

Workplace Health and Safety Bulletin



Methanol at the Work Site

What is Methanol?

Methanol, also known as methyl alcohol, methyl hydrate, carbinol, wood alcohol or wood spirits, is a clear, colourless flammable liquid. It burns with a clean, clear flame, which is almost invisible in daylight. Methanol was first distilled from wood, but is now mostly produced from methane. Methanol is also naturally produced from some bacteria and occurs naturally in blood, urine, saliva and expired air. Many foods contain methanol in small amounts, including citrus fruits and juices, vegetables, fermented beverages and diet foods.

Properties of Methanol

Methanol is completely soluble with water, ethanol, ether and many other organic solvents. Its odour threshold varies widely, so odour cannot be relied upon as a warning property.

Methanol is very flammable; its flashpoint is about 12°C. It mixes well with air, so explosive mixtures can easily be formed. Vapours can accumulate in confined or low areas, or travel a considerable distance to a source of ignition and flash back. At high temperatures, it can decompose to form carbon monoxide and formaldehyde. Formaldehyde and other irritating substances are given off when it burns. Methanol reacts violently with strong oxidizers such as perchlorates, chromium trioxide, bromine, sodium hypochlorite, chlorine and hydrogen peroxide, resulting in a fire or explosion.



Uses of Methanol

Methanol is used in the production of a number of products, including:

- Formaldehyde
- Methyl t-butyl ether (MTBE)
- Acetic acid
- Methyl methacrylate
- Gasoline

It is used as a solvent in:

- Antifreeze
- The oil and gas sector to prevent the formation of gas hydrates at low temperatures
- An absorption agent in gas scrubbers
- Drilling mud in oil fields
- Refrigeration systems
- Laboratories
- Base ingredient for a variety of oilfield chemicals such as corrosion inhibitors and demulsifiers

It is used as an ingredient in shellac, paint, varnish, paint thinner, plastics, inks, dyes, cements, nail polish remover, artificial sweeteners, automotive windshield washer fluid. Denatured alcohol is ethanol to which methanol is added to make it unfit for human consumption. It is also used, on a small scale, as motor fuel (particularly as a fuel blend for race cars).

Health effects

Methanol toxicity has been most often linked to ingestion (drinking) of the chemical. People who ingest the chemical must receive medical attention immediately. The most common way that workers may be exposed to methanol at the work site is by inhaling methanol vapours or by absorption through the skin (either by contact with methanol or its vapours or with methanol-contaminated clothing). However, workers may also be exposed by ingestion from drinking from unmarked containers that contain methanol.

Acute health effects

Methanol is irritating to the eyes, skin and respiratory tract at high concentrations. Problems with vision, including blindness, have been reported in workers exposed to methanol above occupational exposure limits.

When methanol is swallowed or high concentrations are inhaled, the symptoms can include nausea, headache, weakness, vomiting, dizziness, and blurred vision. There may be a delay between exposure and the onset of these symptoms. A significant amount of methanol can be absorbed through the skin, causing the same health effects as with inhalation, including blindness and optic nerve damage. Drowsiness, coma and death have also been reported, depending on the amount of exposure.

Chronic health effects

There is not as much information on long-term health effects from exposure to methanol. However most scientific studies indicate that the long-term health effects are similar to the short-term (acute) effects.

Prolonged or repeated contact with the skin can cause dermatitis (dry, itchy, scaling skin).

Health Assessment

There is no legislated requirement for workers exposed to methanol to have a medical assessment. However, if there is doubt whether a worker should be exposed to methanol, an occupational physician should be consulted.

The American Conference of Governmental Industrial Hygienists (ACGIH) has published Biological Exposure Indices (BEI®) for methanol in urine. Note that the use of biological indices is not a substitute for workplace air monitoring.

The BEI® for methanol is 15 mg/L in urine, measured at the end of shift.

Preventative measures

Preventing exposure to methanol is the best way to protect health. Options that should be considered include the following (listed in order of preference):

- Use of less hazardous substitutes
- Use of engineering controls
- Changes in work practices to reduce exposure (administrative controls)
- Use of personal protective equipment

Substitution

If possible, other less hazardous or less flammable solvents should be substituted for methanol. In fuels, ethanol may be used as a substitute for methanol. In some cases, methanol can be diluted with water to reduce the hazard.

Engineering controls

Engineering controls are processes used to eliminate exposure to a substance. Engineering controls contain the substance, remove the substance from the air or provide a barrier between the worker and the substance. Examples of engineering controls that can be used to prevent exposure to methanol include:

- Installation of local ventilation hoods
- Ventilated enclosures around work processes (fume hoods, glove boxes)
- Use of closed piping and storage systems
- Use of automatic systems to pump methanol from storage containers to process systems or containers

Where ventilation systems are used at the work site, they must be designed in accordance with established engineering principles and not vent back into the work area.

If engineering controls are working properly, they will eliminate or greatly reduce the potential hazard. They only need to be installed once and do not place a physical burden on workers. However, an initial investment is required and the systems must be properly operated and maintained once installed.

Administrative controls

Work practices that can be used in the workplace to reduce exposure to methanol include:

- Educating workers about the hazards of methanol. Workers must participate in training and monitoring programs in the workplace.
- Using good hygiene practices. Workers must not eat, drink or use tobacco products in areas where methanol or products containing methanol are used or stored. The hands, forearms and face should be washed thoroughly after handling methanol, before eating, drinking, smoking, using the washroom and at the end of the work shift.
- Properly using and maintaining engineering controls and other equipment used to reduce exposure.
- Labelling and storing methanol properly.
- Ensuring that unprotected workers are not in areas where products containing methanol are used.
- Cleaning up spills are quickly and properly and using appropriate protective equipment and clothing.
- Keeping product containers tightly sealed when they are not in use.
- Ensuring that eyewash stations and safety showers are located near the work area.
- Using appropriately labelled and designated containers for methanol.

Methanol presents a fire hazard as well as a health hazard to workers. Particular attention must be paid to fire safety and potential sources of ignition in areas where methanol is used and stored. Methanol should be stored in a cool, dry, well-ventilated area, out of direct sunlight and in a part of the work site that is separate from the production area. Storage containers must be compatible with the chemical (methanol will degrade some plastics and react with some metals). Methanol should never be stored with oxidizing or other incompatible chemicals. The product material safety data sheet and manufacturer should be consulted for more information on proper storage and handling.

For more information



http://employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf

Handling and Storage of Flammable Materials at the Work Site – FEX002

 www.enform.ca/assets/files/irp8_final_2005.pdf.

Enform Industry Recommended Practice Volume 8: Pumping of Flammable Fluids

Implementing administrative controls to reduce exposure are often less expensive than other control measures, but workers must be properly trained and use the safe work practices. The employer must monitor this in the workplace.

Workplace air monitoring

When methanol or a product containing methanol is used in the workplace, air monitoring should be done as required by the hazard assessment for the work activities or workplace conditions to ensure that the Occupational Exposure Limit (OEL) is not exceeded. Air samples must be collected and analyzed using a National Institute of Occupational Safety and Health (NIOSH) method or a method approved by a Director of Occupational Hygiene. NIOSH has three methods that can be used for methanol:

- Method 2000, Methanol
- Method 2549, Volatile Organic Compounds (Screening)
- Method 3800, Organic and Inorganic Gases by Extractive FTIR Spectrometry

The NIOSH Manual of Analytical Methods is available online at

 <http://www.cdc.gov/niosh/nmam/>.

Personal protective equipment

If it is not practical or feasible to use substitutes, engineering controls or administrative controls to reduce the potential for exposure, or they are not sufficient, the employer must provide workers with appropriate protective equipment.

Respiratory protective equipment is used to protect workers from inhaling airborne vapours. There are many types of respirators available. It is important to select the correct type and level of respiratory protection based on the type of work being done and the airborne concentrations of methanol at the work site.

If a respirator is required, properly operating NIOSH approved, air-supplying respirators are the most effective type of respiratory protection for methanol vapours. Air purifying respirators with organic vapour cartridges may not provide enough protection against methanol exposure. Because the odour threshold for methanol is variable, it may not be detected by smell below the OEL. Because of this, the wearer will not be able to detect when a cartridge is in need of changing and may unknowingly become overexposed.

If air-purifying respirators are used for methanol, the employer must:

- Ensure that the respirator has an end-of-use indicator (the indicator will show when the cartridges must be changed), or
- Use a change-out schedule that has been calculated by a competent person. If a calculated change-out schedule is used, the U.S. Occupational Safety and Health Administration (OSHA) method, or an equivalent method, must be used. The employer must also have written procedures that address how the calculations are done, confirm the method used for the calculations and specify training to ensure that workers understand and use the system for cartridge change out. The OSHA method may be accessed online at



www.osha.gov/SLTC/etools/respiratory/change_schedule.html

For more information



http://employment.alberta.ca/documents/WHS/WHS-PUB_ppe004.pdf

Guideline for the Development of a Code of Practice for Respiratory Protective Equipment - PPE004



http://employment.alberta.ca/documents/WHS/WHS-PUB_ppe001.pdf

Respiratory Protective Equipment: An Employers' Guide -PPE001



http://employment.alberta.ca/documents/WHS/WHS-PUB_mg005.pdf

Medical Assessment of Fitness to Wear a Respirator - MG005

Employers should also refer to the CSA Standard Z94.4-02, Selection, Use and Care of Respirators.

Since methanol can be absorbed through the skin, chemical resistant gloves (such as neoprene) and other protective clothing are needed for workers who handle methanol, items contaminated by methanol or who may be exposed to airborne methanol vapours. Workers who may be exposed to methanol should ensure that they wear protective

clothing that covers the areas at risk of contact. When handling large quantities or where splashing may occur, protect the arms, legs and torso. Workers should also wear airtight chemical splash goggles or full-face respirator masks to protect the eyes from vapours or splashes. Where skin contact occurs, the area should be thoroughly washed immediately. Contaminated clothing must be properly disposed of or washed before re-using. Workers should not bring contaminated clothing home to be washed. Information about protective clothing materials recommended for methanol is available from the NIOSH database “Recommendations for Chemical Protective Clothing”. The database is available online at

 <http://www.cdc.gov/niosh/prot-cloth/ncpc2.html>.

Although the use of personal protective equipment may initially seem less costly, workers need to be trained to use, care for and maintain the protective equipment. Employers need to provide training, monitor the use of protective equipment and ensure that the protective equipment is properly maintained. In some cases, personal protective equipment can create a hazard to workers (heat stress, limited vision, allergic reactions to the equipment material). These issues need to be evaluated when personal protective equipment is selected.

Regulatory requirements

The Alberta health and safety legislation has general and specific requirements related to methanol. An OEL for methanol is provided that includes a “skin” notation (methanol can be absorbed through the skin). This limit applies to workers directly involved with tasks using methanol or products containing methanol, and also to other workers in the workplace who may be exposed to methanol indirectly from these operations. It is important to note that OELs represent standards for the protection of most healthy workers. Steps must be taken to keep methanol levels as low as reasonably practicable.

The employer must also:

- Train workers on the health hazards from exposure to methanol and the safe work procedures developed by the employer
- Ensure that workers have immediate access to an eyewash and emergency shower
- Comply with requirements for handling and storage of flammable materials

- Ensure that the need for ventilation is properly assessed and systems that are installed are properly designed and maintained. Workers also need training on the proper operation and maintenance of these systems.
- Provide appropriate protective equipment (including respirators) where concentrations of methanol cannot be controlled below safe limits. Workers must use the required protective equipment and must be trained on its proper use and care.


Additional regulatory requirements for the handling and storage of flammable materials in the workplace are in Part 4 of the Alberta Fire Code. More information on these requirements can be found on the Alberta Municipal Affairs website at

 www.municipalaffairs.gov.ab.ca/ss_Fire.htm.

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www.whs.gov.ab.ca/whs-legislation

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