



UK Health
Security
Agency

Methanol

Incident management

This document provides information needed for response to a chemical incident, such as physicochemical properties, health effects and decontamination advice.

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Main points

General

Methanol is a flammable liquid at room temperature with an alcohol like odour. It releases vapours that form an explosive mixture with air. It emits acrid smoke and irritating fumes when heated to decomposition.

Methanol reacts violently with strong oxidants, acids and reducing agents. It is miscible in water.

Health

Methanol is toxic by ingestion, inhalation and dermal absorption.

Absorption of methanol is rapid, but the onset of metabolic toxic features may be delayed for several hours.

Ataxia, drowsiness, dysarthria and nystagmus may occur within 30 minutes of ingestion.

Headache, confusion and vertigo occur with mild to moderate toxicity; convulsions and coma are seen in severe toxicity. Blurred vision, "snow field" effect and photophobia are common visual features.

Exposure to the eyes may cause irritation, immediate stinging and burning sensation with lacrimation.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving methanol, unless casualties are demonstrating signs or symptoms of exposure to caustic or corrosive substances.



Environment

Inform the [Environment Agency](#) where appropriate and avoid release into the environment.

Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.

Hazard identification

Table 1. Standard (UK) dangerous goods emergency action codes for methanol

UN		1230	Methanol	
EAC		•2WE	Use alcohol resistant foam but, if not available, fine water spray can be used. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus [note 1]. Substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters. There may be a public safety hazard outside the immediate area of the incident [note 2].	
APP		A(fl)	Fire kit with gas tight chemical protective suit with breathing apparatus [note 3]	
Hazards	Class	3	Flammable liquids and desensitised liquid explosives	
	Sub-risks	6.1	Toxic substance	
HIN		336	Highly flammable liquid, toxic	

Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

Notes to Table 1

Note 1: Chemical protective clothing with liquid tight connections for whole body (Type 3) conforming to the relevant standards such as BS 8428 or EN 14605 in combination with breathing apparatus conforming to BS EN 137.

Note 2: People should be warned to stay indoors with all doors and windows closed, preferably in rooms upstairs and facing away from the incident. Ignition sources should be

eliminated and ventilation stopped. Effects may spread beyond the immediate vicinity. All non-essential personnel should be instructed to move at least 250 m away from the incident.

Note 3: Normal fire kit in combination with gas-tight chemical protective clothing conforming to BS EN 943 part 2 in combination with breathing apparatus conforming to BS EN 137.

References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)' 2023 (viewed on 07 October 2024)

Table 2a. The GB classification, labelling and packaging (CLP) regulation for methanol




Hazard class and category	Flam. Liq. 2	Flammable liquid, category 2	
	Acute Tox. 3	Acute toxicity (oral, dermal, inhalation), category 3	
	STOT SE 1	Specific target organ toxicity following single exposure, category 1	
Hazard statement	H225	Highly flammable liquid and vapour	
	H301	Toxic if swallowed	
	H311	Toxic in contact with skin	
	H331	Toxic if inhaled	
	H370	Causes damage to organs	
Signal words	DANGER		

Table 2b. Specific concentration limits for methanol

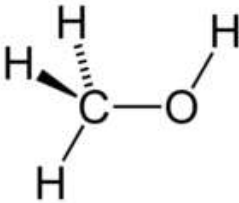
Concentration	Hazard class and category	Hazard statement	
$C \geq 10\%$	STOT SE 1	H370	Causes damage to organs
$3\% \leq C < 10\%$	STOT SE 2	H371	May cause damage to organs

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 07 October 2024).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	67-56-1
Molecular weight	32
Formula	CH ₃ OH
Common synonyms	Methyl alcohol, wood alcohol, carbinol
State at room temperature	Liquid
Volatility	Vapour pressure = 127 mmHg at 25°C
Specific gravity	0.79 at 20°C (water = 1) 1.1 (air = 1)
Flammability	Flammable
Lower explosive limit	6%
Upper explosive limit	50%
Water solubility	Miscible
Reactivity	The vapour mixes well with air; explosive mixtures are easily formed. Reacts violently with strong strong oxidants, acids and reducing agents generating fire and explosion hazard. When heated to decomposition, it emits acrid smoke and irritating fumes, including formaldehyde.
Odour	Alcoholic odour
Structure	

References

International Labour Organization (ILO). [International Chemical Safety Card entry for methanol](#). ICSC 0057, 2018. World Health Organization. Geneva (viewed on 07 October 2024)

PubChem Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. ['PubChem Compound Summary for CID 887, Methanol'](#) (viewed on 07 October 2024)

Reported effect levels from authoritative sources

Table 4a. Exposure by inhalation of vapours

ppm	mg/m ³	Signs and symptoms	Reference
>300	>400	Toxicity has been associated with inhalation of methanol vapours at this level.	a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values.

References

a. International Programme on Chemical Safety. '[Methanol. Environmental Health Criteria 196](#)' 1997. (viewed on 07 October, 2024)

Table 4b. Exposure by ingestion

mL (pure ethanol)	Signs and symptoms	Reference
10	Has resulted in blindness	a
30	Has resulted in death	a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values.

References

a. National Poisons Information Service. [TOXBASE](#) Methanol, December 2016. (viewed on 07 October 2024)

Published emergency response guidelines

Table 5. Interim acute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 minutes	30 minutes	60 minutes	4 hours	8 hours
AEGL-1 [note 1]	670	670	530	340	270
AEGL-2 [note 2]	11,000 [note 4]	4,000	2,100	730	520
AEGL-3 [note 3]	40,000 [note 5]	14,000 [note 4]	7,200 [note 4]	2,400	1,600

Notes to Table 5

Note 1: Level of the chemical in air at or above which the general population could experience notable discomfort.

Note 2: Level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or impaired ability to escape.

Note 3: Level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

Note 4: >10% of the lower explosive limit of 55,000 ppm. Safety consideration against the hazard(s) of explosion(s) must be taken into account.

Note 5: >50% of the lower explosive limit of 55,000 ppm. Extreme safety considerations against the hazard(s) of explosion(s) must be taken into account.

Level of distinct order awareness = 8.9 ppm

Reference

US Environmental Protection Agency (EPA) '[Acute Exposure Guideline Levels](#)' 2024 (viewed 07 October 2024)

Exposure standards, guidelines or regulations

Table 6. Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m ³	ppm	mg/m ³
WEL	200	266	250	333

Abbreviations

WEL = workplace exposure limit.

LTEL = long-term exposure limit.

STEL = short-term exposure limit.

Reference

Health and Safety Executive. '[EH40/2005 Workplace Exposure Limits](#) . Fourth Edition' 2020 (viewed on 07 October 2024)

Table 7. Public health standards and guidelines

Drinking water standard	No value specified
WHO guideline for drinking water quality	No value specified
UK indoor air quality guideline	No value specified
WHO indoor air quality guideline	No value specified
WHO air quality guideline	No value specified

Health effects

Toxic by ingestion, inhalation and skin absorption.

Absorption of methanol is rapid, but the onset of toxic features may be delayed for several hours, particularly if co-ingested with ethanol which delays methanol metabolism due to competitive inhibition.

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
<p>Inhalation/ Ingestion/ Dermal</p>	<p>Ataxia, drowsiness, dysarthria and nystagmus may occur within 30 minutes of ingestion, followed by a latent period of 12 to 24 hours before metabolic toxicity becomes apparent.</p> <p>Poor prognostic features include convulsions, coma, shock, persistent acidosis, bradycardia and renal failure. Severe, but reversible cardiac failure and ECG abnormalities have been described.</p> <p>Central nervous system: Headache, confusion and vertigo occur with mild to moderate toxicity. Convulsions and coma are seen in severe toxicity. Extrapyrarnidal features may develop in patients who survive severe toxicity. This is due to necrosis in the putamen and subcortical white matter, which can often be shown by MRI scan.</p> <p>Visual: Common features include blurred vision, with the appearance of a "snow field", and photophobia. Optic disc and retinal oedema occur with diminished pupillary light response. The extent of these features appears to correlate with the severity of toxicity. Patients may be left with persistent visual impairment including optic atrophy, diminished visual acuity, loss of colour vision, central scotoma or blindness. Blindness is usually permanent, but in some cases a degree of recovery may occur over a period of months.</p> <p>Gastrointestinal: Common features include nausea, vomiting and abdominal pain. Acute pancreatitis can occur and a small, transient rise in liver transaminases may be seen.</p>

Route	Signs and symptoms
	Metabolic: A severe metabolic acidosis with an increased anion and osmolar gap is usually seen. Tachypnoea is common. Hyperglycaemia may occur. Renal failure may develop in severe cases.
Eyes	May be irritating to the eyes, causing an immediate stinging and burning sensation with lacrimation.

Reference

National Poisons Information Service. [TOXBASE](#) '[Methanol](#)' 2016 (viewed on 07 October 2024)

Decontamination at the scene

Chemical specific advice

The approach used for decontamination at the scene will depend upon the incident, location of the casualties and the chemicals involved. Therefore, a risk assessment should be conducted to decide on the most appropriate method of decontamination.

Following disrobe, improvised dry decontamination should be considered for an incident involving methanol, unless casualties are demonstrating signs or symptoms of exposure to caustic or corrosive substances.

People who are processed through improvised decontamination should subsequently be moved to a safe location, triaged and subject to health and scientific advice. Based on the outcome of the assessment, they may require further decontamination.

Emergency services and public health professionals can obtain further advice from the UK Health Security Agency (UKHSA) Radiation, Chemicals and Environment Directorate using the 24- hour chemical hotline number: 0344 892 0555.

Disrobe

The disrobe process is highly effective at reducing exposure to HAZMAT/CBRN material when performed within 15 minutes of exposure.

Therefore, disrobe must be considered the primary action following evacuation from a contaminated area.

Where possible, disrobing should be conducted at the scene and by the casualty themselves. Disrobing should be systematic to prevent transfer of contaminant from clothing to skin. Clothing should not be pulled over the head if possible.

Clothing stuck to the casualty by the contaminant should not be forcefully removed, as this risks causing further harm.

Consideration should be given to ensuring the welfare and dignity of casualties as far as possible. Immediately after decontamination the opportunity should be provided to dry and dress in clean robes or clothes.

Improvised decontamination

Improvised decontamination is an immediate method of decontamination prior to the use of specialised resources. This should be performed on all contaminated casualties unless medical advice is received to the contrary. Improvised dry decontamination should be considered for an incident involving chemicals unless the agent appears to be corrosive or caustic.

Unprotected first responders and members of the public should not approach casualties incapacitated by exposure to administer improvised decontamination, as they may be exposed to contaminants and become a casualty themselves.

Important note: Improvised decontamination should continue until more structured interventions such as Interim or Specialist Operational Response are present.

Improvised dry decontamination

Improvised dry decontamination should be considered for an incident involving methanol unless casualties are demonstrating obvious signs of chemical burns or skin irritation.

Any available dry absorbent material can be used such as kitchen towel, paper tissues (for example blue roll) and clean cloth.

Exposed skin surfaces should be blotted first and then rubbed, starting with the face, head, and neck, and moving down and away from the body.

Blotting and rubbing should not be too aggressive, as it could drive contamination further into the skin.

Casualties should also blow their nose to remove contaminants from the nasal cavities.

All waste material arising from decontamination should be left in situ, and ideally bagged, for disposal at a later stage.

Improvised wet decontamination

Wet decontamination should be used if contamination with a caustic chemical substance is suspected.

Water should only be used for decontamination where casualty signs and symptoms are consistent with exposure to caustic or corrosive substances such as acids or alkalis.

Wet decontamination may be performed using copious amounts of water from any available source such as taps, showers, water bottles, fixed installation hose-reels and sprinklers to gently rinse the affected skin. Other natural sources of water may be considered unless this creates greater risks to the individuals affected. Wet wipes or baby wipes may be used as an effective alternative.

Improvised decontamination should not involve overly aggressive methods to remove contamination as this could further damage affected tissues and drive the contamination further into the skin.

Where appropriate, seek professional advice on how to dispose of contaminated water and prevent run-off going into the water system.

Additional notes

Following improvised decontamination, remain cautious and observe for signs and symptoms in the decontaminated person and in unprotected staff.

If water is used to decontaminate casualties this may be contaminated, and therefore hazardous, and a potential source of further contamination spread.

All materials (paper tissues and so on) used in this process may also be contaminated and, where possible, should not be used on new casualties.

The risk from hypothermia should be considered when disrobe and any form of wet decontamination is carried out.

People who are contaminated should not eat, drink or smoke before or during the decontamination process and should avoid touching their face.

When vulnerable people are affected by a hazardous substance, they may need additional support to remove themselves, their clothing or the substance.

Casualties should remain in the area and should not leave to seek care at a hospital, as this presents a contamination risk. Further care will be administered on site by the appropriate emergency services.

Interim wet decontamination

Interim decontamination is the use of standard Fire and Rescue Service equipment to provide a planned and structured decontamination process prior to the availability of purpose-designed decontamination equipment.

Decontamination at the scene references

Home Office. [‘Initial operational response to a CBRN incident’](#) Version 2.0 July 2015. (viewed on 07 October 2024)

NHS England. [‘Emergency Preparedness, Resilience and Response \(EPRR\): Guidance for the initial management of self-presenters from incidents involving hazardous materials’](#) February 2019 (viewed on 07 October 2024)

JESIP. [‘Initial Operational Response IOR to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) June 2024 (viewed on 07 October 2024)

Clinical decontamination and first aid

Clinical decontamination is the process where trained healthcare professionals, using purpose-designed decontamination equipment, treat contaminated persons individually.

[Detailed information on clinical management](#) can be found on TOXBASE.

Important notes

There are antidotes available for the treatment of methanol poisoning. Early treatment with an antidote will prevent the production of toxic metabolites, severe acidosis and renal failure. Delay in commencing treatment with an antidote will result in a more severely poisoned patient. Details on the use of antidotes in treating methanol poisoning is available on [TOXBASE](#).

Once body surface contaminants have been removed or if your patient was exposed by ingestion or inhalation, the risk that secondary care givers may become contaminated is very low. Secondary carers should wear standard hospital PPE as a precaution against secondary contamination from vomit and body fluids.

If the patient has not been decontaminated following surface contamination, secondary carers must wear appropriate NHS PPE for chemical exposure to avoid contaminating themselves.

The area should be well ventilated.

Clinical decontamination following surface contamination

Avoid contaminating yourself.

Carry out decontamination after resuscitation. This should be performed in a well-ventilated area preferably with its own ventilation system.

Contaminated clothing should be removed, double-bagged, sealed and stored safely.

Decontaminate open wounds first and avoid contamination of unexposed skin.

Any particulate matter adherent to skin should be removed and the patient washed with soap and water under low pressure for at least 10 to 15 minutes.

Pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears.

The earlier irrigation begins, the greater the benefit.

Dermal exposure

Decontaminate (as above) the patient following surface contamination.

If features of systemic toxicity are present, manage as per ingestion/inhalation.

Other supportive measures as indicated by the patient's clinical condition

Ocular exposure

If symptomatic immediately irrigate the affected eye thoroughly.

At home – use lukewarm water, trickled into the eye or in a small cup held over the eye socket. An eye dropper is an alternative.

In hospital - Immediately irrigate the affected eye thoroughly with 1000 mL 0.9% saline or equivalent crystalloid (for example via an infusion bag with a giving set) for a minimum of 10 to 15 minutes. A Morgan Lens may be used if anaesthetic has been given.

If symptoms persist seek medical assistance.

Other supportive measures as indicated by the patient's clinical condition.

Ingestion

Maintain a clear airway and ensure adequate ventilation.

Where the practical expertise exists, consider gastric aspiration/lavage in adults within 1 hour of a potentially life-threatening overdose, providing the airway can be protected. See [TOXBASE](#) for further information.

Activated charcoal is of no use since it does not adsorb significant quantities of methanol.

Monitor vital signs and cardiac rhythm; check the capillary blood glucose.

Ensure adequate hydration to maintain an adequate urine output.

Perform a 12-lead ECG in all patients who require assessment.

Other supportive measures as indicated by the patient's clinical condition.

Inhalation

Maintain a clear airway and ensure adequate ventilation.

If features of systemic toxicity are present, manage as for ingestion.

Other supportive measures as indicated by the patient's clinical condition.

Clinical decontamination and first aid references

National Poisons Information Service. [TOXBASE](#) (viewed on 07 October 2024)

National Poisons Information Service. TOXBASE '[Methanol](#)' 2016 (viewed on 07 October 2024)

National Poisons Information Service. TOXBASE '[Eye irritants – features and management](#)' 2020 (viewed on 07 October 2024)

National Poisons Information Service. TOXBASE '[Skin decontamination – irritants](#)' 2019 (viewed on 07 October 2024)

About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care.

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