



UK Health
Security
Agency

Ethylene glycol

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

Ethylene glycol is an odourless liquid at room temperature, and is miscible with water. It is slightly combustible and reacts with strong oxidants and strong bases.

Health

Ingestion is the main route of exposure.

Initially causes apparent intoxication with alcohol on exposure (but no ethanol on breath).

Metabolic acidosis develops, followed by tachypnoea, coma, seizures, hypertension and convulsions.

If untreated, death from multi-organ failure usually occurs 24 to 36 hours after ingestion.

Eye exposure may cause an immediate stinging and burning sensation with lacrimation.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving ethylene glycol, 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.

Hazard identification

Table 1. Standard (UK) dangerous goods emergency action

UN		Data not available
EAC		
APP		
Hazards	Class	
	Sub-risks	
HIN		

Abbreviations


UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

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

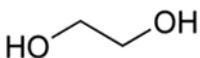
Hazard class and category	Acute Tox. 4	Acute toxicity (oral), category 4	
Hazard statement	H302	Harmful if swallowed	
Signal words	WARNING		

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 3 October 2024).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	107-21-1
Molecular weight	62
Formula	C ₂ H ₆ O ₂
Common synonyms	Ethane-1,2-diol, 1,2-ethanediol, mono ethyl glycol (MEG)
State at room temperature	Liquid
Volatility	Vapour pressure = 0.092 mmHg at 25°C
Specific gravity	1.1 (water = 1) 2.1 (air = 1)
Flammability	Slightly combustible; combustible following preheating
Lower explosive limit	3.2%
Upper explosive limit	15.3%
Water solubility	Miscible with water
Reactivity	Reacts with strong oxidants and strong bases generating fire and explosion hazard
Odour	Odourless
Structure	

References

International Programme on Chemical Safety '[International chemical safety card entry for ethylene glycol](#)' ICSC 0270, 2018. World Health Organization (viewed on 3 October 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information 2024. '[PubChem Compound Summary for CID 174, Ethylene glycol](#)' (viewed on 3 October 2024)

Reported effect levels from authoritative sources

Table 4. Exposure by inhalation

ppm	mg/m ³	Signs and symptoms	Reference
54	140	Reporting of respiratory tract irritation common	a
≥77	≥200	Intolerable, strong upper respiratory tract irritation (with burning sensation in trachea and burning cough)	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. Agency for Toxic Substances and Disease Registry (ATSDR). '[Toxicological profile for ethylene glycol](#)' 2010 (viewed on 3 October 2024)

Table 5. Exposure by ingestion

g	Signs and symptoms	Reference
100 (approximately 90mL pure ethylene glycol)	Fatal dose in a 70kg adult	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 (NPIS). TOXBASE. '[Ethylene glycol](#)' 2016 (viewed on 3 October 2024)

Published emergency response guidelines

Table 6. Acute exposure guideline levels (AEGs)

	Concentration				
	10 minutes	30 minutes	60 minutes	4 hours	8 hours
AEGL-1 [note 1]	No levels reported				
AEGL-2 [note 2]					
AEGL-3 [note 3]					

Notes to Table 6

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.

Exposure standards, guidelines or regulations

Table 7. Occupational standards for ethane-1,2-diol (ethylene glycol) particulate and vapour

		LTEL (8-hour reference period)		STEL (15-min reference period)	
		ppm	mg/m ³	ppm	mg/m ³
WEL	Particulate	-	10	-	-
	Vapour	20	52	40	104

Abbreviations

WEL = workplace exposure limit.

LTEL = long-term exposure limit.

STEL = short-term exposure limit.

Reference

Health and Safety Executive (HSE). '[EH40/2005 Workplace Exposure Limits \(fourth edition\)](#)' (2020) (viewed on 3 October 2024)

Table 8. 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

Ingestion is the most prominent route of exposure. Inhalation and skin absorption are not serious hazards.

Table 9. Signs or symptoms of acute exposure

Route	Signs and symptoms
Ingestion	<p>After a brief period of inebriation due to the intoxicating effect of ethylene glycol itself, metabolic acidosis develops, followed by tachypnoea, coma, seizures, hypertension, the appearance of pulmonary infiltrates and oliguric renal failure. If untreated, death from multi-organ failure usually occurs 24 to 36 hours after ingestion. The stages shown below may merge into each other; the time for each stage is only approximate.</p> <p>Stage 1: 30 minutes to 12 hours after ingestion Symptoms include apparent intoxication with alcohol (but no ethanol on breath), nausea, vomiting and haematemesis, coma and convulsions (often focal). Nystagmus, ataxia, ophthalmoplegia, papilloedema, hypotonia, hyporeflexia, myoclonic jerks, tetanic contractions and cranial nerve palsies (II, V, VII, VIII, IX, X and XII) may occur. Metabolic acidosis develops.</p> <p>Stage 2: 12 to 24 hours after ingestion Symptoms include increased respiratory rate, sinus tachycardia, hypertension, pulmonary oedema and congestive cardiac failure.</p> <p>Stage 3: 24 to 72 hours after ingestion Symptoms including flank pain, renal angle tenderness, acute tubular necrosis, hypocalcaemia (as a consequence of calcium complexing with oxalate), calcium oxalate monohydrate crystalluria, hyperkalaemia and hypomagnesaemia may develop. Calcium oxalate monohydrate crystalluria is diagnostic and hypocalcaemia is frequent. Leucocytosis is a common, but non-specific finding. Severe metabolic acidosis, hyperkalaemia, seizures and coma carry a poor prognosis.</p>
Eyes	Eye exposure may cause an immediate stinging and burning sensation with lacrimation.

Reference

National Poisons Information Service (NPIS). TOXBASE. '[Ethylene glycol](#)', 2016 (Viewed on 3 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 ethylene glycol 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

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

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 3 October 2024)

National Health Service England. [‘Emergency Preparedness, Resilience and Response \(EPRR\): Guidance for the initial management of self-presenters from incidents involving hazardous materials’](#) February 2019 (viewed on 3 October 2024)

Joint Emergency Service Interoperability Programme. [‘Initial Operational Response IOR to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) June 2024 (viewed on 3 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 ethylene glycol poisoning. Further information is available on [TOXBASE](#). 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.

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.

For comprehensive clinical advice consult [TOXBASE](#) directly.

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.

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 1,000mL 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.

Inhalation

Ensure a clear airway and adequate ventilation.

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

Ingestion

Maintain a clear airway and ensure adequate ventilation.

Consider gastric aspiration/lavage in adults within one hour of a potentially life-threatening overdose (if the practical expertise exists), providing the airway can be protected. Activated charcoal is of no use since it does not adsorb significant quantities of ethylene glycol.

Monitor vital signs and check capillary blood sugar. Also check pupil size.

Ensure adequate hydration to maintain a good urine output (0.5 mL/kg/hour) and perfusion.

Perform a 12 lead ECG in patients who require assessment.

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

Clinical decontamination and first aid references

National Poisons Information Service [TOXBASE](#) (viewed on 3 October 2024)

National Poisons Information Service TOXBASE. '[Ethylene glycol: features and management](#)' 2019 (viewed on 3 October 2024)

National Poisons Information Service TOXBASE. '[Chemicals splashed or sprayed into the eyes: Features and clinical management](#)' (2020)

National Poisons Information Service TOXBASE. '[Skin decontamination: irritants](#)' (2019)

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](#).

This document from the UKHSA Radiation, Chemicals and Environment Directorate reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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First published: May 2016

Full document update: August 2019

Full document update: May 2024

For queries relating to this document, please contact: chemcompendium@ukhsa.gov.uk or enquiries@ukhsa.gov.uk

Publishing reference: GOV-17446



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