



Carbon Disulphide

Incident Management

Key Points

Fire

- highly flammable
- reactions with rust, iron, permanganic acid, nitrogen oxide, chlorine, sodium and potassium–sodium alloys can lead to explosive decomposition
- emits toxic fumes of sulphur oxides and carbon monoxide when heated to decomposition
- in the event of a fire involving carbon disulphide, use fine water spray and chemical protective clothing with liquid-tight connections and breathing apparatus

Health

- poisoning usually occurs following inhalation, but may also follow ingestion or dermal contact
- inhalation causes dizziness and headache in mild exposures, anxiety and fatigue on moderate exposures, and inebriation, GI disturbances and CNS excitement followed by CNS depression in severe exposures
- ingestion causes irritation to mucous membranes with nausea and vomiting
- dermal exposure causes irritation and sensitisation, with pain and erythema, with vesicle formation, blistering, exfoliation and possibly second- and third- degree burns
- ocular exposure may be irritating to the eyes

Environment

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

Hazard Identification

Standard (UK) dangerous goods emergency action codes

UN		1131	Carbon disulphide	
EAC		2WE	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body 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		A(fl)	Gas-tight chemical protective suit with breathing apparatus‡ Flammable gas	
Hazards	Class	3	Flammable liquid	
	Sub-risks	6.1	Toxic substance	
HIN		336	Highly flammable liquid, toxic	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Chemical protective clothing with liquid-tight connections for whole body (type 3) conforming to the relevant standards such as BS 8428 or BS EN 14605, in combination with breathing apparatus BS EN 137</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>‡ Normal fire kit in combination with gas-tight chemical protective clothing conforming to BS EN 943 part 2, thermal resistant gloves should be worn such as those conforming to BS EN 511:2006 or BS EN 407:2004</p> <p>Reference 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	
	Repr. 2	Reproductive toxicity, category 2	
	STOT RE 1	Specific target organ toxicity following repeated exposure, category 1	
	Eye Irrit. 2	Eye irritation, category 2	
	Skin Irrit. 2	Skin irritation, category 2	
Hazard statement	H225	Highly flammable liquid and vapour.	
	H361fd	Suspected of damaging fertility. Suspected of damaging the unborn child.	
	H372	Causes damage to organs through prolonged or repeated exposure.	
	H319	Causes serious eye irritation.	
	H315	Causes skin irritation.	
Signal words	DANGER		
<p>* Implemented in the EU on 20 January 2009</p> <p>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).</p>			

Specific concentration limits

Concentration	Hazard class and category	Hazard statement	
$C \geq 1\%$	Repr. 2	H361fd	Suspected of damaging fertility. Suspected of damaging the unborn child
$C \geq 1\%$	STOT RE 1	H372	Causes damage to organs through prolonged or repeated exposure
$0.2\% \leq C < 1\%$	STOT RE 2	H373	May cause damage to organs through prolonged or repeated exposure

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	75-15-0
Molecular weight	76.14
Formula	CS ₂
Common synonyms	Carbon bisulfide, carbon sulphide
State at room temperature	Colourless liquid
Volatility	Vapour pressure = 400 mmHg at 28°C
Specific gravity Vapour density	1.26 (water = 1) 2.63 (air = 1)
Flammability	Highly flammable
Lower explosive limit	1%
Upper explosive limit	50%
Water solubility	Slightly soluble in water, 2 g/L at 20°C
Reactivity	Decomposes rapidly upon exposure to air, and possibly in well aerated water. Heat, flame and reactions with rust, iron, permanganic acid, nitrogen oxide, chlorine, sodium and potassium–sodium alloys can cause the chemical to explode. Liquid carbon disulphide will attack some forms of plastics, rubber, and coatings. Corrosive to some metals due to impurities
Reaction or degradation products	Toxic fumes of sulphur oxides are emitted when carbon disulphide is heated to decomposition
Odour	Pure liquid has a pleasant odour. Commercial and reagent grades have a foul, rotten egg type odour
Structure	S=C=S
References	
Carbon Disulphide (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 carbon disulphide, ICSC 0022, 2000. World Health Organization: Geneva.	

Reported Effect Levels from Authoritative Sources

Exposure by inhalation

ppm	mg/m ³	Length of exposure	Signs and symptoms	Reference
300	933	A few days	Serious pathological changes	a
965–1,608	3,000–5,000	Acute	Psychiatric and neurological changes (eg rapid mood changes and hallucinations)	b
2,000–3,200	6,220–9,952	30–60 minutes	Mild intoxication, paraesthesia and irregular breathing	c
4,800	14,928	Acute	Unconsciousness	c
5,000	15,500	Acute	Rapidly 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

References

- a TOXBASE. Carbon disulphide, 2012. <http://www.toxbase.org> (accessed 07/2015).
- b International Programme on Chemical Safety. Carbon disulphide. Environmental Health Criteria 10, 1979. World Health Organization: Geneva.
- c International Programme on Chemical Safety. Carbon disulphide. Poisons Information Monograph 102, 1993. World Health Organization: Geneva.

Exposure via ingestion

mg/kg	Signs and symptoms	Reference
500–5,000	Fatal dose	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. Carbon disulphide, 2012. <http://www.toxbase.org> (accessed 07/2015).

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	1	3.11
ERPG-2 [†]	50	155
ERPG-3 [‡]	500	1,560

* 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

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/2015%20ERPG%20Levels.pdf)

[involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2015%20ERPG%20Levels.pdf](https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2015%20ERPG%20Levels.pdf)

(accessed 09/2015).

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	17	17	13	8.4	6.7
AEGL-2 [†]	200	200	160	100	50
AEGL-3 [‡]	600	600	480	300	150

* 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	5	15	No guideline value specified	
<p>WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit</p> <p>Reference Health and Safety Executive (HSE). EH40/2005 Workplace Exposure Limits, 2nd Edition, 2011.</p>				

Public health guidelines

Drinking water standard	No guideline value specified
Air quality guideline	<p>100 µg/m³ with an averaging period of 24 hours</p> <p>20 µg/m³ with an averaging period of 30 minutes</p>
Soil guideline values and health criteria values	No guideline value specified
<p>Reference Air Quality Guidelines for Europe. WHO Regional Publications, European Series No. 91, 2nd Edition, 2000. World Health Organization Regional Office for Europe: Copenhagen.</p>	

Health Effects

Major route of exposure

- poisoning from carbon disulphide usually occurs after inhalation, but may also occur after dermal exposure or ingestion

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Mild exposure results in dizziness and headache; moderate exposure in anxiety and fatigue; severe exposure in inebriation, gastrointestinal disturbances and CNS excitement followed by CNS depression, with stupor, confusion, hallucinations, restlessness and unconsciousness, polyneuritis, tremors and headache. Exposure to high concentrations may result in dyspnoea and chest pain; respiratory failure may follow
Ingestion	May cause irritation to mucous membranes, resulting in nausea and vomiting. Symptoms can include respiratory difficulty, cyanosis, tremor, enlarged pupils, convulsions, collapse, coma, Cheyne-Stokes respiration, respiratory paralysis and death
Dermal	Exposure can lead to skin irritation and sensitisation. Exposure to high concentrations can cause skin burns. Dermal exposure has resulted in burning pain and erythema, with vesicle formation, blistering, exfoliation and possibly second- and third-degree burns. When adsorbed through the skin, symptoms similar to those seen after inhalation may occur
Ocular	Carbon disulphide liquid may be irritating to the eyes. Retinopathy (including small retinal haemorrhages and microaneurysm of the fundus) has been reported following gaseous exposure
Reference	
TOXBASE. Carbon disulphide, 03/2012. 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.

Carbon disulphide may cause chemical burns on contact with the skin. Therefore, following disrobe, improvised wet decontamination should be considered (see below for details).

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.

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
- 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
- **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 the patient following surface contamination
- treat burns as for a thermal injury
- burns totalling more than 15% of body surface area (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; excision or skin grafting may be required
- if features of systemic toxicity, manage as 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 (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
- monitor respiratory rate and oxygen saturation
- perform a 12 lead ECG and measure the QRS duration and QT interval
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- maintain a clear airway and ensure adequate ventilation
- do **not** attempt gastric lavage
- monitor pulse, blood pressure, conscious level, respiratory rate and oxygen saturation
- perform a 12 lead ECG and measure the QRS duration and QT interval
- 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	Carbon disulphide, 2012
TOXBASE	Chemicals splashed or sprayed in the eyes, 2014

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.

© Crown copyright 2016, www.gov.uk/phe

Re-use of Crown copyright material (excluding logos) is allowed under the terms of the Open Government Licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ for terms and conditions.

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

First published: January 2016

Update: November 2016 Health Effects, Decontamination at the Scene & Clinical Decontamination and First Aid