

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** DIPROPYLENE GLYCOL METHYL ETHER ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DIPROPYLENE GLYCOL METHYL ETHER

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 DIPROPYLENE GLYCOL METHYL ETHER.

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

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

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(a) DEFINITIONS

- (1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of dipropylene glycol methyl ether in concentrations not in excess of 100 parts per million (ppm), (600 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 dipropylene glycol methyl ether.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which dipropylene glycol methyl ether 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 DIPROPYLENE GLYCOL METHYL ETHER - Inform affected employees of the quantity, location, and manner of use or storage of dipropylene glycol methyl ether.

(c) EXPOSURE MEASUREMENT

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

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- 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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether shall be classified as B-4 at 70 F.
 - (iii) Where a fan is located in duct work and where dipropylene glycol methyl ether is present in concentrations greater than 5000 ppm, 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

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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 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 DIPROPYLENE GLYCOL METHYL

Condition	Permissible Respiratory Protection
<hr/>	
Vapor Concentration	
Equal to or less than 1000 ppm	vapor cartridge(s) with dust, fume, and mist filter(s). A gas mask with a chin-style or front or back mounted organic vapor canister with dust, fume, and mist filter. Any supplied-air respirator. Any self-contained breathing apparatus.
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Equal to or less than 2500 ppm	
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Greater than 2500 ppm or Entry & Escape from Unknown Concentrations	operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous flow mode and an auxiliary self-contained air supply operated in pressure-demand or other positive pressure mode.
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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 dipropylene glycol methyl ether which is contained in Appendix B in order to ensure the safe handling and use of dipropylene glycol methyl ether.

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of dipropylene glycol methyl ether shall be Class I Group C.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, dipropylene glycol methyl ether 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 dipropylene glycol methyl ether shall be Class I Group C.
- (4) Combustible liquids - For the purposes of compliance with section 1910.106, liquid dipropylene glycol methyl ether is classified as a Class IIIA 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 dipropylene glycol methyl ether is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
- (6) Storage - Dipropylene glycol methyl ether shall be stored so as not to come in contact with strong oxidizers.

(g) Personal Protective Equipment

(1) Skin Contact

- (i) Employers shall ensure that clothing wet with liquid dipropylene is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of dipropylene glycol methyl ether from the clothing. Clothing is to be laundered or otherwise cleaned to remove the dipropylene glycol methyl ether, the employer shall in person performing the operation of the hazardous properties of dipropylene glycol methyl ether.

(h) Spills

- (1) Spills of dipropylene glycol methyl ether shall be cleaned up immediately after utilizing available ventilation.

(i) Reserved

- (j) Training and Information - Each employer who has employees exposed to dipropylene glycol methyl ether in excess of the action level, or

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employees who may have eye contact with liquid dipropylene glycol methyl ether, or employees who work where accidental release, spill, fire, or explosion of dipropylene glycol methyl ether may occur, shall annually:

- (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for dipropylene glycol methyl ether, which is contained in Appendix A; and
- (2) Medical -
 - (I) Advise employees as to the signs and symptoms of exposure to dipropylene glycol methyl ether.
 - (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to dipropylene glycol methyl ether 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 dipropylene glycol methyl ether.
 - (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 dipropylene glycol methyl ether, or airborne concentrations of dipropylene glycol methyl ether at or above the action level, a written statement as to whether such employee has a history of any of the following:
 - (I) Chronic lung disease
 - (II) Liver disease
 - (III) Kidney disease
 - (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 dipropylene glycol methyl ether.
 - (6) Results of Periodic Examinations - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).

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- (7) Exclusion or Removal from Exposure - No employee shall continue to be exposed to dipropylene glycol methyl ether 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 dipropylene glycol methyl ether.
 - (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;
 - (II) A description of the employee's duties as they relate to his exposure to dipropylene glycol methyl ether;
 - (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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether.
 - (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 dipropylene glycol methyl ether.
 - (11) Refusal to be Medically Examined - If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.
- (1) Recordkeeping.
- (1) Initial determination.

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- (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 dipropylene glycol methyl ether.
 - (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 dipropylene glycol methyl ether 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 dipr

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- (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 dipropylene glycol methyl ether which is conducted pursuant to this section.
- (2) Exercise of opportunity to observe monitoring.
- (i) When observation of the monitoring of employee exposure to dipropylene glycol methyl ether 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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether above the permissible exposure. The employee shall also be notified of the level of his exposure and the corrective action being taken to reduce the exposure to at or below the permissible exposure.
- (2) Pursuant to paragraph (k) of this Section, when an employee is medically examined the employer shall provide the employee with a copy of the physician's written opinion.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Dipropylene glycol methyl ether
PERMISSIBLE EXPOSURE: 100 parts of dipropylene glycol methyl ether per million parts of air (ppm) or 600 milligrams of dipropylene glycol methyl ether per cubic meter of air (mg/cu m)
APPEARANCE AND ODOR: Colorless liquid with a weak odor

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Dipropylene glycol methyl ether can affect your body if you inhale it, swallow it, or if it comes in contact with your eyes.
- B. Effects of Overexposure:
1. Short-Term Overexposure: Overexposure to high air levels or liquid splashes of dipropylene glycol methyl ether may cause irritation of the eyes and nose. Swallowing, breathing or absorbing this chemical through the skin may cause nausea and sleepiness.
 2. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with dipropylene glycol methyl ether exposure.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If dipropylene glycol methyl ether 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 dipropylene glycol methyl ether saturates your clothing, promptly remove the clothing and wash or shower. Do not rewear the clothing until the dipropylene glycol methyl ether has been removed. Wash any dipropylene methyl ether from your skin regularly. If irritation persists, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of dipropylene glycol methyl ether 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.

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- D. Swallowing: When dipropylene glycol methyl ether 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 dipropylene glycol methyl ether. 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 their use is required. If you can smell dipropylene glycol methyl ether 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: None required.

C. EYE PROTECTION: None required

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Dipropylene glycol methyl ether 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 well-ventilated area away from heat, sparks, flames, and strong oxidizers. Sources of ignition such as smoking and open flames are prohibited wherever dipropylene glycol methyl ether is handled, used, or stored in a manner that could create a potential fire or explosion hazard. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where dipropylene glycol methyl ether is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
DIPROPYLENE GLYCOL METHYL ETHER

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Dipropylene glycol monomethyl ether;
dowanol 50B
2. Formula: $\text{CH}_3\text{CH}(\text{OCH}_3)\text{CH}_2\text{OCH}_2\text{CH}(\text{OH})\text{CH}_3$
3. Molecular weight: 148

B. Physical Data

1. Boiling point (760 mm Hg): 190 C (374 F)
2. Specific gravity (water=1): 0.95
3. Vapor density (air=1 at boiling point of
dipropylene glycol methyl ether): 5.11
4. Melting point: -83 C (-117 F)
5. Vapor pressure at 20 C (68 F): 0.3 mm Hg
6. Solubility in water, % by weight at 20 C (68 F):
Miscible in all proportions
7. Evaporation rate (butyl acetate=1): 0.02
8. Appearance and odor: Colorless liquid with a weak odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 85 C (185 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
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: Dipropylene glycol
methyl ether is a combustible liquid. At elevated
temperatures its vapors can form explosive mixtures with air.
All ignition sources must be controlled where dipropylene
glycol methyl ether is handled, used, or stored in a manner
so as to create a potential fire or explosion hazard.
7. For purposes of complying with the requirements of 29 CFR
1910.106, dipropylene glycol methyl ether is classified as a
Class IIIA combustible liquid.
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 dipropylene glycol
methyl ether shall be Class I Group C.

B. Reactivity

1. Conditions contributing to instability: Heat

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2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving dipropylene glycol methyl ether.
4. Special precautions: Dipropylene glycol methyl ether will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK AND DISPOSAL PROCEDURES

- A. If dipropylene glycol methyl ether 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 may be collected and atomized in a suitable combustion chamber or absorbed on vermiculite, dry sand, earth or similar material and disposed of in a sanitary landfill.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods:
Dipropylene glycol methyl ether may be disposed of by atomizing in a suitable combustion chamber, or by absorbing on vermiculite, dry sand, earth or similar material and disposed of in a sanitary landfill.

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 dipropylene glycol methyl ether 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 dipropylene glycol methyl ether

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to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

- A. Store dipropylene glycol methyl ether in tightly closed containers away from heat.
- B. Employers must advise employees of all plant areas and operations where exposure to dipropylene glycol methyl ether could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to dipropylene glycol methyl ether is likely to occur are: during its production; its use in coatings, resins, plastics, paints, pastes, dyes and inks; as a component of hydraulic fluids, oils and greases; as a chemical intermediate; and during the manufacture of cosmetics and food additives.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Dipropylene glycol methyl ether is primarily a narcotic with mild irritating properties. Single 7 hour exposures of rats to 500 ppm vapor resulted in only mild narcosis with rapid recovery. Repeated daily inhalation exposures to four animal species at 300 to 400 ppm also produced mild narcosis but no other significant effects. These levels are disagreeable to humans, causing some eye and nasal irritation. High vapor concentrations or liquid splashes cause transient irritation of the eyes. There is no skin irritation from even prolonged or repeated contact. Chronic systemic effects have not been observed in humans.

III. SIGNS AND SYMPTOMS

Irritation of the eyes and nose. Weakness, lightheadedness, and headache may occur at high levels.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. 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 dipropylene glycol methyl ether are caused by its irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to dipropylene glycol methyl ether 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

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increased risk from dipropylene glycol methyl ether exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Liver disease -- Although dipropylene glycol methyl ether 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.
2. Kidney disease -- Although dipropylene glycol methyl ether 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.
3. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of dipropylene glycol methyl ether might cause exacerbation of symptoms due to its irritant properties.

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. American Conference of Governmental Industrial Hygienists: "Dipropylene Glycol Methyl Ether," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, p. 96.
2. Patty, Frank A.: "Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised)", Interscience Publishing Company, New York, 1963, pp. 1573-1575.
3. Rowe, V. K., et al.: "Toxicology of Mono-, Di-, and TriPropylene Glycol Methyl Ethers," A.M.A. Archives of Industrial Hygiene and Occupational Medicine, 9:509-525, 1954.
4. Browning, Ethel: "Toxicity and Metabolism of Industrial Solvents," Elsevier Publishing Company, Amsterdam, 1965, pp. 657660.

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- (d) Methods of Compliance
(1) Engineering Controls - Open surface tank classification based on relative evaporation rate of more than 500 hours. In the absence of definitive data on the lower flammable limit of dipropylene glycol methyl ether 5000 ppm was estimated to be the level above which non-sparking materials are required to minimize fire or explosion hazards from fan construction.
- (e) Fire and Safety
(i) 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. 31.
- (f) Personal Protective Equipment, and (h) Sanitation
Eye: Patty, "Ind. Hyg. and Tox.;" Browning, "Toxicity and Metabolism of Ind. Solvents;" Dos MSDS
Skin: Patty, "Ind. Hyg. and Tox.;" Documentation of TLV's
Ingestion: Patty, "Ind. Hyg. and Tox.;" Documentation of TLV's; Browning, "Toxicity and Metabolism of Ind. Solvents"

COMMENTS

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

Patty notes that "when one drop of undiluted material was placed in a rabbit's eye on each of 5 consecutive days, a mild transitory irritation of the conjunctival membranes occurred. Fluorescein staining revealed no corneal damage." Elsewhere it is stated that is is "transiently painful but not damaging." Browning agrees. Dow MSDS states "minimal irritation, nor corneal injury" and suggests that eye protection is "not normally necessary" or if provide need only be "safety glasses without side shields." It would appear that eye protection need not be made mandatory.

Skin - Classification: 0
Output statement numbers: 7b
Exceptions: Statement 7b included because of flash point of 185 deg. F

Patty notes that "continuous contact of . . . with the skin of numerous rabbits for 90 days caused only a very slight scaliness . . . The response was similar to that produced by water alone under the same conditions." Single application rabbit skin absorption tests using 20 ml/kg resulted only in transient narcosis. Patch tests on 250 humans "produced no evidence of primary irritation or sensitization of the skin." Documentation of TLV's has the notation "skin" after the chemical's name because "65 repeated doses during 90 days resulted in death in a significant number of exposed rabbits at levels of 3 ml/kg and above. There was a possibility that the compound activated latent respiratory infection in the exposed animals." Finally, in the Medical Surveillance Guidelines (Appendix C), it is stated that there is no skin irritation from even prolonged or repeated contact and that chronic systemic effects have not been observed in humans.

It is concluded that skin contact with this substance has not

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been shown to be hazardous to humans. It is therefore assigned a classification of zero.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Patty gives a single oral dose rat LD50 of about 5.5 ml/kg. Its toxicity is considered to be on the borderline between slight and practically non-toxic by the Documentation of TLV's. Vapor pressure is 0.4 mm Hg at 26 C. Browning adds that 1.0 g/kg given to rats for 35 days caused no ill effects.

SUBSTANCE TECHNICAL GUIDELINES
DIPROPYLENE GLYCOL METHYL ETHER

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Dipropylene glycol monomethyl ether; dowanol 50B

2. Formula: $\text{CH}_3\text{CH}(\text{OCH}_3)\text{CH}_2\text{OCH}_2\text{CH}(\text{OH})\text{CH}_3$

3. Molecular weight: 148

B. Physical Data

1. Boiling point (760 mm Hg): 190 C (374 F)

2. Specific gravity (water=1): 0.95

3. Vapor density (air=1 at boiling point of dipropylene glycol methyl ether): 5.11

4. Melting point: -83 C (-117 F)

5. Vapor pressure at 20 C (68 F): 0.3 mm Hg

6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions

7. Evaporation rate (butyl acetate=1): 0.02

8. Appearance and odor: Colorless liquid with a weak odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 85 C (185 F) (closed cup)

2. Autoignition temperature: Data not available

3. Flammable limits in air, % by volume: Data not available

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: Dipropylene glycol methyl ether is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where dipropylene glycol methyl ether is handled, used, or stored in a manner that could create a potential fire or explosion hazard.

7. For purposes of complying with the requirements of 29 CFR 1910.106, dipropylene glycol methyl ether is classified as a Class IIIA combustible liquid.

8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article

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500 of the National Electrical Code for dipropylene glycol methyl ether 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.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving dipropylene glycol methyl ether.
4. Special precautions: Dipropylene glycol methyl ether will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If dipropylene glycol methyl ether 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 may be collected and atomized in a suitable combustion chamber.

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

C. Waste disposal methods: Dipropylene glycol methyl ether may be disposed of:

1. By absorbing 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 dipropylene glycol methyl ether 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

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must determine the concentration of dipropylene glycol methyl ether to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

- A. Store dipropylene glycol methyl ether in tightly closed containers away from heat.
- B. Employers should advise employees of all plant areas and operations where exposure to dipropylene glycol methyl ether could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to dipropylene glycol methyl ether is likely to occur are: during its production; its use in coatings, resins, plastics, paints, pastes, dyes and inks; as a component of hydraulic fluids, oils and greases; as a chemical intermediate; and during the manufacture of cosmetics and food additives.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Dipropylene glycol methyl ether

D.O.L. STANDARD: 100 ppm

WARNING PROPERTIES:

Odor Threshold: Browning states that dipropylene glycol monomethyl ether has "a mild ether odour in moderate concentrations but a strong objectionable odour at 1000 ppm."

Eye Irritation Level: Dipropylene glycol methyl ether vapor is not known to irritant, but according to Patty, the undiluted liquid when placed in a rabbit's eye "on each of 5 consecutive days (causes) a mild transitory irritation of the conjunctival membranes."

Other Information: According to Browning, "high concentrations of the vapour (of dipropylene glycol methyl ether) cause marked irritation of the nasal mucous membrane, which is difficult for humans to tolerate."

Evaluation of Warning Properties: Browning reports that nasal irritation is warning property which "is a valuable protection against concentrations might have toxic effects, and an inhalation hazard is not likely since, remarks, 'levels that may be toxic on repeated exposure probably will not be tolerated voluntarily.'" The Documentation of TLV's notes that concentrations of 300 to 400 ppm dipropylene glycol methyl ether "were very disagreeable levels of 100 ppm, which might be voluntarily tolerated without complaint considered to be safe with respect to organic injury."

For the purposes of this standard, dipropylene glycol methyl ether is treated as a material with good warning properties. Gas sorbent respirator equipment is permitted.

IDLH: In the available toxicological information, there is no evidence of an IDLH concentration for dipropylene glycol methyl ether, as this substance "is low in toxicity by inhalation." (Patty) For the purposes of this standard, respirators have been selected on the basis of the protection factor afforded by each device up to a concentration of 5000 ppm. Concentrations above 5000 ppm are unlikely to be encountered in the workplace because of the high boiling point and low vapor pressure of this substance.

Other Toxicological Information: Concerning the effects of dipropylene glycol methyl ether, Browning states that "no toxic effects on human beings have been reported and Rowe et al. (1951) believe that it presents practically no hazard from inhalation of the vapour. . . . By inhalation, exposure of rats to 500 ppm for 7h caused only transient narcosis. . . . For rabbits and monkeys, 800 ppm for 186 days caused no ill-effects; for rats and guinea pigs,

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1500 ppm for 184 days caused only slight depression of growth and very slight injury to liver and lungs, also slight narcosis."

Patty also states that dipropylene glycol methyl ether "is low in by inhalation. The hazards to health associated with the handling and ordinary use of this material would seem to be minimal."

LFL: Data not available

VAPOR PRESSURE AT 20 C: 0.3 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 395 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
DIPROPYLENE GLYCOL METHYL ETHER

Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor and skin contact with liquid during application of coating materials (latex paints, lacquers, leather protective coatings)	A, B	General dilution ventilation
2. Inhalation of vapor and skin contact with liquid during use as a general solvent for oils and greases (especially useful since it is completely miscible in water)	A, B	General dilution ventilation
3. Inhalation of vapor and skin contact with liquid during use as a coupling and dispersing agent (manufacture and application of printing pastes and dyes, printing and writing inks)	A, B	General dilution ventilation
4. Inhalation of vapor and skin contact with liquid during manufacture of cosmetics	A, B	General dilution ventilation
5. Inhalation of vapor during the manufacture of coating materials (latex paints, lacquers, leather protective coating)	A	General dilution ventilation
6. Inhalation of vapor and skin contact with liquid during use as a food additive (slimicide in food packaging materials, adhesives in food packaging)	A, B	General dilution ventilation
7. Inhalation of vapor during manufacture of dipropylene glycol methyl ether	A	General dilution ventilation; local exhaust ventilation; process enclosure
8. Inhalation of vapor during manufacture and use of heat transfer agents (hydraulic brake fluids)	A	General dilution ventilation

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| 9. | Inhalation of vapor and skin contact with liquid during manufacture and use of metal cleaning and glass cleaning and antifogging compositions | A,B | General dilution ventilation |
| 10. | Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage tanks and in cases of accidental spillage | A,B | General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, respiratory, protective devices) |

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