



Ethanol

Incident Management

Key Points

Fire

- highly flammable
- reacts violently with strong oxidising agents including nitric acid, silver nitrate, mercuric nitrate or magnesium perchlorate, causing fire and explosion hazard
- the vapour mixes well with air and explosive mixtures are easily formed
- in the event of a fire involving ethanol use alcohol-resistant foam and normal fire kit with breathing apparatus

Health

- ingestion is the main route of exposure
- ingestion may cause excitation, emotional liability, euphoria, decreased reaction time, diminished judgement, fine motor incoordination, dysarthria and nausea
- in severe cases respiratory depression, hypotension, loss of protective airway reflexes (risk of aspiration), hypothermia, incontinence, coma, hypoglycaemia (particularly in children), seizures and death may occur
- inhalation may cause irritation of the nose and throat with choking and coughing
- skin or eye contact can cause burning and stinging, prolonged or repeated skin contact can have a drying or irritant effect


Environment

- avoid release to the environment; inform the Environment Agency of substantial incidents


Hazard Identification

Standard (UK) dangerous goods emergency action codes


Ethanol (ethyl alcohol) or ethanol solution (ethyl alcohol solution), packing group II

UN		1170	Ethanol (ethyl alcohol) or ethanol solution (ethyl alcohol solution), packing group II	
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*. Danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and watercourses. There may be a public safety hazard outside the immediate area of the incident†	
APP		–	–	
Hazards	Class	3	Flammable liquids	
	Sub-risks	–	–	
HIN		33	Highly flammable liquid (flash-point below 23°C)	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30</p> <p>† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p>Reference Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p>				

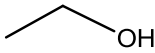
Ethanol (ethyl alcohol) or ethanol solution (ethyl alcohol solution), packing group III

UN		1171	Ethanol (ethyl alcohol) or ethanol solution (ethyl alcohol solution), packing group III	
EAC		•2Y	Use alcohol-resistant foam but, if not available, fine water spray can be used. Wear normal fire kit in combination with breathing apparatus*. Danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and watercourses	
APP		–	–	
Hazards	Class	3	Flammable liquids	
	Sub-risks	–	–	
HIN		30	Flammable liquid (flash-point below 23°C and 60°C inclusive) or flammable liquid or solid in the molten state with a flash point above 60°C, heated to a temperature equal to or above its flash point, or self-heating liquid	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30</p> <p>Reference</p> <p>Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p>				

Classification, labelling and Packaging (CLP)*

Hazard class and category	Flam. Liq. 2	Flammable liquid, category 2	
Hazard statement	H225	Highly flammable liquid and vapour	
Signal words	DANGER		
* Implemented in the EU on 20th January 2009			
Reference			
European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. http://echa.europa.eu/information-on-chemicals/cl-inventory-database (accessed 05/2015).			

Physicochemical Properties

CAS number	64-17-5
Molecular weight	46.07
Formula	C ₂ H ₆ O
Common synonyms	Ethyl alcohol, grain alcohol
State at room temperature	Clear, colourless liquid
Volatility	59.3 mmHg at 25°C, volatile
Specific gravity	0.8 (water = 1)
Flammability	Highly flammable
Lower explosive limit	3.3%
Upper explosive limit	19%
Water solubility	Miscible in water
Reactivity	Reacts vigorously/explosively with strong oxidants such as nitric acid, silver nitrate, mercuric nitrate and magnesium perchlorate, causing fire and explosion hazard. Reacts slowly with calcium hypochlorite, silver oxide and ammonia, causing fire and explosion hazard. The vapour mixes well with air and explosive mixtures are easily formed
Reaction or degradation products	No data available
Odour	Characteristic odour
Structure	
References	
<p>Hazardous Substances Data Bank [Internet]. Bethesda MD, US: National Library of Medicine (US); [Last Revision Date 20/12/2012]. Ethanol; Hazardous Substances Databank Number: 82. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (as accessed 05/2015).</p> <p>International Programme on Chemical Safety (IPCS). International Chemical Safety Card (ICSC) entry for Ethanol. ICSC 0044, 2000. World Health Organization: Geneva.</p>	

Reported Effect Levels from Authoritative Sources

Exposure by ingestion

g/kg bw	mL/kg absolute ethanol	Signs and symptoms	Reference
3	4	Fatal dose in children	a
5–8	6–10	Fatal dose in adults	a

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

Reference
a TOXBASE: Ethanol, 2010. <http://www.toxbase.org> (accessed 05/2015).

Exposure by inhalation

ppm	mg/L	Signs and symptoms	Reference
5,000	9.4	Irritation and uncomfortable to breathe but tolerable	a
~5,300–10,000	10–20	Transient coughing and irritation to eyes and nose	a
~16,000	30	Lacrimation and cough	a
>~20,300	>40	Intolerable	a

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

Reference
a Ethanol, OECD Screening Information Data Set (SIDS), Initial Assessment Report for SIAM 19, 2004.

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	1,800 ⁽¹⁾	3,456
ERPG-2 [†]	3,300 ⁽²⁾	6,336
ERPG-3 [‡]	N/A	N/A

* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour

[†] Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action

[‡] Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects

(1) Odour threshold should be detectable near ERPG-1

(2) 10–49% lower explosive limit (LEL); LEL = 33,000 ppm

Reference

American Industrial Hygiene Association (AIHA). 2014 Emergency Response Planning Guideline Values.

[https://www.aiha.org/get-](https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2014%20ERPG%20Values.pdf)

[involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2014%20ERPG%20Values.pdf](https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2014%20ERPG%20Values.pdf)

(accessed 06/2015).

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	Data not available				
AEGL-2 [†]					
AEGL-3 [‡]					

* Level of the chemical in air at or above which the general population could experience notable discomfort

[†] 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

[‡] 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

Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m ³	ppm	mg/m ³
WEL	1,000	1,920	No guideline value specified	
WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit Reference EH40/2005 Workplace Exposure Limits (second edition, published 2011).				

Public health guidelines

Drinking water standard	No guideline value specified
Air quality guideline	No guideline value specified
Soil guideline values and health criteria values	No guideline value specified

Health Effects

Major route of exposure

- ethanol is absorbed rapidly by the GI tract

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms	
Inhalation	Ethanol inhalation causes irritation of the nose and throat with choking and coughing. CNS depression is possible at high concentrations	
Ingestion	Mild	Disinhibition, excitation, emotional lability, sociable, talkative, euphoria, decreased reaction time, diminished judgement, fine motor incoordination, dysarthria, nausea
	Moderate	Blurred vision, violence, disorientation, confusion, ataxia, vasodilation, stupor, vomiting, sweating,
	Severe	Diplopia, marked incoordination, coma, hypothermia, hypoglycaemia and convulsions may occur
	Potentially Fatal	Respiratory depression, hypotension, loss of protective airway reflexes (risk of aspiration), hypothermia, incontinence, coma, hypoglycaemia (particularly in children) which can lead to convulsions Cardiac arrhythmias (including atrial fibrillation and atrioventricular block) and myocardial infarction have been reported Metabolic acidosis may be present and may be severe Rhabdomyolysis may be present especially following a period of unconsciousness after ethanol intoxication Hypokalaemia, lactic acidosis, bradycardia, acute hepatitis, hypotonia.
Dermal	Burning and stinging. Prolonged or repeated contact can have a drying and irritant effect due to the defatting action of the skin. Contact urticaria has been reported	
Ocular	Stinging, burning and lacrimation	
References		
TOXBASE. Ethanol, 03/2016. http://www.toxbase.org (accessed 11/2016).		

Decontamination at the Scene

Summary

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 ethanol **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 Public Health England (Centre for Radiation, Chemical and Environmental Hazards) 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 (eg blue roll) and clean cloth etc
- 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

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 etc) used in this process may also be contaminated and, where possible, should not be used on a 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/clothes

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.

Decontamination at the scene references

National Ambulance Resilience Unit. Joint Emergency Services Interoperability Programme (JESIP). Initial operational response to a CBRN incident. Version 1.0, September 2013.

NHS England. Emergency Preparedness, Resilience and Response (EPRR). Chemical incidents: planning for the management of self-presenting patients in healthcare settings. April 2015.

Clinical Decontamination and First Aid

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

Detailed information on clinical management can be found on TOXBASE – www.toxbase.org.

Important notes

- 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
- carry out decontamination after resuscitation; resuscitate the patient according to standard guidelines

Clinical decontamination following surface contamination

- avoid contaminating yourself
- do NOT allow smoking nearby. There may be a risk of fire
- carry out decontamination in a well-ventilated area, preferably with its own ventilation system
- the patient should remove soiled clothing and wash him/herself if possible
- put soiled clothing in a sealed container to prevent escape of volatile substances
- wash hair and all contaminated skin with liberal amounts of water (preferably warm) and soap
- pay special attention to skin folds, fingernails and ears

Dermal exposure

- decontaminate (as above) following surface contamination
- if features of systemic toxicity manage as per ingestion
- other supportive measures as indicated by the patients clinical condition

Ocular exposure

- if symptomatic, immediately irrigate the affected eye thoroughly
- for patients at home, use lukewarm tap water, trickled into the eye or in a small cup held over the eye socket; an eye dropper is an alternative
- if symptoms persist seek medical assistance

- in hospital immediately irrigate the affected eye thoroughly with 0.9% saline 1000 mL (for example via an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10-15 minutes
- refer for ophthalmological assessment if there is doubt regarding the management of corneal damage
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- symptomatic and supportive management only

Ingestion

- maintain a clear airway and adequate ventilation
- in the event of cardiac arrest in hospital or witnessed out of hospital cardiac arrest with bystander CPR, resuscitation should be continued for at least 1 hour and only stopped after discussion with a senior clinician
- prolonged resuscitation for cardiac arrest is recommended following poisoning as recovery with good neurological outcome may occur
- gut decontamination is unlikely to be of benefit since ethanol is rapidly absorbed and activated charcoal does not significantly reduce the rate of absorption
- monitor pulse, blood pressure, cardiac rhythm, conscious level, respiratory rate and body temperature
- monitor capillary blood glucose using reagent strips in all patients
- if hypothermic, rewarm slowly using conventional means
- other supportive measures as indicated by the patient's clinical condition

Clinical decontamination and first aid references

TOXBASE	http://www.toxbase.org (accessed 11/2016)
TOXBASE	Ethanol – features and management, 03/2016
TOXBASE	Eye irritants, 01/2016
TOXBASE	Skin decontamination – solvents, 05/2012

This document from the PHE Centre for Radiation, Chemical and Environmental Hazards reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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