

Occupational Health Guideline for Methyl Cellosolve

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $\text{CH}_3\text{OCH}_2\text{CH}_2\text{OH}$
- Synonyms: 2-Methoxyethanol; glycol monomethyl ether; ethylene glycol monomethyl ether; methyl oxitol; Ektasolve; Jeffersol EM
- Appearance and odor: Colorless liquid with a mild, non-residual odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for methyl cellosolve is 25 parts of methyl cellosolve per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 80 milligrams of methyl cellosolve per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Methyl cellosolve can affect the body if it is inhaled, is swallowed, or comes in contact with the eyes or skin. It may enter the body through the skin.

• Effects of overexposure

1. Short-term Exposure: 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 Exposure: 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: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to methyl cellosolve.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to methyl cellosolve at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing 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.

—A complete blood count: This compound has been shown to affect the hematopoietic system. A complete blood count should be performed including a red cell count, a white cell count, a differential count of a stained smear, as well as hemoglobin and hematocrit.

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

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis.

• Summary of 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 re-

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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duced to 20 ppm, no further cases occurred. The LC50 for 7-hour exposures of rats was 1480 ppm; death was due to lung and kidney injury. Rabbits exposed to 800 ppm and 1600 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.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 76.1
2. Boiling point (760 mm Hg): 124 C (256 F)
3. Specific gravity (water = 1): 1.0
4. Vapor density (air = 1 at boiling point of methyl cellosolve): 2.6
5. Melting point: -85 C (-121 F)
6. Vapor pressure at 20 C (68 F): 6 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions
8. Evaporation rate (butyl acetate = 1): Approximately 1

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fires 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.

• Flammability

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. Extinguishant: Dry chemical, alcohol foam, carbon dioxide

• Warning properties

1. Odor Threshold: May reports an odor threshold for methyl cellosolve of 60 ppm.
2. Eye Irritation Level: Grant states that methyl cellosolve, "tested by applying three drops to rabbit eyes, . . . was found to be only slightly irritating, causing only temporary, slight reddening of the conjunctiva." Browning states that the "vapor of methyl cellosolve is irritant to mucous membranes," but does not give concentrations producing this irritation.
3. Evaluation of Warning Properties: Although the odor threshold of methyl cellosolve is within three times the permissible exposure limit, odor is not considered an adequate warning property. Browning reports that cases of toxic encephalopathy and macrocytic anemia have been reported among workers exposed to concentrations as low as 25 to 75 ppm methyl cellosolve. The latter was present in a solvent mixture including ethanol and cellulose acetate, however.

The AIHA *Hygienic Guide* states that "warning properties, both odor and irritation, are not sufficient to prevent exposure to concentrations which are physiologically significant."

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

Sampling and analyses may be performed by collection of methyl cellosolve vapors using an adsorption tube with subsequent desorption with methanol in methylene chloride and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure methyl cellosolve may be used. An analytical method for methyl cellosolve is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing

necessary to prevent repeated or prolonged skin contact with liquid methyl cellosolve.

- Clothing contaminated with liquid methyl cellosolve should be placed in closed containers for storage until it can be discarded or until provision is made 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 person performing the operation should be informed of methyl cellosolve's hazardous properties.
- Where exposure of an employee's body to liquid methyl cellosolve may occur, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.
- Non-impervious clothing which becomes contaminated with liquid methyl cellosolve and any clothing which becomes wet with liquid methyl cellosolve should be removed immediately and such clothing should not be reworn until the methyl cellosolve is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid methyl cellosolve may contact the eyes.

SANITATION

- Skin that becomes contaminated with liquid methyl cellosolve should be immediately washed or showered to remove any methyl cellosolve.
- Employees who handle liquid methyl cellosolve should wash their hands thoroughly before eating or smoking.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to methyl cellosolve may occur and control methods which may be effective in each case:

Operation	Controls
Use 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, and epoxy resin coatings	Local exhaust ventilation; personal protective equipment
Use in printing on plastic materials, rotogravure printing, and cellulose acetate pigment printing on textiles	General dilution ventilation; personal protective equipment

Operation

Controls

Use during non-heat related application of surface coatings containing solvent, including varnishes and lacquers	Local exhaust ventilation; personal protective equipment
Use in manufacture of surface coatings and dyeing agents for stains, lacquers, dyes, and inks	Process enclosure; local exhaust ventilation
Liberation during sealing of moisture-proof cellophane wrappers and packaging	Process enclosure
Liberation during dyeing operations, including cellulose acetate fibers and fabric, rayon, leather dyeing, and wood staining	Process enclosure; general dilution ventilation
Use as an anti-icing agent in JP-4 military jet fuel and as an anti-stall additive in gasoline	General dilution ventilation
Liberation during synthesis of plasticizer and other compounds	Process enclosure; local exhaust ventilation

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If methyl cellosolve gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If methyl cellosolve gets on the skin, promptly wash the contaminated skin with water. If methyl cellosolve soaks through the clothing, remove the clothing immediately and flush the skin with water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of methyl cellosolve, move 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.

• Swallowing

When methyl cellosolve has been swallowed, get medical attention immediately. If medical attention is not

immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

- **Rescue**

Move the 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. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

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

- 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. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber. Methyl cellosolve should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- **Waste disposal method:**

Methyl cellosolve may be disposed of by atomizing in a suitable combustion chamber.

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RESPIRATORY PROTECTION FOR METHYL CELLOSOLVE

Condition	Minimum Respiratory Protection* Required Above 25 ppm
Vapor Concentration	
250 ppm or less	Any supplied-air respirator.** Any self-contained breathing apparatus.**
1250 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
2000 ppm or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 2000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece 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 breathing apparatus 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.

*Only NIOSH-approved or MSHA-approved equipment should be used.

**If eye irritation occurs, full-facepiece respiratory protective equipment should be used.

