Public Health England

Protecting and improving the nation's health

1,2-dibromoethane

Incident Management

Key Points

Fire

- non-combustible
- reacts vigorously with powdered aluminium or magnesium, metals such as sodium, potassium and calcium, strong bases and strong oxidants, causing a fire and explosion hazard
- forms hydrogen bromide and bromine fumes on contact with hot surfaces or flames
- in the event of a fire involving 1,2-dibromoethane, use fine water spray and chemical protective clothing with liquid-tight connections and breathing apparatus

Health

- major routes of exposure are inhalation, ingestion and dermal contact
- inhalation may cause eye, mucous membrane and respiratory tract irritation; severe exposure may cause pneumonitis and pulmonary oedema
- ingestion may cause nausea, vomiting and diarrhoea
- ulceration of the mucosa of the mouth, throat and stomach may occur
- inhalation, ingestion or dermal exposure can result in systemic toxicity; symptoms include CNS, respiratory, cardiovascular, metabolic, renal and hepatic effects
- dermal contact may cause blistering, erythema and ulceration; chemical burns may follow
- ocular exposure may cause irritation and possibly corneal damage

Environment

- hazardous to the environment; inform the Environment Agency of substantial incidents

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Hazard Identification

Standard (UK) dangerous goods emergency action codes

UN		1605	Ethylene dibromide	
EAC		2X	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses	
APP		B	Gas-tight chemical protective suit with breathing apparatus†	
Hazards	**Class**	6.1	Toxic substance	
	Sub-risks	–	–	
HIN		66	Highly toxic substance	

UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number

* 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 BS EN 137

† Chemical protective clothing should be gas tight conforming to BS EN 943 part 2 in combination with breathing apparatus conforming to BS EN 137

Reference

Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.

Classification, labelling and packaging (CLP)*

Hazard class and category	Carc. 1B	Carcinogenicity, category 1B	
	Acute Tox. 3	Acute toxicity (oral, dermal, inhalation), category 3	
	Eye Irrit. 2	Eye irritation, category 2	
	STOT SE 3	Specific target organ toxicity following single exposure, category 3	
	Skin Irrit. 2	Skin irritation, category 2	
	Aquatic Chronic 2	Chronic hazards to the aquatic environment, category 2	
	H350	May cause cancer	
Hazard statement	H331	Toxic if inhaled	
	H311	Toxic in contact with skin	
	H301	Toxic if swallowed	
	H319	Causes serious eye irritation	
	H335	May cause respiratory irritation	

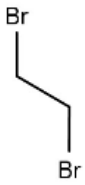
	H315	Causes skin irritation
	H411	Toxic to aquatic life with long-lasting effects
Signal words	DANGER	

* Implemented in the EU on 20 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 07/2015).

Physicochemical Properties

CAS number	106-93-4
Molecular weight	187.9
Formula	$Br(CH_2)_2Br$ / $C_2H_4Br_2$
Common synonyms	Ethylene dibromide, EDB
State at room temperature	Colourless liquid
Volatility	Vapour pressure = 11 mmHg at 25°C
Specific gravity **Vapour density**	2.2 (water = 1) 6.5 (air = 1)
Flammability	Non-combustible
Lower explosive limit	Data not available
Upper explosive limit	Data not available
Water solubility	Slightly soluble in water
Reactivity	Reacts vigorously with powdered aluminium or magnesium, metals such as sodium, potassium and calcium, strong bases and strong oxidants, causing a fire and explosion hazard. Attacks fats, rubber, some forms of plastic and coatings. Decomposes slowly in the presence of heat and light
Reaction or degradation products	On contact with hot surfaces or flames the chemical decomposes forming toxic and corrosive fumes, hydrogen bromide and bromine
Odour	Sweet or chloroform odour
Structure	

References

Ethylene Dibromide (HAZARDTEXT™ Hazard Management). In Klasco RK (Ed): TOMES® System, Truven Healthcare Analytics Inc, Greenwood Village CO, US. RightAnswer.com Inc, Midland MI, US. http://www.rightanswerknowledge.com (accessed 07/2015).

International Programme on Chemical Safety. International Chemical Safety Card entry for ethylene dibromide. ICSC 0045, 2012. World Health Organization: Geneva.

Reported Effect Levels from Authoritative Sources

Exposure by inhalation

ppm	mg/m^3	Exposure duration	Signs and symptoms	Reference
28	215	30 minutes	Fatal	a
50	384	Not given	Throat and nasal irritation	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 International Programme on Chemical Safety. 1,2-dibromoethane. Environmental Health Criteria (EHC) 177, 2000. World Health Organization: Geneva.

Exposure by ingestion

mg/kg	Signs and symptoms	Reference
140	Fatal	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 International Programme on Chemical Safety. 1,2-dibromoethane. Environmental Health Criteria 177, 2000. World Health Organization: Geneva.

Exposure by skin contact

mL	Concentration	Signs and symptoms	Reference
0.5	100%	Painful erythema and oedema	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 European Commission. Recommendation from the Scientific Committee on Occupational Exposure Limits for 1,2-dibromoethane (ethylene dibromide), 2011.

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m^3)
ERPG-1*	Data not available	
ERPG-2†		
ERPG-3‡		

* 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

Acute exposure guideline levels (AEGLs) (interim)

	Concentration (ppm)				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	52	26	17	7.1	4.6
AEGL-2†	73	37	24	10	6.5
AEGL-3‡	170	76	46	17	10

* 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

Reference

US Environmental Protection Agency. Acute Exposure Guideline Levels. http://www.epa.gov/oppt/aegl/pubs/chemlist.htm (accessed 07/2015).

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	0.5	3.9	No guideline value specified	

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, 2nd Edition, 2011.

Public health guidelines

WHO guideline value – drinking water	0.4 µg/L
Air quality guideline	No guideline value specified
Soil guideline values and health criteria values	No guideline value specified

Reference

WHO. Guidelines for Drinking-Water Quality, 4th Edition, 2011. World Health Organization: Geneva.

Health Effects

Major route of exposure

- rapidly absorbed by inhalation, ingestion and dermal contact

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Inhalation may cause eye, mucous membrane and respiratory tract irritation. Severe exposure may cause pneumonitis and pulmonary oedema. Systemic effects may also occur
Ingestion	Ingestion may cause nausea, vomiting and diarrhoea. Ulceration of the mucosa of the mouth, throat and stomach may occur
Dermal	Dermal contact may cause blistering, erythema and ulceration. Chemical burns may follow prolonged contact. May cause systemic effects after absorption through the skin
Ocular	Ocular exposure may cause irritation and possibly corneal damage
Systemic features	**CNS**: dizziness, drowsiness, headache, agitation, delirium and coma **Respiratory**: tachypnoea and respiratory failure **Cardiovascular**: hypotension or hypertension. Fatal cardiovascular shock may develop within 12 hours in severe cases. Cardiac conduction abnormalities (right bundle branch block, atrioventricular block, supraventricular tachycardia and asystole) **Metabolic**: hypoglycaemia, hyperkalaemia, hypercalcaemia and hyperphosphataemia **Renal and hepatic**: toxicity may be delayed for up to 36 hours. Deaths occur from hepatorenal injury

References

TOXBASE. Dibromoethane, 06/2014. 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.

1,2-dibromoethane may cause blisters, erythema and ulceration on contact with skin. Therefore, following disrobe, improvised wet decontamination should be considered (see below for details).

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
- 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 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
- 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.

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

Clinical decontamination following surface contamination

- carry out decontamination after resuscitation
- this should be performed in a well-ventilated area, preferably with its own ventilation system
- do **not** apply neutralising chemicals as heat produced during neutralisation reactions may cause thermal burns, and increase injury
- 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 copious amounts of water under low pressure for at least 10–15 minutes, or until the pH of the skin is normal (pH of the skin is 4.5–6, although it may be closer to 7 in children, or after irrigation). **The earlier irrigation begins, the greater the benefit**
- pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears

Dermal exposure

- decontaminate (as above) the patient following surface contamination
- following decontamination recheck the pH of affected areas after a period of 15–20 minutes and repeat irrigation if abnormal; burns with strong solutions may require irrigation for several hours or more
- once the pH is normal and stabilised, treat as for a thermal injury
- burns totalling more than 15% of body surface area in adults (more than 10% in children) will require standard fluid resuscitation as for thermal burns
- moderate/severe chemical burns should be reviewed by a burns specialist

- 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 (eg 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 (eg by an infusion bag with a giving set). A Morgan lens may be used if anaesthetic has been given. Irrigate for 10–15 minutes irrespective of initial conjunctival pH. Aim for a final conjunctival pH of 7.5–8.0. 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 discussed **urgently** with an ophthalmologist
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- maintain a clear airway and ensure adequate ventilation
- give oxygen to symptomatic patients
- monitor pulse, blood pressure, cardiac rhythm, conscious level and respiratory rate
- perform a 12 lead ECG
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- **maintain airway and establish haemodynamic stability**
- in severely affected patients critical care input is essential. Urgent assessment of the airway is required. A supraglottic-epiglottic burn with erythema and oedema is usually a sign that further oedema will occur that may lead to airway obstruction
- do **not** attempt gastric lavage
- do **not** give neutralising chemicals as heat produced during neutralisation reactions may increase injury
- monitor pulse, blood pressure, oxygen saturation, cardiac rhythm, conscious level and respiratory rate
- perform a 12 lead ECG

- other supportive measures as indicated by the patient's condition

Clinical decontamination and first aid references

TOXBASE http://www.toxbase.org (accessed 11/2016)

TOXBASE Dibromoethane, 06/2014

TOXBASE Skin contamination – corrosives, 06/2010

TOXBASE Chemicals splashed or sprayed in the eyes, 02/2014

TOXBASE Corrosive – ingestion, 08/2013

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.

For queries relating to this document, please contact: generaltox@phe.gov.uk

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