NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND

SUPPORTING DOCUMENTATION FOR

*** METHYL CELLOSOLVE ***

NIOSH/OSHA Draft Technical Standard and Supporting Documentation for METHYL CELLOSOLVE

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 CELLOSOLVE.

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 CELLOSOLVE

(a) DEFINITIONS

(1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of methyl cellosolve in concentrations not in excess of 25 parts per million (ppm) (80 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 cellosolve.

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

(c) EXPOSURE MEASUREMENT

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

(ii) Any measurements of airborne concentrations of methyl cellosolve taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to methyl cellosolve; 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 cellosolve at or above the action level, the exposure of the employee believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum exposure of the employee.

(3) IDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of methyl cellosolve 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 cellosolve 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 cellosolve 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 cellosolve 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 cellosolve 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 cellosolve to at or below the permissible exposure.

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

(ii) Where a fan is located in duct work and where methyl cellosolve is present in concentrations greater than 6250 ppm, one fourth of the lower flammable limit, the fan rotating element 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.

(iii) In the design of open surface tank ventilation for the purposes of section 1910.94(d), operations involving methyl cellosolve shall be classified as B-3 at 70 F.

(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 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 CELLOSOLVE

Condition	
Vapor Concentration	
Equal to or less than 250 ppm	Any self-contained breathing apparatus.
Equal to or less than 1200 ppm	Any self-contained breathing apparatus with a full facepiece.
Greater than 1200 ppm, or Entry & Escape from Unknown Concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. air respirator with a full facepiece operated in pressure- auxiliary self-contained air supply operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece

	operated in pressure-demand or other positive pressure mode
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

(f) Fire and Safety

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

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

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

(4) Combustible liquids - For the purposes of compliance with sections 1910.106, liquid methyl cellosolve 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 cellosolve is handled, used or stored in a manner so as to create a potential fire or explosion hazard.

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

(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 any possibility of skin contact to liquid methyl cellosolve. Face shields shall comply with section 1910.133(a)(6).

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

(iii) Employers shall ensure that non-impervious clothing which becomes wet with liquid methyl cellosolve be removed promptly

and not reworn until the methyl cellosolve 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 methyl cellosolve may occur.

(h) Spills

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

(2) Liquid methyl cellosolve 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 contaminated with liquid methyl cellosolve promptly wash or shower to remove any methyl cellosolve from the skin.

(2) Employers shall ensure that employees who handle liquid methyl cellosolve wash their hands thoroughly with soap or mild detergent and water before eating or smoking.

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

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

(2) Medical -

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

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

(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 cellosolve.

(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 Examination - The employer shall make available to each employee who is to be exposed to liquid methyl cellosolve or airborne concentrations of methyl cellosolve at or above the action level or is at risk to skin exposure, a medical examination which shall include as a minimum the following:

(I) A medical history and physical examination with emphasis on the central nervous system and skin.

(II) A blood count to include at least a hemoglobin, hematocrit, white and red cell count and a

differential smear.

(III) Urinalysis to include specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

(3) The employer shall obtain from the physician, as a record of the examination, the following information:

(I) The physician's written opinion stating whether or not the employee has any detected medical conditions which would place him at increased risk from exposure to methyl cellosolve.

(II) A recording of the complete blood count.

(III) A recording of the urinalysis.

(4) Periodic Examinations - The employer shall make available to each employee, exposed to methyl cellosolve in excess of the action level at 12 months from the date of the employee's first exposure, and at every 12 months of exposure thereafter, a medical examination which must include the following:

(I) A medical history and physical examination (see (k)(2)(I) of this section).

(II) A complete blood count (see (k)(2)(II) of this section).

(III) Urinalysis (see (k)(2)(III) of this section).

(5) The employer shall obtain from the physician, as a record of the periodic examination, the following information:

(I) The physician's written opinion stating whether or not the employee has any detected medical conditions which would place him at increased risk to further exposure to methyl cellosolve.

(II) A recording of the complete blood count.

(III) A recording of the urinalysis.

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

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

(8) 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;

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

(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.

(9) 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 cellosolve 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 on the employee's exposure to methyl cellosolve.

(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 cellosolve.

(10) Alternative Medical Examinations - If the examining physician chooses to use alternative medical examinations to those specified in sections (2) and (4), the employer may accept such alternative medical surveillance examinations as meeting the requirements of this part provided that the employer:

(I) Obtains a statement from the examining physician setting forth the alternative medical examinations and the rationale for substitution and evidence that they will be equally effective.

(II) Informs each exposed employee of the fact that alternative medical examinations to those required in section (2) or (4) above are to be made available.

(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 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 cellosolve.

(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 cellosolve which is 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) Annual training.

(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 employee 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) Results of tests required in Section (k)(3) and (k)(5) of this Section;
(b) Physician's written opinion;
(c) Any employee medical complaints relative to exposure to methyl cellosolve;
(d) A signed statement of any refusal to be examined;
(e) A copy of information provided to the physician pursuant to paragraph (k)(8) (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

employee 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 cellosolve 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 cellosolve 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 cellosolve 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 cellosolve above the permissible exposure. The employee shall also be notified of the level of his exposure and 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 cellosolve

PERMISSIBLE EXPOSURE: 25 parts of methyl cellosolve per million parts of air (ppm) or 80 milligrams of methyl cellosolve per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with a mild, non-residual odor

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Methyl cellosolve can affect your body if you inhale it, swallow it, or if it comes in contact with your eyes or skin. Methyl cellosolve may enter your body through your skin.

B. Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to methyl cellosolve may cause irritation of the eyes, nose and throat, drowsiness, weakness and shaking. Swallowing methyl cellosolve may be fatal.

2. Long-Term Overexposure: Prolonged or repeated exposure may cause headache, drowsiness, weakness, fatigue, staggering, personality change and decreased mental ability. Anemia and other blood changes may result.

3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with methyl cellosolve exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If methyl cellosolve gets into your eyes, wash the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists, get medical attention. Contact lenses should not be worn when working with this chemical.

B. Skin Exposure: If methyl cellosolve gets on your skin, promptly wash the contaminated skin with water. If methyl cellosolve soaks through your clothing, remove the clothing immediately and flush the skin with water. If irritation persists get medical attention. Do not wear the clothing again until the methyl cellosolve has been removed. Replace or repair impervious clothing that has developed leaks.

C. Breathing: If you or any other person breathes in large amounts of methyl cellosolve 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 cellosolve 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 cellosolve. 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.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where there use is required. If you can smell methyl cellosolve 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 shield or other appropriate protective clothing to prevent any possibility of skin contact with liquid methyl cellosolve.

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 cellosolve contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Methyl cellosolve 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, strong caustics and strong oxidizers. Sources of ignition such as smoking and open flames are prohibited wherever methyl cellosolve 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 cellosolve, and containers must be bonded and grounded when pouring or transferring liquid methyl cellosolve. If your skin becomes contaminated with liquid methyl

cellosolve, you must promptly wash or shower to remove any methyl cellosolve from the skin. You must promptly remove any non-impervious clothing that becomes contaminated with liquid methyl cellosolve and this clothing must not be reworn until the methyl cellosolve is removed from the clothing. If you handled methyl cellosolve, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where methyl cellosolve is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
METHYL CELLOSOLVE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 2-Methoxyethanol; glycol monomethyl ether; ethylene glycol monomethyl ether; methyl oxitol; Ektasolve; Jeffersol EM
2. Formula: $CH_3OCH_2CH_2OH$
3. Molecular weight: 76.1

B. Physical Data

1. Boiling point (760 mm Hg): 124 C (256 F)
2. Specific gravity (water=1): 1.0
3. Vapor density (air=1 at boiling point of methyl cellosolve): 2.6
4. Melting point: -85 C (-121 F)
5. Vapor pressure 20 C (68 F): 6 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
7. Evaporation rate (butyl acetate=1): approximately 1
8. Appearance and odor: Colorless liquid with a mild, non-residual odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 42 C (107 F) (closed cup)
2. Autoignition temperature: 285 C (545 F)
3. Flammable limits in air, % by volume: Lower: 2.5 Upper: 19.8
4. Extinguishing media: Dry chemical, alcohol foam, 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 cellosolve is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where methyl cellosolve is used, handled or stored. Methyl cellosolve 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 cellosolve is handled.
7. For purposes of complying with the requirements of 29 CFR 1910.106, methyl cellosolve is classified as a Class II combustible liquid. At 6250 ppm ppm, one-fourth of the lower flammable limit, methyl cellosolve 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 cellosolve shall be Class I Group C.

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions. Contact with strong caustics may cause decomposition.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving methyl cellosolve.
4. Special precautions: Methyl cellosolve will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If methyl cellosolve 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 cellosolve 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 cellosolve may be disposed of:

1. 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 8-hour 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 cellosolve 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 cellosolve to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

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

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

C. Non-sparking tools must be used to open and close metal methyl cellosolve containers. These containers should be effectively grounded and bonded prior to pouring.

D. Employers must advise employees of all plant areas and operations where exposure to methyl cellosolve could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to methyl cellosolve is likely to occur are: during its production; its use as a solvent for resins, surface coatings, inks, adhesives and dyes; as a softening agent for heat-sealing cellophane; as a component of antiicing and antistall agents; and its use in the synthesis of plasticizers.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

Methyl cellosolve exerts its effects primarily on the hematopoietic and central nervous systems, although the vapor is also a mild irritant. Cases of toxic encephalopathy and macrocytic anemia have been reported from industrial exposures that may have been as low as 25 to 75 ppm. Symptoms were headache, drowsiness, lethargy and weakness. Manifestations of central nervous system instability included ataxia, dysarthria, tremor and somnolence. These effects are usually reversible. In acute exposures the central nervous system effects were the more pronounced, while prolonged exposure to lower concentrations produced primarily evidence of depression of erythrocyte formation. Anemia may be pronounced. When exposure was reduced to 20 ppm, no further cases occurred. The LC50 for 7 hour exposures of rats was 1,480 ppm; death was due to lung and kidney injury. Rabbits exposed to 800 ppm and 1,600 ppm for 4 to 10 days showed irritation of the upper respiratory tract and lungs, severe glomerulonephritis, hematuria and albuminuria. Instilled in rabbit eyes it caused immediate pain, conjunctival irritation, and slight corneal cloudiness which cleared in 24 hours.

III. SIGNS AND SYMPTOMS

Headache, drowsiness and weakness; ataxia, tremor and somnolence; pallor due to anemia. The liquid may be irritating to the eyes.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Central nervous system effects and blood disorders have been reported in humans exposed to methyl cellosolve. Also kidney damage has been reported after ingestion by humans, and in animals. This agent is also absorbed through the skin. It is important that the physician becomes familiar with plant operating conditions in which

exposure to methyl cellosolve 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

The following medical procedures must be made available to each employee who is exposed to methyl cellosolve:

1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the central nervous system should be stressed.

2. Complete blood count -- This compound has been shown to affect the hematopoietic system. A complete blood count must be performed before exposure including red and white cell count, a differential count of a stained blood smear, as well as hemoglobin and hematocrit.

3. Urinalysis -- This compound has caused acute kidney damage in animals and in humans after oral ingestion.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis.

References

1. American Conference of Governmental Industrial Hygienists: "Methyl Cellosolve," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, pp. 158-159.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1543-1547.

3. Hygienic Guide Series: "Methyl Cellosolve," American Industrial Hygiene Association Journal, 31:517-520, 1970.

4. Browning, Ethel: "Toxicity and Metabolism of Industrial Solvents," Elsevier Publishing Company, Amsterdam, 1965, pp. 604609.

REFERENCES AND SOURCES
METHYL CELLOSOLVE
1910.93

(d) Methods of Compliance - Open surface tank classification based on a relati evaporation rate of 16 hours.

(d) Fire and Safety

(1) Electrical - Classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," H. Carhart et al., National Academy of Sciences, 1973, report to U. S Coast Guard, report no. CG-D-92-74, p. 14.

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

Eye: Union Carbide Toxicology Study; Browning, "Toxicity and Metabolism of Ind. Solvents;" Patty, "Ind. Hyg. and Tox.;" Grant, "Toxicology of the Eye"

Skin: Union Carbide Toxicology Study; Documentation of TLV's; Browning, "Toxicity and Metabolism of Ind. Solvents;" Patty, "ind. Hyg. and Tox.;" AIHA Hyg. Guides; NIOSH Toxic Substances List (1974)

Ingestion: Patty, "Ind. Hyg. and Tox"

COMMENTS

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

Union Carbide states the "only mild surface burns are produc by one drop of this chemical in the eye of a rabbit." Browning says that "instillation into the eyes of rabbits caused immediate pain, conjunctival irritation and transitory cloudiness of the cornea." Patty says exactly the same thing as Browning but adds that cloudiness clears within 24 hours. Grant, in summarizing th work of others, states that 3 drops applied to a rabbit's eyes wa found to be only slightly irritating, causing only temporary slig reddening and swelling of the conjunctiva, graded 3 on a scale of to 10 after 24 hours. One instance of contamination of a human eye with methyl cellosolve has been recorded, and in this case recovery was complete within 48 hours.

A classification of 2 is clearly indicated as being appropri

Skin - Classification: 2
Output statement numbers: 2, 7a, 8b, 14g and 21 combined, 14i
Exceptions: See below

The Toxic Substance List and Union Carbide give a skin absor tion LD50 for rabbits of 1.34 ml/kg. Documentation of TLV's has notation "skin" after the substance name. Browning and Patty giv skin absorption LD50's of 2 g/kg. Browning states it "is absorba by the skin of animals in toxic amounts." Patty states it is "readily absorbed through the skin in toxic amounts. The materia exerts its principal physiological action upon the brain, blood, and kidneys." It is also stated in both that repeated or prolong contact with the skin of rabbits failed to cause appreciable irritation. AIHA notes that skin contact, even with the vapor, can be a significant contribution to overall exposure.

Methyl cellosolve has a vapor pressure of 6 mm Hg at 20 degrees C. It is miscible in all proportions with water and has flash point of 115 degrees F.

A classification of 2 is concluded to be appropriate if statements 14g and 14i are used instead of 17g and 17i to prevent any possibility of excessive skin absorption. Note that all skin penetration LD50's are low, serious physiological effects of the substance are detailed in the literature, and the AIHA reports that even skin contact with the vapor can contribute to exposures even though the vapor pressure of the liquid is but 6 mm Hg.

Ingestion - Classification:

Output statement numbers: 20b

Exceptions: None

Patty considers this substance "low in single-dose oral toxi moderate in repeated dose oral toxicity." He gives single dose LD50's ranging from 0.89 g/kg for rabbits to 3.4 g/kg for rats an reports "at lower dosage levels deaths are delayed and are accomp by lung edema, slight liver injury, and marked kidney injury. Hematuria may occur from single doses." It is also reported that rabbits fed daily doses of 0.1 ml/kg for 7 days showed temporary hematuria and that "larger doses caused exhaustion, tremors, albuminuria, hematuria, and death. Autopsy revealed severe kidne injury."

A classification of 2 is concluded to be appropriate to prevent any of the cited effects. The vapor pressure of the substance is not significant.

SUBSTANCE TECHNICAL GUIDELINES
METHYL CELLOSOLVE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 2-Methoxyethanol; glycol monomethyl ether; ethylene glycol monomethyl ether; methyl oxitol; Ektasolve; Jeffersol EM
2. Formula: $CH_3OCH_2CH_2OH$
3. Molecular weight: 76.1

B. Physical Data

1. Boiling point (760 mm Hg): 124 C (256 F)
2. Specific gravity (water=1): 1.0
3. Vapor density (air=1 at boiling point of methyl cellosolve): 2.6
4. Melting point: -85 C (-121 F)
5. Vapor pressure 20 C (68 F): 6 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
7. Evaporation rate (butyl acetate=1): approximately 1
8. Appearance and odor: Colorless liquid with a mild, non-residual odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 42 C (107 F) (closed cup)
2. Autoignition temperature: 285 C (545 F)
3. Flammable limits in air, % by volume: Lower: 2.5 Upper: 19.8
4. Extinguishing media: Dry chemical, alcohol foam,

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 cellosolve is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where methyl cellosolve is used, handled or stored in a manner that could create a potential fire or explosion hazard. Methyl cellosolve 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 cellosolve is handled.
7. For purposes of complying with the requirements of 29 CFR 1910.106, methyl cellosolve is classified as a Class II combustible liquid. For example, 6300 ppm, approximately one-fourth of the lower flammable limit, is one situation in which methyl cellosolve 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 cellosolve shall be Class I Group C.

B. Reactivity
1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions. Contact with strong caustics may cause decomposition.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving methyl cellosolve.
4. Special precautions: Methyl cellosolve will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If methyl cellosolve 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 cellosolve 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 cellosolve 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 8-hour 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 cellosolve 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 cellosolve to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

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

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

C. Non-sparking tools must be used to open and close metal methyl cellosolve containers. These containers should be effectively grounded and bonded prior to pouring.

D. Employers should advise employees of all plant areas and operations where exposure to methyl cellosolve could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to methyl cellosolve is likely to occur are: during its production; its use as a solvent for resins, surface coatings, inks, adhesives and dyes; as a softening agent for heat-sealing cellophane; as a component of antiicing and antistall agents; and its use in the synthesis of plasticizers.

USE/EXPOSURE AND CONTROL DOCUMENT
METHYL CELLOSOLVE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during spray application (or other method involving heat) of surface coatings containing solvent (including wood and wire-coating lacquers, metal coatings, alkyd baking enamels, phenolic varnishes, epoxy resin coatings)	A,D	Local exhaust ventilation; personal protective equipment (goggles or face shield, gloves) good personal hygiene
2.	Inhalation of vapor and skin contact with liquid during printing operations (including printing on plastic materials, rotogravure printing, and cellulose acetate pigment printing on textiles)	A,D	General dilution ventilati personal protective equipment (gloves)
3.	Inhalation of vapor and skin contact with liquid during other than spray or heat-related application of surface coatings containing solvent (including lacquers and varnishes)	A,D	Local exhaust ventilation; personal protective equipment (goggles or face shield, gloves) good personal hygiene
4.	Inhalation of vapor and skin contact with liquid during manufacture of surface coatings and dyeing agents (including stains, lacquers, dyes and inks)	A,D	Process enclosure; local exhaust ventilation
5.	Inhalation of vapor and skin contact with liquid during sealing of moisture proof cellophane wrappers and packaging	A,D	Process enclosure
6.	Inhalation of vapor and skin contact with liquid during dyeing operations (including cellulose acetate fibers and fabric and other textiles including rayon, leather dyeing and wood staining)	A,D	Process enclosure; general dilution ventilation
7.	Inhalation of vapor and skin contact with liquid	A,D	Process enclosure; general dilution ventilation

	during synthesis of substance		
8.	Inhalation of vapor and skin contact with liquid during use as an anti - icing agent (in JP-4 military jet fuel and as an anti-stall additive in gasoline)	A,D	General dilution ventilation
9.	Inhalation of vapor and skin contact with liquid during synthesis of plasticizer and other compounds (primarily di (2-methoxyethyl)- phthalate and methyl cellulose acetate)	A,D	Process enclosure; local exhaust ventilation
10.	Inhalation of vapor and skin contact with liquid durn and use of adhesives containing solvent (including polyvinyl acetal, formal and butyral and polyurethane adhesives)	A,D	Process enclosure; local exhaust ventilation; personal protective equipment (gloves)

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