

Information and recommendations for paramedics and doctors at the site

- Exposed or intoxicated patients do not pose a significant risk of secondary contamination.
- Ingestion of 10-15 ml methanol can cause severe systemic toxic effects, in particular irreversible blindness and central nervous system depression concomitant with metabolic acidosis. Dosage of approximately 1 ml methanol/kg body weight may result in death.
- Methanol is slightly irritating when it comes in contact with the eyes, skin, and upper respiratory tract causing redness and lacrimation of the eyes, coughing, and defatting and inflammation of the skin.
- Inhalation exposure to a concentration above 1000 ppm and prolonged or extensive skin contact may result in significant systemic toxic absorption of methanol.
- Methanol intoxication can be treated by inhibiting the formation of toxic metabolites. This can be achieved by the administration of 4-methylpyrazole (fomepizole) or ethanol. If conscious after ingestion of methanol and if not already done, the adult patient should immediately drink alcoholic beverages containing about 0.7 g ethanol/kg body weight, e.g. 150 ml of whiskey/brandy. Alternatively, or if the patient's consciousness is impaired, 4-methylpyrazole or ethanol should be administered intravenously.
- Obtain blood sample for measurement of the methanol concentration (if analytical method is immediately available). Collect a urine sample for biomonitoring.

1. Substance information

Methanol (CH₃OH), CAS 67-56-1

Synonyms: carbinol, methyl alcohol, wood alcohol, wood spirit
Methanol is, at room temperature, a clear, colorless, volatile and flammable liquid (boiling point 65°C, 116°F, respectively). Its mild alcohol odor can be perceived at a threshold concentration of 5 to 100 ppm. Methanol is soluble in water.

Methanol is widely used as a solvent, as an antifreeze fluid, as a fuel and as an intermediate in the manufacture of formaldehyde, acetic acid and methyl esters.

2. Routes of exposure

Inhalation

Inhalation is a relevant route of industrial exposures. Methanol's odor and irritant properties generally provide adequate warning of hazardous concentrations. Methanol is slightly heavier than air and may cause asphyxiation in poorly ventilated, low-lying, or enclosed spaces.

Skin/eye contact

Methanol can cause slight irritation to the skin and the eyes. **Methanol is well absorbed through the intact skin.**

Ingestion

Ingestion of methanol results in severe systemic intoxication. Severe signs or symptoms of intoxication may be preceded by an asymptomatic latent period.

3. Acute health effects

Ingestion of 0.1 g methanol/kg body weight or more should be considered as severe, ingestion of more than 1 g methanol/kg body weight as potentially lethal. Inhalation exposure to a concentration of more than 1000 ppm or prolonged or extended skin exposure may also cause systemic toxicity. Three stages are usually distinguished:

1. Narcotic stage

Until up to 8 hours after methanol intoxication, symptoms of inebriation as in ethanol intoxication, but to a lesser degree, might occur: slight central nervous system depression, confusion, ataxia. Gastrointestinal irritation may result in nausea, vomiting, and epigastric pain.

2. Latent period

Patients with - even severe - methanol intoxication are often asymptomatic during a latent period between 6 and 36 hours after exposure.

3. Acidosis/neurotoxicity

The severity of methanol poisoning symptoms is proportional to **anion gap metabolic acidosis** resulting from the oxidation of methanol to formic acid, which accumulates. Headache, dizziness, vomiting, periodic respiration, and coma with respiratory failure eventually leading to death may occur. **Visual disturbances become evident soon after onset of metabolic acidosis. Congested and edematous retina, blurred edges of the optic disc, dilated, unreactive pupils, and dim vision are characteristic and may result in blindness.** Pancreatic injury may result in severe abdominal pain.

Local effects

Methanol is slightly irritating when it comes in contact with the eyes, skin, and upper respiratory tract causing redness and lacrimation of the eyes, coughing, and defatting and inflammation of the skin.

4. Actions**First aid**

Patients exposed to methanol do not pose a significant risk of secondary contamination. Patients should be removed from the contaminated zone immediately. Patients who are unable to walk may be removed on backboards or stretchers; if these are not available, carefully remove/transport patients with appropriate action to a safe zone, taking into account your self-protection. Immediate priorities must follow the "A, B, C's" of resuscitation.

After ingestion

If conscious and if not already done, the adult patient should immediately drink alcoholic beverages containing about 0.7 g ethanol/kg body weight, e.g. 150 ml of whiskey/brandy. Do not induce emesis. If the patient's consciousness is impaired or if a large dose has been ingested less than 30 minutes before evaluation of the patient's condition, consider immediate gastric lavage with a small-bore tube.

4-methylpyrazole, a synthetic alcohol dehydrogenase inhibitor, is often considered as first-line treatment:

Immediate intravenous infusion of the loading dose of 15 mg/kg body weight over 30 min. Early administration of 4-methylpyrazole probably obviates the need for treatment by hemodialysis.

If 4-methylpyrazole is not available, intravenous infusion of 0.6 g ethanol/kg body weight represents an alternative treatment option.

If the patient has concurrently ingested ethanol, then the ethanol loading dose must be modified so that the blood ethanol level does not exceed 100 to 130 mg/dl (21.7 to 28.2 mmol/l).

If symptomatic, administer IV leucovorin 1 mg/kg bodyweight once (up to 50 mg/dose) followed by IV folic acid 1 mg/kg bodyweight (up to 50 mg/dose) once every 4 hours for 6 doses, to enhance the metabolism of formic acid. If asymptomatic, administer folic acid only.

If signs of hypoxemia are present, humidified supplemental oxygen should be administered.

Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.

After inhalation or skin/eye contact

Patients exposed only to methanol vapor who have no evidence of skin or eye irritation do not need decontamination. All others require decontamination.

Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid methanol and if clothing is contaminated, remove and double-bag the clothing.

Treat patients exposed to an airborne concentration of 1000 ppm or greater and patients with prolonged or extended skin exposure similarly to those having ingested methanol.

Assure that exposed skin and hair have been flushed with plain water for at least 15 minutes. If not, continue flushing during other basic care and transport. Protect eyes during flushing of skin and hair.

Assure that exposed or irritated eyes have been irrigated with plain water or saline for at least 15 minutes. If not, continue eye irrigation during other basic care and transport.

Remove contact lenses if present and easily removable without additional trauma to the eye.

Patients who have ingested methanol or have been exposed to an airborne concentration of 1000 ppm or greater and patients with prolonged or extended skin exposure should be transferred to a hospital/emergency department.

*Patient release/
follow-up instructions*

Asymptomatic patients, who have not ingested methanol, exposed to an airborne concentration of **less than 1000 ppm** and without prolonged or extended skin exposure **as well as patients who have a normal clinical examination and no signs or symptoms of toxicity may be discharged after an appropriate observation period in the following circumstances:**

- a) The evaluating physician is experienced in the evaluation of individuals with methanol exposure.
- b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.
- c) The physician is comfortable that the patient understands the health effects of methanol and the provided follow-up instructions.
- d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release.
- e) Heavy physical work should be precluded for 24 hours.

All patients requiring treatment for methanol intoxication should be examined by an ophthalmologist.

In this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for paramedics and doctors at the site in assessing the condition and managing the treatment of patients exposed to methanol. It is not, however, a substitute for the professional judgement of a paramedic or a doctor and must be interpreted in the light of specific information regarding the patient available to such a paramedic or doctor and in conjunction with other sources of authority.

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