



# Carbon Tetrachloride

## Incident management

### Key Points

#### **Fire**

- Non flammable
- Reacts with some metals such as aluminium, magnesium and zinc causing fire and explosion hazard
- Emits irritating or toxic fumes including chlorine, hydrogen chloride and phosgene, when heated to decomposition
- In the event of a fire involving carbon tetrachloride, use fine water spray and normal fire kit with breathing apparatus

#### **Health**

- Toxic via all routes of exposure Ingestion, inhalation or prolonged skin contact can cause systemic effects including headache, dizziness, ataxia, confusion, drowsiness, convulsions and coma. Liver and kidney effects, cardiovascular arrhythmias, hypotension and pulmonary oedema may also occur.
- Central nervous system depression will be increased by alcohol and sedative drugs
- Dermal contact can result in pain, redness and swelling
- Ocular exposure may cause pain and minimal injury to the conjunctiva


#### **Environment**

- Chronic hazard to the aquatic environment
- Inform Environment Agency of substantial incidents

Prepared by the Toxicology Department  
CRCE, PHE  
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## Hazard Identification

### *Standard (UK) Dangerous Goods Emergency Action Codes<sup>(a)</sup>*




<b>UN</b>		<b>1846</b>	Carbon tetrachloride	
<b>EAC</b>		<b>2Z</b>	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.	
<b>APP</b>		-		
<b>Hazards</b>	<b>Class</b>	<b>6.1</b>	Toxic substances	
	<b>Sub risks</b>	-		
<b>HIN</b>		<b>60</b>	Toxic or slightly toxic substance	

UN – United Nations number; EAC – Emergency Action Code; APP – Additional Personal Protection; HIN - Hazard Identification Number

\*Normal fire fighting clothing i.e. fire kit (BS EN 469), gloves (BS EN 659) and boots (HO specification A29 and A30) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

<sup>a</sup> Dangerous Goods Emergency Action Code List 2011. National Chemical Emergency Centre (NCEC). The Stationary Office, London.

**Chemical Hazard Information and Packaging for Supply Classification<sup>(a)</sup>**

<b>Classification</b>	<b>Carc. Cat 3</b>	Category 3 carcinogen	
	<b>T</b>	Toxic	
	<b>N</b>	Dangerous for the environment	
<b>Risk phrases</b>	<b>R23/24/25</b>	Toxic by inhalation, in contact with skin and if swallowed	
	<b>R40</b>	Limited evidence of a carcinogenic effect	
	<b>R48/23</b>	Toxic: danger of serious damage to health by prolonged exposure through inhalation	
	<b>R59</b>	Dangerous for the ozone layer	
	<b>R52/53</b>	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment	
<b>Safety phrases</b>	<b>S1/2</b>	Keep locked up and out the reach of children	
	<b>S23</b>	Do not breathe fumes/vapour/spray	
	<b>S36/37</b>	Wear suitable protective clothing and gloves	
	<b>S45</b>	In case of accident, or if you feel unwell seek medical advice immediately (show the label where possible)	
	<b>S59</b>	Refer to manufactures/supplier for information on recovery/recycling	
	<b>S61</b>	Avoid release to the environment. Refer to special instructions/safety data sheet	





**Specific Concentration Limits**

Concentration	Classification
<b>C ≥ 1%</b>	T; R23/24/25
<b>0.2% ≤ C &lt; 1%</b>	Xn; R20/21/22
<b>C ≥ 1%</b>	T; R48/23
<b>0.2% ≤ C &lt; 1%</b>	Xn; R48/20

<sup>a</sup> Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.2.

<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 02/2013)

**Globally Harmonised System of Classification and Labelling of Chemicals (GHS)<sup>(a)</sup>\***

<b>Hazard Class and Category</b>	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	
<b>Hazard Statement</b>	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	

<sup>a</sup> Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.1.  
<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 02/2013)

## CARBON TETRACHLORIDE – INCIDENT MANAGEMENT

<b>Suppl. Hazard Statement</b>	EUH059	Hazardous to the ozone layer
<b>Signal Words</b>	DANGER	

### Specific concentration limits

Concentration	Hazard Class and Category	Hazard Statement	
$C \geq 1 \%$	STOT RE 1	<b>H372</b>	Causes damage to organs through prolonged or repeated exposure
$0.2 \% \leq C < 1 \%$	STOT RE 2	<b>H373</b>	May cause damage to organs through prolonged or repeated exposure

\* Implemented in the EU on 20 January 2009.

## Physicochemical Properties

<b>CAS number</b>	56-23-5
<b>Molecular weight</b>	153.8
<b>Empirical formula</b>	CCl <sub>4</sub>
<b>Common synonyms</b>	Tetrachloromethane; Perchloromethane; Necatorina; Benzinoform; Tetrachlorocarbon
<b>State at room temperature</b>	Colourless liquid
<b>Volatility</b>	Vapour pressure 12.2 KPa (91.3 mm Hg) at 20°C
<b>Specific gravity</b>	1.59 at 20°C (water = 1)
<b>Flammability</b>	Non combustible
<b>Lower explosive limit</b>	Data not available
<b>Upper explosive limit</b>	Data not available
<b>Water solubility</b>	Poor solubility in water, 0.1g 100 ml <sup>-1</sup> at 20°C
<b>Reactivity</b>	Reacts with some metals such as aluminium, magnesium, zinc causing fire and explosion hazard
<b>Reaction or degradation products</b>	Gives off irritating or toxic fumes including chlorine, hydrogen chloride and phosgene, on contact with hot surfaces or flames
<b>Odour</b>	Characteristic odour
<b>Structure</b>	$  \begin{array}{c}  \text{Cl} \\    \\  \text{Cl} - \text{C} - \text{Cl} \\    \\  \text{Cl}  \end{array}  $

References<sup>(a,b,c)</sup>

<sup>a</sup> International Programme on Chemical Safety (IPCS): Carbon tetrachloride. International Chemical Safety Card: 0024. 2000, WHO: Geneva.

<sup>b</sup> The Merck Index (14<sup>th</sup> Edition). Entry 1816: Carbon tetrachloride, 2006

<sup>c</sup> The Dictionary of Substances and their Effects. Ed. S Gangolli. Second Edition, Volume 7, 1999.

### Threshold Toxicity Values

<b>EXPOSURE VIA INHALATION</b>			
<b>ppm</b>	<b>mg m<sup>-3</sup></b>	<b>SIGNS AND SYMPTOMS</b>	<b>REFERENCES</b>
10 - 80	64 – 513	No adverse effects observed following exposure for 3 – 4 hours	a
> 80	> 472	Nausea, vomiting, headache, tachycardia, tachypnoea, drowsiness, dizziness, unconsciousness, kidney and liver injury and death (10 to 30 minute exposure)	a

<sup>a</sup> International Programme on Chemical Safety (IPCS). Carbon tetrachloride. Environmental Health Criteria 208. 1999, WHO: Geneva.

## Published Emergency Response Guidelines

**Emergency Response Planning Guideline (ERPG) Values<sup>(a)</sup>**

	Listed value (ppm)	Calculated value (mg m <sup>-3</sup> )
<b>ERPG-1*</b>	20	125.81
<b>ERPG-2**</b>	100	629.04
<b>ERPG-3***</b>	750	4717.79

\* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr 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 hr 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 hr without experiencing or developing life-threatening health effects.

**Acute Exposure Guideline Levels (AEGLs)<sup>(b)</sup>****Interim values**

	ppm				
	10 min	30 min	60 min	4 hr	8 hr
<b>AEGL-1<sup>†</sup></b>	58	58	44	25	19
<b>AEGL-2<sup>††</sup></b>	380	250	190	100	81
<b>AEGL-3<sup>†††</sup></b>	1100	680	520	300	220

<sup>†</sup> The level of the chemical in air at or above which the general population could experience notable discomfort.

<sup>††</sup> The 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.

<sup>†††</sup> The level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

<sup>a</sup> American Industrial Hygiene Association (AIHA). 2011 Emergency Response Planning Guideline Values.

[http://www.aiha.org/insideaiha/GuidelineDevelopment/ERPG/Documents/2011erpgweelhandbook\\_table-only.pdf](http://www.aiha.org/insideaiha/GuidelineDevelopment/ERPG/Documents/2011erpgweelhandbook_table-only.pdf) (accessed 01/2013).

<sup>b</sup> U.S. Environmental Protection Agency. Acute Exposure Guideline Levels, <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 01/2013).



## Exposure Standards, Guidelines or Regulations

### Occupational Standards

<b>WEL</b> <sup>(a)</sup>	LTEL(8 hour reference period): 2 ppm (13 mg m <sup>-3</sup> )
	STEL(15 min reference period): No guideline value specified

### Public Health Guidelines

<b>DRINKING WATER QUALITY GUIDELINE</b> <sup>(b)</sup>	4 µg L <sup>-1</sup>
<b>AIR QUALITY GUIDELINE</b>	No guideline value specified
<b>SOIL GUIDELINE VALUE AND HEALTH CRITERIA VALUES</b>	Data not available
<b>HEALTH CRITERIA VALUES</b> <sup>(c)</sup>	<b>Tolerable Daily Intake</b> <sub>oral</sub> 1.42 µg kg <sup>-1</sup> bw day <sup>-1</sup>
	<b>Mean Daily Intake</b> <sub>oral</sub> 0.2 µg day <sup>-1</sup>
	<b>Tolerable Daily Soil Intake</b> <sub>oral</sub> Adult: 1.4 µg kg <sup>-1</sup> bw day <sup>-1</sup> Child: 1.4 µg kg <sup>-1</sup> bw day <sup>-1</sup>
	<b>Tolerable Daily Intake</b> <sub>inhalation</sub> 3.26 µg kg <sup>-1</sup> bw day <sup>-1</sup>
	<b>Mean Daily Intake</b> <sub>inhalation</sub> 50 µg day <sup>-1</sup>
	<b>Tolerable Daily Soil Intake</b> <sub>inhalation</sub> Adult: 2.5 µg kg <sup>-1</sup> bw day <sup>-1</sup> Child: 2.0 µg kg <sup>-1</sup> bw day <sup>-1</sup>

WEL – Workplace exposure limit; LTEL - Long-term exposure limit; STEL – Short-term exposure limit

<sup>a</sup> EH40/2005 Workplace Exposure Limits (second edition, published 2011).  
<http://www.hse.gov.uk/pubns/priced/eh40.pdf> (accessed 01/2013)

<sup>b</sup> Guidelines for Drinking-Water Quality, Fourth Edition. WHO, Geneva. 2011.

<sup>c</sup> Department for Environment, food and Rural Affairs and the Environment Agency. Contaminants in soil: collection of toxicological data and intake values for humans. Carbon tetrachloride.2005

## Health Effects

### **Major Route of Exposure<sup>(a)</sup>**

- Toxic by all routes of exposure

### **Immediate Signs or Symptoms of Acute Exposure<sup>(a,b)</sup>**

- Ingestion may cause nausea, vomiting, abdominal pain and diarrhoea.
- Systemic effects are possible following ingestion, inhalation and prolonged skin contact. Initial features reflect effects on the central nervous system and include headache, dizziness, ataxia, confusion and drowsiness or, in more severe cases, respiratory depression, convulsions and coma. Fever, hypotension and subconjunctival haemorrhage may be present. Cardiac arrhythmias, including ventricular fibrillation may cause sudden death and is due in part to carbon tetrachloride-induced sensitisation of the myocardium to catecholamines.
- Evidence of hepatic injury usually occurs some 2-4 days after exposure but may be observed as early as 24 hours. Jaundice, increased liver enzyme activity, prolonged INR, metabolic acidosis and liver failure may occur. Haemolysis may be present. Renal failure usually begins a few days after hepatic damage becomes manifest and reaches its peak in the second week. Oliguria may progress to anuria due to renal tubular necrosis. Pulmonary oedema may be related to renal failure or direct cardiotoxicity.
- CNS depression will be increased by alcohol and sedative drugs.
- Skin contact can result in pain, redness and swelling as well as contact dermatitis.
- Eye contact may cause pain and minimal injury to the conjunctiva...

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TOXBASE - <http://www.toxbase.org> (accessed 02/2013)

<sup>a</sup> TOXBASE: Carbon tetrachloride, 2009.

<sup>b</sup> TOXBASE: Carbon tetrachloride, features and management 2009.

## Decontamination and First Aid

### Important Notes

- Ambulance staff, paramedics and emergency department staff treating chemically-contaminated casualties should be equipped with Department of Health approved, gas-tight (Respirex) decontamination suits based on EN466:1995, EN12941:1998 and prEN943-1:2001, where appropriate.
- Decontamination should be performed using local protocols in designated areas such as a decontamination cubicle with adequate ventilation.

### Dermal Exposure<sup>(a)</sup>

- 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 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 the irrigation begins, the greater the benefit.**
- Pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears.
- For management of systemic effects see ingestion.

### Ocular Exposure<sup>(b)</sup>

- Remove patient from exposure.
- Remove contact lenses if present and immediately irrigate the affected eye thoroughly with water or 0.9% saline for at least 10 – 15 minutes. Continue until the conjunctival sac pH is normal (7.5 – 8.0). Retest after 20 minutes and use further irrigation if necessary.
- Any particles lodged in the conjunctival recesses should be removed.
- Patients with corneal damage and those whose symptoms do not resolve rapidly should be referred for **urgent** ophthalmological assessment.

### Inhalation<sup>(a)</sup>

- Maintain a clear airway and ensure adequate ventilation
- Good neurological outcome after cardiac arrest due to poisoning may occur following prolonged resuscitation.
- If appropriate remove the patient from the source of exposure and decontaminate patient (see dermal exposure).
- Administer 100% oxygen via high-flow mask, or endotracheal tube if needed.
- Monitor pulse, blood pressure, respiratory rate, oxygen saturation and cardiac rhythm for a minimum of 2 hours after exposure.
- Other measures as indicated by the patient's clinical condition.

### Ingestion<sup>(a)</sup>

- Maintain a clear airway and ensure adequate ventilation.

<sup>a</sup> TOXBASE: Carbon tetrachloride, features and management, 2009.

<sup>b</sup> TOXBASE: Chemicals Splashed or Sprayed into the Eyes, 2012.

- Good neurological outcome after cardiac arrest due to poisoning may occur following prolonged resuscitation.
- If appropriate remove the patient from the source of exposure and decontaminate patient (see dermal exposure).
- Administer oxygen if altered mental status or dyspnoea occurs.
- Monitor pulse, blood pressure, respiratory rate, oxygen saturation, conscious level and cardiac rhythm for a minimum of 6 hours.
- Other measures as indicated by the patient's clinical condition.

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 in this document.