



Carbon Tetrachloride

Incident Management

Key Points

Fire

- reacts with some metals such as aluminium, magnesium, zinc causing fire and explosion hazard
- gives off toxic fumes including chlorine, hydrogen chloride and phosgene on contact with hot surfaces or flames
- in the event of a fire use fine water spray, wear normal fire kit in combination with breathing apparatus

Health

- toxic by all routes of exposure
- inhalation leads to rapid CNS depression, as well as hepatic and renal damage
- ingestion may cause nausea, vomiting, abdominal pain and diarrhoea
- skin contact can result in pain, redness and swelling as well as contact dermatitis
- eye exposure causes pain, blepharospasm, lacrimation, conjunctivitis, oedema and photophobia


Environment

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




Hazard Identification

Standard (UK) dangerous goods emergency action codes

Carbon Tetrachloride

UN		1846	Carbon tetrachloride	
EAC		2Z	Use fine water spray. Wear normal fire kit in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses	
APP		-	-	
Hazards	Class	6.1	Toxic substances	
	Sub-risks	–	–	
HIN		60	Toxic or slightly toxic substance	
<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 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</p> <p>Reference Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC) Part of Ricardo-AEA. The Stationery Office, 2017.</p>				

Classification, labelling and packaging (CLP)***Carbon Tetrachloride**

Hazard class and category	Carc. 2	Carcinogen, category 2	
	Acute Tox. 3	Acute toxicity (oral, dermal, inhalation), category 3	
	STOT RE 1	Specific target organ systemic toxicity following repeated exposure, category 1	
	Aquatic Chronic 3	Chronic hazard to the aquatic environment, category 3	
	Ozone 1	Hazardous to the ozone layer	
	Hazard statement	H351	Suspected of causing cancer
	H331	Toxic if inhaled	
	H311	Toxic in contact with skin	
	H301	Toxic if swallowed	
	H372	Causes damage to organs through prolonged or repeated exposure	
	H412	Harmful to aquatic life with long lasting effects.	
	H420	Harms public health and the environment by destroying ozone in the upper atmosphere	
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 08/2018).			

Specific concentration limits

Concentration	Hazard class and category	Hazard statement	
$C \geq 1 \%$	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 08/2018).			

Physicochemical Properties

CAS number	56-23-5
Molecular weight	153.8
Formula	CCl ₄
Common synonyms	Tetrachloromethane; Perchloromethane: Tetrachlorocarbon
State at room temperature	Colourless liquid
Volatility	Vapour pressure: 115 mm Hg at 25°C
Specific gravity Vapour density	1.59 at 20°C (water = 1) 5.3 at 20°C (air = 1)
Flammability	Non combustible
Lower explosive limit	-
Upper explosive limit	-
Water solubility	Poor solubility in water, 0.1g/100 mL at 20°C
Reactivity	Reacts with some metals such as aluminium, magnesium, zinc causing fire and explosion hazard
Reaction or degradation products	Gives off irritating or toxic fumes including chlorine, hydrogen chloride and phosgene, on contact with hot surfaces or flames
Odour	Characteristic sweet odour
Structure	$ \begin{array}{c} \text{Cl} \\ \\ \text{Cl} - \text{C} - \text{Cl} \\ \\ \text{Cl} \end{array} $

References

Hazardous Substances Data Bank. Carbon Tetrachloride HSDB No. 53 (last revision date 24/06/2005). US National Library of Medicine: Bethesda MD. <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB> (accessed 08/2018)

International Programme on Chemical Safety. International Chemical Safety Card entry for. Carbon Tetrachloride. ICSC 0024, 2000. World Health Organization, Geneva.

Reported Effect Levels from Authoritative Sources

Exposure by ingestion

mg/kg	Signs and symptoms	Reference
80-180	Fatty accumulation and necrosis of the liver	a
≥100	Nausea	a
114-10,800	Neurological symptoms indicative of central nervous system depression	a
680–910	Vomiting and abdominal pain	a
<p>These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values</p> <p>References</p> <p>a Agency for Toxic Substances and Disease Registry. Toxicological Profile for carbon tetrachloride, 2006. Atlanta, US.</p>		

Exposure by inhalation

ppm	mg/m ³	Signs and symptoms	Reference
200	1,258	Effects on liver and kidney function, and nausea (under 3 hours)	a
250	1,573	Degeneration or necrosis of the liver	a
<p>These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values</p> <p>References</p> <p>a Agency for Toxic Substances and Disease Registry. Toxicological Profile for carbon tetrachloride, 2006. Atlanta, US.</p>			

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	20 ¹	126
ERPG-2 [†]	100	629
ERPG-3 [‡]	750	4,720

* 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 should be detectable near ERPG-1

American Industrial Hygiene Association (AIHA). 2016 Emergency Response Planning Guideline Values. <https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2016%20ERPG%20Table.pdf> (accessed 08/2018).

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	NR	NR	NR	NR	NR
AEGL-2 [†]	27	18	13	7.6	5.8
AEGL-3 [‡]	700	450	340	200	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

NR Not recommended

Reference
US Environmental Protection Agency. Acute Exposure Guideline Levels. <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 08/2018).

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	2	13	Not given	
<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

UK drinking water standard	3 µg/L
WHO guideline value	4 µg/L
Air quality guideline	Guideline value not given
Soil guideline values and health criteria values	Guideline value not given
<p>Reference The Water Supply (Water Quality) Regulations 2016 The Private Water Supplies (England) Regulations 2016 and The Private Water Supplies (Wales) Regulations 2017 Guidelines for drinking-water quality: fourth edition incorporating the first addendum. Geneva: World Health Organization; 2017</p>	

Health Effects

Major route of exposure

- inhalation, ingestion or dermal contact

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	May lead to rapid CNS depression, as well as hepatic and renal damage. Early fatalities following inhalation are typically due to ventricular fibrillation associated with cardiac arrest or respiratory failure secondary to CNS depression. See below for more information on systemic effects
Ingestion	Ingestion may cause nausea, vomiting, abdominal pain and diarrhoea. Systemic toxicity may occur
Dermal	Skin contact can result in pain, redness and swelling as well as contact dermatitis. Systemic features may occur if exposure is prolonged or extensive
Ocular	Pain, blepharospasm, lacrimation, conjunctivitis, oedema and photophobia may occur. May cause corneal burns and limbal ischaemia
Systemic features	<p>Initial CNS effects including headache, dizziness, ataxia, confusion and drowsiness. In more severe cases, respiratory depression, convulsions and coma may occur</p> <p>Fever, hypotension and subconjunctival haemorrhage may be present. Cardiac arrhythmias, including ventricular fibrillation may cause sudden death</p> <p>Evidence of hepatic injury usually occurs two to four days after exposure but may be observed as early as 24 hours. Jaundice, increased liver enzyme activity, increased INR, metabolic acidosis and liver failure may occur. Haemolysis may be present. Renal failure usually follows this a few days later and reaches its peak in the second week. Oliguria may progress to anuria due to renal tubular necrosis and can develop in the absence of hepatic dysfunction</p> <p>Pulmonary oedema may be related to renal failure or direct cardiotoxicity</p>
References	
TOXBASE: Carbon Tetrachloride, 08/2014. http://www.toxbase.org (accessed 08/2018)	
TOXBASE: Chemicals Splashed or Sprayed into the Eyes, 06/2017. http://www.toxbase.org (accessed 08/2018)	

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 carbon tetrachloride 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.

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 note

- **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

Clinical decontamination following surface contamination

- 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 the 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 prolonged exposure or features of systemic toxicity are present manage as for inhalation/ingestion
- 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 or equivalent crystalloid (for example via an infusion bag with a giving set) for a minimum of 10 – 15

minutes irrespective of the initial conjunctival pH. A Morgan Lens may be used if anaesthetic has been given. 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 referred **urgently** to an ophthalmologist
- other supportive measures as indicated by the patient's clinical condition

Inhalation/Ingestion

- maintain a clear airway and ensure 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
- administer 100% oxygen
- monitor pulse, BP, respiratory rate, oxygen saturation, level of consciousness and cardiac rhythm
- perform 12 lead ECG in all patients who require assessment
- other supportive measures as indicated by the patient's clinical condition

Health effects and decontamination references

TOXBASE	http://www.toxbase.org (accessed 08/2018)
TOXBASE	Carbon Tetrachloride, 08/2014
TOXBASE	Chemicals Splashed or Sprayed into the Eyes, 06/2017
TOXBASE	Skin decontamination – solvents, 05/2012
TOXBASE	Personal protective equipment and decontamination at the scene or in hospital

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.

First published: August 2018

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

For all other enquiries, please contact: phe.enquiries@phe.gov.uk

© Crown copyright 2018, 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.