Public Health England

Protecting and improving the nation's health

Cyclohexane

Incident Management

Key Points

Fire

- highly flammable
- reacts with strong oxidants; ignition distant from the release point is possible, as the vapour is heavier than air and may travel along the ground
- emits acrid smoke and fumes when heated to decomposition
- in the event of a fire involving cyclohexane, use normal foam and normal fire kit with breathing apparatus

Health

- aspiration into the lungs causes pneumonitis with choking, coughing, wheeze, breathlessness, cyanosis and fever
- inhalation may cause headache, dizziness, drowsiness, incoordination and euphoria
- ingestion may cause nausea, vomiting and occasionally diarrhoea
- severe poisoning may result in pulmonary oedema, drowsiness, convulsions or coma and cardiac arrhythmias
- dermal exposure may cause irritation; drying and cracking due to defatting action may occur after repeated or prolonged contact
- ocular exposure can cause pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia

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		1145	Cyclohexane	
EAC		3YE	Use normal foam. 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 liquid	
	Sub-risks	–	–	
HIN		33	Highly flammable liquid (flashpoint below 23°C)	

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

* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN 137 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.

† 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

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)*

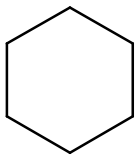
Hazard class and category	Flam. Liq. 2	Flammable liquids, category 2	
	Asp. Tox. 1	Aspiration hazard, category 1	
	Skin Irrit. 2	Skin irritation, category 2	
	STOT SE 3	Specific target organ toxicity following single exposure, category 3	
	Aquatic Acute 1	Acute hazards to the aquatic environment, category 1	
	Aquatic Chronic 1	Chronic hazards to the aquatic environment, category 1	
Hazard statement	H225	Highly flammable liquid and vapour	
	H304	May be fatal if swallowed and enters airways	
	H315	Causes skin irritation	
	H336	May cause drowsiness or dizziness	
	H400	Very toxic to aquatic life	
	H410	Very 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	110-82-7
Molecular weight	84.2
Empirical formula	C_6H_{12}
Common synonyms	Hexahydrobenzene, hexamethylene, hexanaphthene
State at room temperature	Colourless liquid
Volatility	Vapour pressure: 96.9 mmHg at 25°C
Specific gravity **Vapour density**	0.8 (water = 1) 3 (air = 1)
Flammability	Highly flammable
Lower explosive limit	1.3%
Upper explosive limit	8.4%
Water solubility	Very poor solubility
Reactivity	Cyclohexane presents a dangerous fire hazard when exposed to heat or flame. Distant ignition is possible as the vapour is heavier than air and may travel along the ground. Reacts with strong oxidants
Reaction or degradation products	When heated to decomposition, cyclohexane emits acrid smoke and fumes
Odour	Solvent odour
Structure	

References

Cyclohexane (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).

Hazardous Substances Data Bank. Cyclohexane, HSDB No. 60 (last revision date 07/04/2015; cited 07/2015). US National Library of Medicine: Bethesda MD. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed 07/2015).

International Programme on Chemical Safety. International Chemical Safety Card entry for cyclohexane. ICSC 0242, 2011. World Health Organization: Geneva.

Reported Effect Levels from Authoritative Sources

Data not available

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)

	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	100	350	300	1,050
WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit **Reference** HSE. EH40/2005 Workplace Exposure Limits, 2nd Edition, 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

- inhalation, ingestion, aspiration into the lungs and skin contact

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	May cause headache, dizziness, drowsiness, incoordination and euphoria Severe poisoning may result in pulmonary oedema, drowsiness, convulsions or coma and cardiac arrhythmias.
Ingestion	Can cause nausea, vomiting and occasionally diarrhoea See above for information on severe poisoning
Aspiration into the lungs	Causes pneumonitis with choking, coughing, wheeze, breathlessness, cyanosis and fever Rarely pleural effusions or pneumatoceles develop
Dermal	May cause irritation. Drying and cracking due to defatting action may occur after repeated or prolonged contact. There may be transient pain with erythema, blistering and superficial burns
Ocular	May cause irritation, pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia

References

TOXBASE. Cyclohexane, 02/2016. http://www.toxbase.org (accessed 11/2016).

TOXBASE. Chemicals splashed or sprayed into the eyes, 02/2014. 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.

Following disrobe, improvised dry decontamination should be considered for an incident involving cyclohexane **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
- 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

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.

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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; 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) the patient following surface contamination
- if features of systemic toxicity are present manage as per ingestion

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
- monitor vital signs and measure blood sugar (BM)
- perform a 12 lead ECG
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- maintain a clear airway and ensure adequate ventilation
- gastric lavage should **not** be undertaken
- monitor vital signs and measure blood sugar (BM)
- perform a 12 lead ECG
- 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	Cyclohexane, 02/2016
TOXBASE	Chemicals splashed or sprayed into the eyes, 02/2014
TOXBASE	Skin decontamination – solvents, 05/2016

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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