UK Health Security Agency

Tetrachloroethylene

Incident management

This document provides information needed for response to a chemical incident, such as physicochemical properties, health effects and decontamination advice.

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Contents

Main points

General

Tetrachloroethylene, also known as tetrachloroethene is a clear colourless volatile liquid at room temperature. It has a sweet ether-like smell. It reacts violently with finely divided metals generating a fire and explosion hazard.

This compound decomposes on contact with hot surfaces or flames, producing fumes of hydrogen chloride, phosgene and chlorine. It decomposes slowly on contact with moisture to produce trichloroacetic acid and hydrochloric acid.

Health

Systemic features may occur by inhalation and ingestion of tetrachloroethylene.

Systemic features include excitement, headache and dizziness leading to drowsiness, ataxia and dysarthria; coma and respiratory depression may occur in severe cases.

Inhalation can cause irritation of the respiratory tract and chemical pneumonia.

Ingestion may cause burning in mouth and throat, epigastric pain, nausea and vomiting.

Dermal exposure may cause skin irritation, dermatitis and deep burns due to its defatting action on the skin.

Tetrachloroethylene may be irritating to the eyes; contact with eyes has caused injury to the corneal epithelium.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving tetrachloroethylene unless casualties are demonstrating signs or symptoms of exposure to caustic or corrosive substances.

Environment

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

Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.

Hazard identification

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

UN		1897	Tetrachloroethylene	
EAC		2Z	Use fine water spray. Wear normal fire kit in combination with breathing apparatus [note 1]. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
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.

Note to Table 1

Note 1: Normal firefighting clothing is appropriate: self-contained open circuit positive pressure compressed air breathing apparatus conforming to BS EN 137 worn in combination with fire kit conforming to BS EN 469, fire fighters' gloves conforming to BS EN 659 and firefighters' footwear conforming to BS EN 15090 (Footwear for firefighters) type F3- Hazmat and structural firefighting or alternatively firefighters' boots conforming to Home Office Specification A29 (rubber boots) or A30 (leather boots). Leather footwear including those conforming to A30 may not provide adequate chemical resistance therefore caution should be exercised in the use of these boots.

References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. 'Dangerous Goods Emergency Action Code List'. 2025 (viewed on 28 May 2025)

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

Hazard class and category	Carc. 2	Carcinogencicity, category 2	
	Aquatic chronic 2	Chronic aquatic hazard, category 2	
Hazard statement	H351	Suspected of causing cancer	
	H411	Toxic to aquatic life with long lasting effects	
Signal words	WARNING		

References

The Health and Safety Executive (HSE). 'GB CLP Regulation' (viewed on 28 May 2025).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	127-18-4
Molecular weight	165.8
Formula	C_2Cl_4
Common synonyms	Tetrachloroethene, perchloroethylene, PCE
State at room temperature	Clear colourless, volatile liquid
Volatility	Readily volatile, vapour pressure = 18.5 mmHg at 25°C
Specific gravity	1.62 at 20°C (water = 1) 5.83 (air = 1)
Flammability	Not flammable
Lower explosive limit	-
Upper explosive limit	-
Water solubility	0.02%, insoluble
Reactivity	Reacts violently with finely divided metals generating a fire and explosion hazard. Decomposes on contact with hot surfaces or flames, this produces fumes of hydrogen chloride, phosgene and chlorine. Decomposes slowly on contact with moisture to produce trichloroacetic acid and hydrochloric acid. Reacts violently with concentrated nitric acid producing carbon dioxide.
Odour	Sweet ether-like smell

References

World Health Organization. International Programme on Chemical Safety. 'International chemical safety card for tetrachloroethylene'. ICSC 0076, 2013. World Health Organization (WHO) Geneva (viewed on 28 May 2025)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 31373, Tetrachloroethylene (viewed on 28 May 2025)

Reported effect levels from authoritative sources

Table 4a. Exposure by inhalation

Concentration		Duration of exposure	Signs and symptoms
mg/m³	ppm		
520-550	77-81	-	Transient eye irritation
690	102	7 hours	Mild nasal irritation
700	103	7 hours	Mild eye, nose, or throat irritation, frontal headache, flushing, sleepiness, and/or difficulty in speaking
1420-2450	209-361	2 hours	Lightheadedness, a sense of irresponsibility, nausea, and impaired motor coordination
3250	479	130 minutes	Sensory changes and elation
6280	926	95 minutes	Lassitude, mental fogginess, and exhilaration
6400-8200	943-1209	Immediate	Immediate severe eye and respiratory tract irritation
13 400	2000		Intolerable

Table 4b. Exposure by ingestion

Dose (g)	Signs and symptoms
4.5-6	Vertigo, inebriation, giddiness, nausea, sleepiness, and loss of consciousness
Dose (g/kg bw)	**Signs and symptoms**
1.6-4.8	Vomiting, gastrointestinal bleeding, shock, and potentially death (in children)

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values

Abbreviations

mg/m^3 = milligrams per cubic metre
g = grams
g/kg bw = grams per kilogram body weight
ppm = parts per million

Reference

International Programme on Chemical Safety (ICPS). Tetrachloroethene - Concise International Chemical Assessment Document 68. (2006) (viewed on 29 May 2025)

Published emergency response guidelines

Table 5. Interim acute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 minutes	**30 minutes**	**60 minutes**	**4 hours**	**8 hours**
AEGL-1 [note 1]	35	35	35	35	35
AEGL-2 [note 2]	230	230	230	120	81
AEGL-3 [note 3]	1600	1600	1200	580	410

Notes to Table 5

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 (EPA). ‘Acute Exposure Guideline Levels’ (viewed on 29 May 2025)

Exposure standards, guidelines or regulations

Table 6. Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m³	ppm	mg/m³
WEL	20	138	40	275

Abbreviations

WEL = workplace exposure limit.
LTEL = long-term exposure limit.
STEL = short-term exposure limit.
ppm = parts per million

Reference

Health and Safety Executive (HSE). 'EH40/2005 Workplace Exposure Limits Fourth Edition' 2020 (viewed on 29 May 2025)

Table 7. Public health standards and guidelines

UK drinking water standard	10 µg/L (cumulative total concentration of both trichlorothylene and tetrachloroethylene)
WHO guideline for drinking water quality	100 µg/L
UK indoor air quality guideline	40 µg/m³ (long-term value)
WHO indoor and outdoor air quality guideline	0.25 mg/m³ (annual average)

Reference

The Private Water Supplies (England) Regulations 2016 and The Private Water Supplies (Wales) Regulations 2017 (viewed on 29 May 2025)

The Water Supply (Water Quality) Regulations 2018 (Water, England and Wales) (viewed on 29 May 2025)

World Health Organization. 'Guidelines for Drinking-water Quality, 4th Edition Incorporating First and Second Addendum' 2022 (viewed on 29 May 2025)

World Health Organization Regional Office for Europe, Copenhagen World Health Organization Regional Publications. 'Guidelines for Indoor Air Quality:Selected Pollutants' 2010 (viewed on 29 May 2025)

Public Health England. ‘Indoor Air Quality Guidelines for selected Volatile Organic Compounds (VOCs) in the UK’ 2019 (viewed on 29 May 2025)

World Health Organization Regional Office for Europe. ‘Air Quality Guidelines for Europe, European Series, No. 91, 2nd Edition’ 2000 (viewed on 29 May 2025)

Health effects

Toxic by inhalation and ingestion; irritating to eyes, skin, and respiratory tract

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Inhalation can cause irritation of the respiratory tract and chemical pnuemonia. Sudden death (due to cardiac arrhythmias) has been associated with abuse of hydrocarbons. Systemic features are common following inhalation and CNS depression is usually the first presenting feature..
Ingestion	Ingestion may cause 'burning' in the mouth and throat, epigastric pain, nausea and vomiting. There is a risk of aspiration leading to chemical pneumonitis, particularly if vomiting occurs. Systemic features are possible.
Skin	May cause skin irritation, dermatitis and deep burns due to its defatting action on the skin. Significant dermal exposure with certain chlorinated hydrocarbons may lead to systemic toxicity.
Systemic features	Chlorinated hydrocarbons predominantly cause CNS depression. Symptoms include excitement, headache and dizziness leading to drowsiness, ataxia and dysarthria. Coma and respiratory depression may occur in severe cases. Cardiac arrhythmias may occur as a result of sensitisation of the heart to endogenous catecholamines. Hypoxia increases the risk of developing cardiac dysrhythmias. Chlorinated solvents can cause kidney and liver toxicity following large exposures.
Eye	May be irritating to the eyes; contact with the eyes has caused injury to the corneal epithelium.

Reference

National Poisons Information Service (NPIS). TOXBASE ‘Tetrachloroethylene’ 2025 (viewed on 29 May 2025)

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 tetrachloroethylene 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 (UKHSA) Radiation, Chemicals, Climate and Environmental Hazards 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, disrobing should be conducted at the scene and by the casualty themselves. Disrobing should be systematic to prevent transfer of contaminant from clothing to skin. Clothing should not be pulled over the head if possible.

Clothing stuck to the casualty by the contaminant should not be forcefully removed, as this risks causing further harm.

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.

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.

Unprotected first responders and members of the public should not approach casualties incapacitated by exposure to administer improvised decontamination, as they may be exposed to contaminants and become a casualty themselves.

Important note: Improvised decontamination should continue until a more structured intervention, such as an Interim Operational Response is carried out, or Specialist Operational Response are present.

Improvised dry decontamination

Improvised dry decontamination should be considered for an incident involving tetrachloroethylene unless casualties are demonstrating obvious signs of chemical burns or skin irritation.

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 first and then rubbed, starting with the face, head, and neck, and moving down and away from the body.

Blotting and rubbing should not be too aggressive, as it could drive contamination further into the skin.

Casualties should also blow their nose to remove contaminants from the nasal cavities.

All waste material arising from decontamination should be left in situ, and ideally bagged, for disposal at a later stage.

Improvised wet decontamination

Wet decontamination should be used if contamination with a caustic chemical substance is suspected.

Wet decontamination may be performed using copious amounts of water from any available source such as taps, showers, water bottles, fixed installation hose-reels and sprinklers to gently rinse the affected skin. Other natural sources of water may be considered unless this creates greater risks to the individuals affected. Wet wipes or baby wipes may be used as an effective alternative.

Improvised decontamination should not involve overly aggressive methods to remove contamination as this could further damage affected tissues and 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.

When vulnerable people are affected by a hazardous substance, they may need additional support to remove themselves, their clothing or the substance.

Casualties should remain in the area and should not leave to seek care at a hospital, as this presents a contamination risk. Further care will be administered on site by the appropriate emergency services.

Interim wet decontamination

Interim decontamination is the use of standard Fire and Rescue Service 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 2015 (viewed on 29 May 2025)

National Health Service England. 'Emergency Preparedness, Resilience and Response (EPRR): Guidance for the initial management of self-presenters from incidents involving hazardous materials' 2019 (viewed on 29 May 2025)

Joint Emergency Service Interoperablility Programme. 'Initial Operational Response IOR to Incidents Suspected to Involve Hazardous Substances or CBRN Materials' 2024 (viewed on 29 May 2025)

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.

For comprehensive clinical advice consult TOXBASE directly.

Clinical decontamination following surface contamination

Avoid contaminating yourself.

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 soap and water under low pressure for at least 10 to 15 minutes.

Pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears.

The earlier irrigation begins, the greater the benefit.

Dermal exposure

Decontaminate (as above) the patient following surface contamination.

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

Carry out 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 1,000mL 0.9% saline or equivalent crystalloid (for example, by an infusion bag with a giving set) for a minimum of 10 to 15 minutes irrespective of initial conjunctival pH. A Morgan Lens may be used if anaesthetic has been given.

Aim for a neutral conjunctival pH of 7 to 7.2. The conjunctivae may be tested with indicator paper. Retest at 15 to 30 minutes after irrigation and use further irrigation if necessary.

Any particles lodges 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.

Carry out other supportive measures as indicated by the patient's clinical condition.

Ingestion/inhalation/systemic toxicity

Maintain a clear airway and ensure adequate ventilation.

Gastric decontamination after ingestion is contraindicated due to the increased risk of aspiration.

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

Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE 'Tetrachloroethylene' 2025 (viewed on 29 May 2025)

National Poisons Information Service (NPIS). TOXBASE 'chemicals splashed or sprayed into the eyes - features and clinical management' 2020 (viewed on 29 May 2025)

National Poisons Information Service (NPIS). TOXBASE 'skin decontamination - irritants' 2019 (viewed on 29 May 2025)

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 health secure.

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

This document from the UKHSA Radiation, Chemicals, Climate and Environmental Hazards Directorate reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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For queries relating to this document, please contact chemcompendium@ukhsa.gov.uk or enquiries@ukhsa.gov.uk

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