



UK Health
Security
Agency

Methyl Ethyl Ketone

Incident management

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Main points

General

Highly flammable colourless liquid.

Reacts with strong oxidisers.

Emits toxic acrid smoke and fumes when heated to decomposition.

Health

Inhalation can cause shortness of breath and chest tightness.

Ingestion may cause nausea, vomiting, haematemesis and inflammation of the oral mucosa.

Skin contact may cause irritation with erythema, drying and dermatitis.

Systemic effects following inhalation, ingestion or following prolonged skin contact include headache, dizziness, fainting, tremor, incoordination, hypothermia, respiratory depression, bradycardia, tachycardia, dyspnea, convulsions and coma.

Eye contact with liquid or vapour may cause irritation and transient epithelial injury.

Casualty decontamination at the scene


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

Environment

Avoid release to the environment. Inform the [Environment Agency](#) of any incidents.

Hazard identification

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

UN		1193	Ethyl methyl ketone (methyl ethyl ketone)	
EAC		•2YE	Use alcohol-resistant foam but, if not available, fine water spray can be used. Wear normal fire kit in combination with breathing apparatus [note 1]. Danger that the substance can be violently or explosively reactive. Spillages 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		–	–	
Hazards	Class	3	Flammable liquids	
	Sub-risks	–	–	
HIN		33	Highly flammable liquid (flash point below 23°C)	

Abbreviations

UN = United Nations number

EAC = emergency action code

APP = additional personal protection

HIN = hazard identification number

Notes for Table 1

[note 1] Normal firefighting clothing is appropriate, namely:




- self-contained, open circuit, positive pressure, compressed breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469
- firefighters' gloves conforming to BS EN 659
- firefighters' footwear conforming to BS 15090 (Footwear for firefighters) type F3 – Hazmat and structural firefighting [CH-marking for chemical resistance] or firefighters' boots conforming to Home Office specification A29 (rubber boots) or A30 (leather boots)

[note 2] People should 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 metres away from the incident.

Reference

'[Dangerous Goods Emergency Action Code List](#)'. National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. The Stationery Office (2021)

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

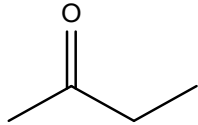
Hazard class and category	Flam. Liq. 2	Flammable liquid, category 2	
	Eye Irrit. 2	Eye irritation, category 2A	
	STOT SE 3	Specific target organ toxicity following single exposure, category 3	
Hazard statement	H225	Highly flammable liquid and vapour	
	H319	Causes serious eye irritation	
	H336	May cause drowsiness or dizziness	
Supplemental hazard statement	EUH066	Repeated exposure may cause skin dryness or cracking	
Signal words	DANGER		

Reference

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed July 2022)

Physicochemical properties

Table 3. Physicochemical properties

CAS number	78-93-3
Molecular weight	72.11
Formula	C ₄ H ₈ O
Common synonyms	Methyl acetone, butanone, MEK
State at room temperature	Colourless liquid
Volatility	Vapour pressure = 90.6 mmHg at 25°C
Specific gravity	0.7997 at 25°C
Flammability	Highly flammable
Lower explosive limit	1.8%
Upper explosive limit	10%
Water solubility	Moderately soluble in water; the solubility decreases with increasing temperature.
Reactivity	Reacts with strong oxidisers, aliphatic amines, ammonia, caustics, chlorosulphonic acid, copper, hydrogen peroxide, inorganic acids, isocyanates, nitric acid, oleum, potassium tert-butoxide, 2-propanol, pyridines and sulphuric acid. Vigorously reacts with chloroform in contact with alkalis.
Reaction or degradation products	In air reacts with hydroxyl radicals to form acetaldehyde. Will release potentially toxic acrid smoke and fumes when heated to decomposition.
Odour	Moderately sharp, fragrant, mint-like or acetone-like odour.
Structure	

Reference

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. [PubChem Compound Summary for CID 6569, Methyl ethyl ketone](#) (viewed July 2022).

Reported effect levels from authoritative sources

Table 4. Exposure by inhalation

ppm	mg/m ³	Signs and symptoms
>200	>590	Irritation of eyes, nose, throat and mucous membranes
>300	>885	CNS depressive effects

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

Reference

SCOEL. [Recommendation from the Scientific Committee on Occupational Exposure Limits for 2-butanone](#) (1999)

Published emergency response guidelines

Table 5. Acute exposure guideline levels (AEGLs)

	ppm				
	10 minutes	30 minutes	60 minutes	4 hours	8 hours
AEGL-1 [note 1]	200	200	200	200	200
AEGL-2 [note 2]	4,900 [note 4]	3,400 [note 4]	2,700 [note 4]	1,700 [note 4]	1,700 [note 4]
AEGL-3 [note 3]	-	-	4,000	2,500	2,500

Notes for 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] The lower explosive limit (LEL) = 18,000 ppm.

If AEGL value is >10% of the LEL – safety considerations against the hazard(s) of explosion(s) must be taken into account.

If AEGL value is >50% of the LEL (10,000) – extreme safety considerations against the hazard(s) of explosion(s) must be taken into account.

Reference

US Environmental Protection Agency. '[Acute Exposure Guideline Levels](#)' (viewed in July 2022)

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	600	300	899

Abbreviations

WEL = workplace exposure limit

LTEL = long-term exposure limit

STEL = short-term exposure limit

Reference

HSE. '[EH40/2005 Workplace Exposure Limits](#). Fourth Edition' (2020)

Table 7. Public health guidelines and standards

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

Health effects

Major route of exposure

Inhalation, ingestion and skin contact.

Table 8. Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Inhalation may cause olfactory and pulmonary irritation, shortness of breath chest tightness. Systemic features are possible from high concentrations or prolonged exposure.
Ingestion	Ingestion may cause nausea, vomiting, haematemesis and inflammation and pain of the oral mucosa with hypersalivation. Aspiration into the lungs may occur leading to chemical pneumonitis. Systemic features may also develop.
Dermal	May cause erythema, defatting, dermatitis and drying of the skin. Dermatitis and paresthesia can occur from exposure to the vapour alone. Ketones can be absorbed through intact skin. Prolonged contact can lead to the development of systemic effects.
Systemic	Gastrointestinal upset, headache, dizziness, fainting, tremor, incoordination, hypothermia, respiratory depression, bradycardia, tachycardia, dyspnea, convulsions, coma and death have been reported. Hyperglycaemia, ketosis and metabolic acidosis can occur. Central nervous system depression can be prolonged.
Ocular	Exposure to ketone vapours is expected to be irritating to the eyes even at low concentrations. Eye contact with liquid may cause irritation and transient epithelial injury. Prolonged contact may cause permanent corneal damage.

Reference

[TOXBASE](#). Methyl ethyl ketone. August 2019 (viewed July 2022)

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 methyl ethyl ketone 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 (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, disrobe at the scene should be conducted by the casualty themselves and should be systematic to avoid transferring any contamination from clothing to the skin. Consideration should be given to ensuring the welfare and dignity of casualties as far as possible.

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.

Improvised dry decontamination

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 and rubbed, starting with the face, head and neck and moving down and away from the body.

Rubbing and blotting should not be too aggressive, or it could drive contamination further into the skin.

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

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

Improvised wet decontamination

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 any available source of water such as taps, showers, fixed installation hose-reels and sprinklers.

When using water, it is important to try and limit the duration of decontamination to between 45 and 90 seconds and, ideally, to use a washing aid such as cloth or sponge.

Improvised decontamination should not involve overly aggressive methods to remove contamination as this could 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.

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.

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

Interim wet decontamination

Interim decontamination is the use of standard fire and rescue service (FRS) equipment to provide a planned and structured decontamination process prior to the availability of purpose-designed decontamination equipment.

References

- Home Office. '[Initial operational response to a CBRN incident.](#)' Version 2.0 (July 2015)
- NHS England. '[Emergency Preparedness, Resilience and Response \(EPRR\): Guidance for the initial management of self-presenters from incidents involving hazardous materials.](#)' (February 2019)

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

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 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.

Systemic toxicity would not be expected unless exposure has been extensive or prolonged, in such cases follow the management guidance for inhalation.

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

Ocular exposure

Remove contact lenses if present.

Anaesthetise the eye with a topical local anaesthetic (for example, oxybuprocaine, amethocaine or similar). However, do not delay irrigation if local anaesthetic is not immediately available.

Immediately irrigate the affected eye thoroughly with 1,000 mL 0.9% saline or equivalent crystalloid (for example via an infusion bag with a giving set) for a minimum of 10-15 minutes irrespective of initial conjunctival pH. A Morgan Lens may be used if anaesthetic has been given.

Aim for a neutral conjunctival pH of 7.5 to 8.0. The conjunctivae may be tested with indicator paper. Retest 20 minutes after irrigation and use further irrigation if necessary.

Repeated instillation of local anaesthetics may reduce discomfort and help more thorough decontamination; however, prolonged use of concentrated local anaesthetics is damaging to the cornea.

Patients with corneal damage, those who have been exposed to strong acids or alkalis and those whose symptoms do not resolve rapidly should be referred urgently to an ophthalmologist.

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

Inhalation

Ensure a clear airway and adequate ventilation

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

Check and record pupil size.

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

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

Ingestion

Ensure a clear airway and adequate ventilation.

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

Check and record pupil size.

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

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

Clinical decontamination and first aid references

- [TOXBASE](#) (viewed in July 2022)
- TOXBASE Methyl ethyl ketone (2019)
- TOXBASE Ketones: features and management (2019)
- TOXBASE Skin decontamination: irritants (2019)
- TOXBASE Chemicals splashed or sprayed into the eyes: features and management (2020)

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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