UK Health Security Agency

Carbon tetrachloride

Incident management

Contents

Main points

General

Carbon tetrachloride is a clear, non-flammable, volatile liquid with a sweet odour. It is also known as tetrachloromethane and perchloromethane.

It reacts with some metals such as aluminium, magnesium and zinc causing fire and explosion hazards.

Carbon tetrachloride gives off toxic fumes including chlorine and hydrogen chloride on contact with hot surfaces or flames.

Health

Carbon tetrachloride is toxic by all routes of exposure.

Inhalation exposure can lead to systemic toxicity.

Ingestion may cause nausea, vomiting, abdominal pain and diarrhoea.

Initial features of systemic toxicity include headache, dizziness, ataxia, weakness, lethargy, stupor, confusion and drowsiness. Renal and hepatic toxicity can also occur.

Dermal exposure causes pain, redness and swelling as well as contact dermatitis.

Ocular exposure may cause mild conjunctivitis.

Casualty decontamination at the scene

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.

Environment

Carbon tetrachloride is hazardous to the environment.

Inform the Environment Agency where appropriate and avoid release into the environment..

Hazard identification

Table 1. Standard (UK) dangerous goods emergency action codes

UN		1846	Carbon tetrachloride	
EAC		2Z	Use fine water spray. Wear normal fire kit in combination with breathing apparatus [note 1]. 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	

Abbreviations

UN = United Nations number.
EAC = emergency action code.
APP = additional personal protection.
HIN = hazard identification number.

Notes to Table 1

[note 1] 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' footwear conforming to BS 15090 type F3 or alternatively firefighters' boots conforming to Home Office Specification A29 or A30.

Reference

Dangerous Goods Emergency Action Code List National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. The Stationery Office 2021

Table 2. The GB classification, labelling and packaging (CLP) regulation

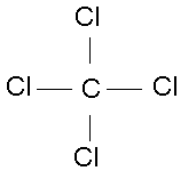
Hazard class and category	Carc. 2	Carcinogen, category 2	
	Acute Tox. 3	Acute toxicity (oral, dermal, inhalation), category 3	
	STOT RE 1	Specific target organ systemic toxicity following repeated exposure, category 1	
	Aquatic Chronic 3	Chronic hazard to the aquatic environment, category 3	
	Ozone 1	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		

Reference

The Health and Safety Executive (HSE). GB CLP Regulation (viewed June 2022)

Physicochemical properties

Table 3. Physicochemical properties

CAS number	56-23-5
Molecular weight	153.8
Formula	CCl4
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	

References

International Programme on Chemical Safety. International chemical safety card entry for Carbon tetrachloride ICSC 0024, 2000. World Health Organization (WHO) Geneva

PubChem Compound Summary for CID 5943, Carbon tetrachloride PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information 2004 (viewed June 2022)

Reported effect levels from authoritative sources

Table 4. 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

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. Agency for Toxic Substances and Disease Registry. Toxicological Profile for carbon tetrachloride 2006 Atlanta, USA

Table 5. 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

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. Agency for Toxic Substances and Disease Registry. Toxicological Profile for carbon tetrachloride 2006 Atlanta, USA

Published emergency response guidelines

Table 6. Acute exposure guideline levels (AEGLs) showing concentrations in ppm

	ppm				
	10 min	**30 min**	**60 min**	**4 hours**	**8 hours**
AEGL-1 [note 1]	NR	NR	NR	NR	NR
AEGL-2 [note 2]	27	18	13	7.6	5.8
AEGL-3 [note 3]	700	450	340	200	150

Notes to Table 6

[note 1] Level of the chemical in air at or above which the general population could experience notable discomfort.
[note 2] 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.
[note 3] 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. Access Acute Exposure Guideline Levels (AEGLs) Values | US EPA (viewed June 2022)

Exposure standards, guidelines or regulations

Table 7. Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m^3	ppm	mg/m^3
WEL	1	6.4	5	32

Abbreviations

WEL = workplace exposure limit.
LTEL = long-term exposure limit.
STEL = short-term exposure limit.

Reference

HSE. EH40/2005 Workplace Exposure Limits Fourth Edition 2020

Table 8. Public health guidelines

UK drinking water standard	3 µg/L
WHO guideline for drinking water quality	4 µg/L
WHO air quality guideline	Guideline value not given

Reference

- The Private Water Supplies (England) Regulations (2016) and The Private Water Supplies (Wales) Regulations (2017)
- The Water Supply (Water Quality) Regulations (2018) (Water, England and Wales)
- WHO. Guidelines for Drinking-water Quality, 4th Edition Incorporating First and Second Addendum 2022 WHO: Geneva

Health effects

Major route of exposure

Inhalation, ingestion or dermal contact

Table 9. Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Inhalation may be lead to systemic toxicity, see below for more details.
Ingestion	Ingestion may cause dyspepsia, nausea, vomiting, abdominal pain and diarrhoea. Systemic toxicity may occur.
Dermal	Skin contact can result in pain, redness irritation and swelling as well as contact dermatitis. Systemic features may occur if exposure is prolonged or extensive.
Ocular	Mild conjunctivitis may occur.
Systemic features	Initial systemic features reflect effects on the central nervous system including headache, dizziness, ataxia, weakness, lethargy, stupor, confusion and drowsiness. In more severe cases, tremor, polyneuritis, blurred vision respiratory depression, convulsions and coma may occur. Fever, hypotension and subconjunctival haemorrhage may be present. Cardiac arrhythmias, including ventricular fibrillation may cause sudden death and are due in part to carbon tetrachloride-induced sensitisation of the myocardium to catecholamines. In a few case, mild anaemia is observed and may occasionally become severe. 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 begins a few hours to days after hepatic damage becomes manifest and it 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.

	Pulmonary oedema may be related to renal failure or direct cardiotoxicity. CNS depression may be increased by alcohol and sedative drugs.

Reference

TOXBASE Carbon tetrachloride. December 2018 (viewed June 2022)

Decontamination at the scene

Chemical-specific advice

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 the UK Health Security Agency (Radiation, Chemicals and Environment Directorate) 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 (for example 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 and so on) 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 or 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

Home Office. Initial operational response to a CBRN incident Version 2.0 (July 2015)

NHS England. Emergency Preparedness, Resilience and Response (EPRR): Guidance for the initial management of self-presenters from incidents involving hazardous materials (February 2019)

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.

Important notes

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 after resuscitation.

This should be performed in a well-ventilated area, preferably with its own ventilation system.

Avoid contaminating yourself.

The patient should remove soiled clothing and wash him/herself if possible.

Contaminated clothing should be removed, double-bagged, sealed and stored safely to prevent escape of volatile substances.

Decontaminate open wounds first and avoid contamination of unexposed skin. Wash hair and all contaminated skin with liberal amounts of water (preferably warm) and soap.

Pay special attention to skin folders, fingernails and ears.

Dermal exposure

Decontaminate the patient (as above) following surface contamination

If features of systemic toxicity are present manage as per ingestion.

Chemical 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.

Cover affected area with a clean non-adherent dressing

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 (for example, 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 (for example, by an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given.

Irrigate for 10 to 15 minutes irrespective of initial conjunctival pH. Aim for a final conjunctival pH of 7.5 to 8.0. The conjunctivae may be tested with indicator paper. Retest 20 minutes after irrigation and use further irrigation if necessary.

Any particles lodged in the conjunctival recesses should be removed.

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/ingestion

Maintain a clear airway and ensure adequate ventilation.

For cardiac arrest in hospital or witnessed out of hospital, prompt bystander CPR, resuscitation should be usually continued for at least one hour and only stopped after discussion with a senior clinician.

Prolonged resuscitation, even for several hours, may be appropriate following poisoning as recovery with good neurological outcome may occur.

Gut decontamination is contraindicated.

Monitor vital signs and cardiac rhythm; check the capillary blood glucose.

Check and record pupil size.

Perform a 12-lead ECG in all patients who require assessment.

Other measures as indicated by the patient's clinical condition.

Clinical decontamination and first aid references

- TOXBASE. (viewed June 2022)
- TOXBASE. Carbon tetrachloride (2018)
- TOXBASE. Chemicals Splashed or Sprayed into the Eyes (2020)
- TOXBASE. Skin decontamination-solvents (2019)

About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation heath secure.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care.

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