHYL ISOBUTYL CARBINOL - Inform affected employees of the quantity, location, and manner of use or storage of methyl isobutyl carbinol.

(c) EXPOSURE MEASUREMENT

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

(ii) Any measurements of airborne concentrations of methyl isobutyl ca taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to methyl isobutyl carbinol; 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol shall be classified as B-3 at 70 F.

(iii) Where a fan is located in duct work and where methyl isobutyl carbinol is present in concentrations greater than 2500 ppm, one fourth of the lower flammable limit, the fan rotating element shall be of non-sparking 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

(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 METHYL ISOBUTYL CARBINOL

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 1000 ppm	organic vapor carridge(s). A gas mask with a chin-style or front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Equal to or less than 2000 ppm	operated in pressure-demand (positive pressure) mode or with a full facepiece, helmet or hood operated in continuous-flow mode.
Greater than 2000 ppm, or	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode.

Entry and Escape from Unknown Concentrations	air respirator with a full facepiece operated in pressure- 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 methyl isobutyl carbinol which is contained in Appendix B in order to ensure the safe handling and use of methyl isobutyl carbinol.

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

(2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, methyl isobutyl carbinol 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 methyl isobutyl carbinol shall be Class I Group D.

(4) Combustible liquids - For the purposes of compliance with section 1910.106, liquid methyl isobutyl carbinol is classified as a Class II combustible 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 methyl isobutyl carbinol is handled, used or stored in a manner so as to create a potential fire or explosion hazard.

(6) Storage - Methyl isobutyl carbinol shall be stored so as not to come in contact with strong oxidizers.

(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 methyl isobutyl carbinol. Face shields shall comply with section 1910.133(a)(6).

(ii) Employers shall ensure that non-impervious clothing which becomes wet with liquid methyl isobutyl carbinol be removed

promptly and not reworn until the methyl isobutyl carbinol is removed from the clothing.

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

(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 methyl isobutyl carbinol may occur.

(h) Spills

(1) Spills of methyl isobutyl carbinol shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.

(2) Liquid methyl isobutyl carbinol 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 methyl isobutyl carbinol promptly wash or shower as necessary to remove any methyl isobutyl carbinol from the skin.

(2) Employers shall ensure that employees who handle liquid methyl isobutyl carbinol 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 methyl isobutyl carbinol in excess of the action level, or employees who may have skin or eye contact with liquid methyl isobutyl carbinol, or employees who work where accidental release, spill, fire, or explosion of methyl isobutyl carbinol may occur, shall annually:

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

(2) Medical -

(I) Advise employees as to the signs and symptoms of exposure to methyl isobutyl carbinol.

(II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to methyl isobutyl carbinol 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 methyl isobutyl carbinol.

(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 methyl isobutyl carbinol, or airborne concentrations of methyl isobutyl carbinol at or above the action level, a written statement as to whether such employee has a history of any of the following:

(I) Skin disease
(II) Liver disease
(III) Kidney disease

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

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

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

(I) Any of the medical conditions listed in (k)(2)
(II) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to methyl isobutyl carbinol.

(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 methyl isobutyl carbinol 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 methyl isobutyl carbinol.

(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 methyl isobutyl carbinol;
(II) A description of the employee's duties as they relate to his exposure to methyl isobutyl carbinol;
(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
(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 methyl isobutyl carbinol 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 methyl isobutyl carbinol.

(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 methyl isobutyl carbinol.

(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.

(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 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 methyl isobutyl carbinol.

(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 methyl isobutyl carbinol 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 meth

(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 methyl isobutyl carbinol which is conducted pursuant to this section.

(2) Exercise of opportunity to observe monitoring.

(i) When observation of the monitoring of employee exposure to methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Methyl isobutyl carbinol

PERMISSIBLE EXPOSURE: 25 parts of methyl isobutyl carbinol vapor per million parts of air (ppm) or 100 milligrams of methyl isobutyl carbinol vapor per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with a mild odor

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Methyl isobutyl carbinol can affect your body if it is swallowed, inhaled, or if it comes in contact with your skin or eyes.

B. Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to methyl isobutyl carbinol may cause eye and skin irritation. The overexposed person may also experience headache and drowsiness.
2. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with methyl isobutyl carbinol exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If methyl isobutyl carbinol 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 methyl isobutyl carbinol gets on your skin wash the contaminated skin with water promptly. If methyl isobutyl carbinol soaks through your clothing remove the clothing promptly and flush the skin with water. CDo not rewear the clothing until the methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol. 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol.

C. EYE PROTECTION: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) if there is any possibility of liquid methyl isobutyl carbinol contacting the eye.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Methyl isobutyl carbinol is a combustible liquid and its vapors can form explosive mixtures with air at elevated temperatures. It must be stored in tightly closed containers in a cool, well-ventilated area away from heat, sparks, flames, and strong oxidizers. Sources of ignition such as smoking and open flames are prohibited wherever methyl isobutyl carbinol 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 methyl isobutyl carbinol, and containers must be bonded and grounded when pouring or transferring liquid methyl isobutyl carbinol. If your skin becomes wet with liquid methyl isobutyl carbinol, you must promptly wash or shower to remove any methyl isobutyl carbinol from the skin. You must promptly remove any non-impervious clothing that becomes wet with liquid methyl isobutyl carbinol and this clothing must not be reworn until the methyl isobutyl carbinol is removed from the clothing. If you handle liquid methyl isobutyl carbinol, you

must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities. Fire extinguishers, eye flushing facilities and quick drenching facilities, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where methyl isobutyl carbinol is used in your work area and for any additional plant safety and health rules.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for METHYL ISOBUTYL CARBINOL

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
METHYL ISOBUTYL CARBINOL

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: methyl amyl alcohol; 4-methyl-2-pentanol; MIBC
2. Formula: $(CH_3)_2CHCH_2CHOHCH_3$
3. Molecular weight: 102

B. Physical Data

1. Boiling point (760 mm Hg): 132 C (269 F)
2. Specific gravity (water = 1): 0.8
3. Vapor density (air = 1 at boiling point of methyl isobutyl carbinol): 3.5
4. Melting point: -90 C (-130 F)
5. Vapor pressure at 20 C (68 F): 3.8 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 1.5
7. Evaporation rate (butyl acetate = 1): 0.27
8. Appearance and odor: Colorless liquid with a mild odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point : 41 C (106 F) (closed cup)
2. Autoignition temperature: data not available
3. Flammable limits in air, % by volume: Lower: 1.0; Upper: 5.5
4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Methyl isobutyl carbinol is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where methyl isobutyl carbinol is used, handled or stored. Methyl isobutyl carbinol vapors are heavier than air and may travel along the ground and be ignitied by sparks or open flames at locations remote from the site at which methyl isobutyl carbinol is handled.
7. For purposes of complying with the requirements of 29 CFR 1910.106, methyl isobutyl carbinol is classified as a Class II combustible liquid. At 2500 ppm, one-fourth of the lower

flammable limit, methyl isobutyl carbinol 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 methyl isobutyl carbinol shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: heat
2. Incompatibilities: Contact with strong oxidizers may cause fire and explosion
3. Hazardous decomposition products: toxic gases and vapors (such as carbon monoxide) may be released in a fire involving methyl isobutyl carbinol.
4. Special precautions: Methyl isobutyl carbinol will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If methyl isobutyl carbinol 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. Methyl isobutyl carbinol 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:

Methyl isobutyl carbinol 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

A. Store methyl isobutyl carbinol in tightly closed containers in a cool, well-ventilated area.

B. High exposures to methyl isobutyl carbinol can occur when transferring the liquid from one container to another.

C. Non-sparking tools must be used to open and close metal methyl isobutyl carbinol 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 methyl isobutyl carbinol could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to methyl isobutyl carbinol is likely to occur are: its use as an ingredient in solvents for resins, lacquers and other surface coatings; as an extractant in the dewaxing of mineral oils and manufacture of antibiotics; as an ingredient in hydraulic fluids; in ore flotation procedures; and as an intermediate in chemical synthesis.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for METHYL ISOBUTYL CARBINOL

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; minor skin absorption.

II. TOXICOLOGY

Only limited observations of the effects of methyl isobutyl carbinol have been reported, but exposure of rats to 2,000 ppm for eight hours is fatal, while 1,000 ppm is not. The most important effects of methyl isobutyl carbinol are narcosis and eye irritation. Unacclimated volunteer subjects exposed to 50 ppm vapor had eye irritation. Chronic systemic effects have not been reported in humans.

III. SIGNS AND SYMPTOMS

Eye irritation; probable headache and drowsiness at much higher concentrations. Chronic skin exposure may produce a dermatitis.

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 methyl isobutyl carbinol are caused by its narcotic and irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to methyl isobutyl carbinol 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 examination 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 exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- Methyl isobutyl carbinol 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.

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

3. Kidney disease -- Although methyl isobutyl carbinol is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

C. PERIODIC EXAMINATIONS

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

References

1. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 368-369.

2. American Conference of Governmental Industrial Hygienists: "Methyl Isobutyl Carbinol," (3d ed. 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, pp. 166-167.

3. Smyth, H. F., Jr., Carpenter, C. P. and Weil, C. S.: "Range-Finding Toxicity Data: List IV," A.M.A. Archives of Industrial Hygiene and Occupational Health, 4:119-122, 1951.

4. Hygienic Guide Series: "Methyl Isobutyl Carbinol," Industrial Hygiene Journal, 17:168, 1956.

REFERENCES AND SOURCES
METHYL ISOBUTYL CARBINOL
1910.93

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

Eye: Grant, "Toxicology of the Eye"

Skin: Patty, "Industrial Hygiene and Toxicology;" Browning, "Toxicity and Metabolism of Industrial Solvents;" "Encyclopedia of Occupational Safety and Health," International Labour Office; "Documentation of Threshold Limit Values"

Ingestion: Browning, "Toxicity and Metabolism of Industrial Solvents;" "Encyclopedia of Occupational Safety and Health," International Labour Office

COMMENTS

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

Grant reports that this substance "has been tested by application of a drop to rabbit eyes and has been found to cause injury of presumably transient type, graded 5 on a scale of 1 to 10 after 24 hours."

No other information concerning eye with the liquid could be found. Based on Grant's interpretation of the data of Smyth and Carpenter, the substance is assigned a classification of 2.

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

Browning and Patty give a rabbit skin penetration LD50 of 3.56 ml/kg. Patty notes that application to rabbit skin resulted in a "trace of capillary injection." ILO agrees that "the liquid may be very slightly irritating to the skin." The Documentation of TLV's agrees that skin irritation is minimal and that the substance is absorbed through the skin.

Methyl isobutyl carbinol has a vapor pressure of 3.8 mm Hg at 20 degrees C. It is 1.5% soluble in water and has a flash point of 106 degrees F.

There is no indication in the literature as to what the effects of excessive skin absorption are. The LD50 given indicates, however, that the rate of absorption is appreciable. A classification of 2 is, therefore, concluded to be warranted.

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

Browning gives an oral rat LD50 of 2.59 g/kg. ILO considers the substance to be only slightly toxic when ingested.

The substance is, at most, moderately toxic in single oral doses. Since there is no indication in the literature as to the nature of its effects in repeated small doses, it is assigned a classification of zero.

SUBSTANCE TECHNICAL GUIDELINES
METHYL ISOBUTYL CARBINOL

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for METHYL ISOBUTYL CARBINOL

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: methyl amyl alcohol; 4-methyl-2-pentanol; MIBC
2. Formula: $(CH_3)_2CHCH_2CHOHCH_3$
3. Molecular weight: 102

B. Physical Data

1. Boiling point (760 mm Hg): 132 C (269 F)
2. Specific gravity (water = 1): 0.8
3. Vapor density (air = 1 at boiling point of methyl isobutyl carbinol): 3.5
4. Melting point: -90 C (-130 F)
5. Vapor pressure at 20 C (68 F): 3.8 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 1.5
7. Evaporation rate (butyl acetate = 1): 0.27
8. Appearance and odor: Colorless liquid with a mild odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point : 41 C (106 F) (closed cup)
2. Autoignition temperature: data not available
3. Flammable limits in air, % by volume: Lower: 1.0; Upper: 5.5
4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Methyl isobutyl carbinol is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where methyl isobutyl carbinol is used, handled or stored in a manner that could create a potential fire or explosion hazard. Methyl isobutyl carbinol 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 methyl isobutyl carbinol is handled.
7. For purposes of complying with the requirements of 29 CFR 1910.106, methyl isobutyl carbinol is classified as a Class II combustible liquid. For example, 2500 ppm, approximately one-fourth of the lower flammable limit, is one situation in which methyl isobutyl carbinol 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 methyl isobutyl carbinol shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact with strong oxidizers may cause fire and explosion.

3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving methyl isobutyl carbinol.
4. Special precautions: Methyl isobutyl carbinol will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If methyl isobutyl carbinol 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. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber. Methyl isobutyl carbinol 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: Methyl isobutyl carbinol may be disposed of:
1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the 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 methyl isobutyl carbinol 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 methyl isobutyl carbinol to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

A. Store methyl isobutyl carbinol in tightly closed containers in a cool, well-ventilated area.

B. High exposures to methyl isobutyl carbinol can occur when transferring the liquid from one container to another.

C. Non-sparking tools must be used to open and close metal methyl isobutyl carbinol 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 methyl isobutyl carbinol could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to methyl isobutyl carbinol is likely to occur are: its use as an ingredient in solvents for resins, lacquers and other surface coatings; as an extractant in the dewaxing of mineral oils and manufacture of antibiotics; as an ingredient in hydraulic fluids; in ore flotation procedures; and as an intermediate in chemical synthesis.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Methyl isobutyl carbinol

D.O.L. STANDARD: 25 ppm

WARNING PROPERTIES:

Odor Threshold: The Documentation of TLV's states that Silverman and associa observed that human subjects did not find the odor of methyl isobutyl ca objectionable at 50 ppm.

Eye Irritation: According to the Documentation of TLV's, Silverman and assoc found that human subjects experienced eye irritation at 50 ppm methyl is

Evaluation of Warning Properties: Since eye irritation occurs at a level onl times the permissible exposure limit, methyl isobutyl carbinol is consid good warning properties. Gas sorbent respiratory equipment is permitted

IDLH: 2000 ppm

Basis for IDLH Value: This IDLH is based upon the report in Browning and in that exposures to 2000 ppm for 8 hours killed 5 out of 6 rats, but no ra died from a 2-hour exposure to the saturated vapor.

Other Toxicological Information: Browning reports that "the only details of toxic dosage for animals are given by Smyth, Carpenter, and Weil . . . B inhalation 2000 ppm for 8h killed 5 out of 6 rats, but no deaths occurre from inhalation of saturated vapor for 2h." Patty reports the same info tion. Browning and Patty, however, give different vapor pressure for methyl isobutyl carbinol at 20 C. Browning gives 1.8 mm Hg and Patty gi yielding saturated concentrations of approximately 2370 ppm and 4630 ppm respectively.

LFL: 10,000 ppm

VAPOR PRESSURE AT 20 C: 3.8 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 5000 ppm

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for METHYL ISOBUTYL CARBINOL

USE/EXPOSURE AND CONTROL DOCUMENT
METHYL ISOBUTYL CARBINOL

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapors and skin and eye contact with liquid during the application of nitrocellulose lacquers and other coatings (vinyl, acrylic esters, and alkyds) containing methyl isobutyl carbinol	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
2.	Inhalation of vapors and skin and eye contact with liquid during the application of hot spray lacquers containing methyl isobutyl carbinol	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
3.	Inhalation of vapors and skin and eye contact with liquid during the use of methyl isobutyl carbinol as an extractant in the dewaxing of mineral oils	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
4.	Inhalation of vapors and skin and eye contact during the use of methyl isobutyl carbinol as a frother in froth flotation of various minerals especially copper	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
5.	Inhalation of vapors and skin and eye contact during the use of methyl isobutyl carbinol as an extractant in the manufacture of antibiotics	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
6.	Inhalation of vapors and skin and eye contact during the preparation of brake fluids containing methyl isobutyl carbinol	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
7.	Inhalation of vapors and skin and eye contact with liquid during the prepara-	A,B,D	General dilution ventilation; local exhaust ventilation; personal protec-

	tion of lubricant additives from methyl isobutyl carbinol		tive equipment (impervious gloves, goggles). By analogy with n-butanol.
8.	Inhalation of vapors and skin and eye contact with liquid during the synthesis of surfactants from methyl isobutyl carbinol	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.
9.	Inhalation of vapors and skin and eye contact with liquid during the preparation of lubricating oil additives from methyl isobutyl carbinol	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (impervious gloves, goggles). By analogy with n-butanol.

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