UK Health Security Agency

Vinyl chloride

Incident management

Contents

Main points

General

Vinyl chloride is an extremely flammable gas with a mild sweet odour. It is reactive under light and on contact with air, oxidising agents or metals.

Vinyl chloride emits toxic vapours of hydrogen chloride and phosgene when heated to decomposition.

Health

The main route of exposure to vinyl chloride is likely to be via inhalation.

Inhalation can cause weakness, ataxia, inebriation, headache, fatigue, , paraesthesia, nausea, vomiting, epigastric pain, visual and auditory disturbances, narcosis and death.

Dermal exposure to liquefied gas causes irritation, pain, burns and contact dermatitis; rapid evaporation may produce local frostbite.

Ocular exposure causes irritation, pain and possible frostbite and corneal injury.

Casualty decontamination at the scene

Decontamination may not be required following exposure to vinyl chloride as it exists as a gas at room temperature. Vinyl chloride may be stored as a liquid under pressure in cylinders for industrial use, this liquid will rapidly volatilise on release, though it may cause thermal burns on contact with skin.

Environment

Inform the Environment Agency where appropriate.

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 vinyl chloride

UN		1086	Vinyl chloride	
EAC		2YE	Use fine water spray. Wear normal fire kit in combination with breathing apparatus [note 1]. Substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters. There may be a public safety hazard outside the immediate area of the incident [note 2].	
APP		–	–	
Hazards	**Class**	2.1	Flammable gases	
	Sub-risks	–	–	
HIN		239	Flammable gas, which can spontaneously lead to violent reaction	

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 i.e., 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.

[note 2] People should be warned to stay indoors with all doors and windows closed, preferably in rooms upstairs and facing away from the incident. Ignition sources should be

eliminated, and ventilation stopped Effects may spread beyond the immediate vicinity. All non-essential personnel should be instructed to move at least 250 m away from the incident.

Reference

‘National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. The Stationery Office. (viewed March 2024)

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

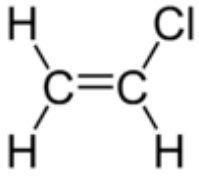
Hazard class and category	Press. Gas	Pressurised gas	
	Flam. Gas 1	Flammable gas, category 1	
	Carc. 1A	Carcinogenicity, category 1A	
Hazard statement	H220	Extremely flammable gas	
	H350	May cause cancer	
Signal words	DANGER		

Reference

The Health and Safety Executive (HSE). 'GB CLP Regulation' (viewed March 2024).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	75-01-4
Molecular weight	62.5
Formula	C_2H_3Cl
Common synonyms	Chloroethene, chloroethylene, monochloroethylene
State at room temperature	Gas
Volatility	Vapour pressure = 344 kPa at 20°C
Specific gravity	(Water = 1) 0.9 (Air = 1) 2.2
Flammability	Flammable
Lower explosive limit	3.6%
Upper explosive limit	33%
Water solubility	Poor
Reactivity	Vinyl chloride can form explosive peroxides under specific circumstances. It readily polymerizes due to heating and under the influence of air, light and on contact with a catalyst, strong oxidizing agents and metals such as copper and aluminium. This generates fire or explosion hazard. Decomposes on burning. This produces toxic and corrosive fumes of hydrogen chloride and phosgene. Attacks iron and steel in the presence of moisture.
Odour	Mild sweet odour
Structure	

References

International Programme on Chemical Safety. ’. World Health Organization (WHO) Geneva (viewed March 2024).

PubChem [Internet]. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information; 2004-. PubChem Compound Summary for CID 6338, Vinyl Chloride (viewed March 2024).

Reported effect levels from authoritative sources

Table 4. Exposure by inhalation

ppm	mg/m^3	Signs and symptoms
9000 – 20,000	23,006 – 51,124	Dizziness, nausea and headache
70,000 – 100,000	178,932 – 255,617	Narcotic effects
120,000	306,741	Cardiac arrythmia
>120,000	>306,741	Lethal dose

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

Reference

International Programme for Chemical Safety (IPCS). Vinyl Chloride – Poisons Information Monograph 558 (1997).

Published emergency response guidelines

Table 5. cute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 minutes	**30 minutes**	**60 minutes**	**4 hours**	**8 hours**
AEGL-1 [note 1]	450	310	250	140	70
AEGL-2 [note 2]	2800	1600	1200	820	820
AEGL-3 [note 3]	12,000 [note 4]	6800 [note 4]	4800* [note 4]	3400	3400

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.
[note 4] Safety considerations for the hazard of explosions must be taken into account due to the explosive nature of the compound.

Reference

US Environmental Protection Agency (EPA). (viewed March 2024).

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	1	2.6	No guideline specified	

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 7. Public health standards and guidelines

UK drinking water standard	0.5 µg/L [note 1]
WHO guideline for drinking water quality	0.3 µg/L
WHO air quality guideline	Vinyl chloride is a human carcinogen. No safe level can be indicated.Exposure to 1 µg/m3 equates to an estimated lifetime cancer risk of 1×10^{-6}

[note 1] The parametric value refers to the residual monomer concentration in the water as calculated according to specifications of the maximum release from the corresponding polymer in contact with the water. This is controlled by product specification.

References

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)

World Health Organisaton (WHO). Guidelines for Drinking-water Quality, 4th Edition Incorporating First and Second Addendum 2022 WHO: Geneva

WHO Regional Office for Europe. 'Air Quality Guidelines for Europe, European Series, No. 91, 2nd Edition', 2000. WHO: Copenhagen

Health effects

Inhalation is the main route of exposure

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Features include weakness, ataxia, inebriation, headache, fatigue, paraesthesiae, GI upset, epigastric pain, visual and auditory disturbances, narcosis and death
Dermal	Exposure to liquid vinyl chloride may cause dermal irritation, pain and burns. Rapid evaporation may produce local frostbite.
Ocular	Irritation and pain with possible frostbite and corneal injury.

Reference

TOXBASE. Vinyl Chloride. January 2023 (viewed March 2024)

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.

Decontamination may not be required following exposure to vinyl chloride as it exists as a gas at room temperature. Vinyl chloride may be stored as a liquid under pressure in cylinders for industrial use, this liquid will rapidly volatilise on release, though it may cause thermal burns on contact with skin.

Emergency services and public health professionals can obtain further advice from the UK Health Security Agency (UKHSA) Radiation, Chemicals and Environment Directorate using the 24- hour chemical hotline number: 0344 892 0555.

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.

Dermal exposure

. Remove clothing carefully, irrigate with water (ideally at 37 degrees if frostbite is suspected). Treat severe symptoms as thermal burns. Refer to plastic surgeons as appropriate.

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

Patients should be advised on discharge to seek medical attention if symptoms subsequently develop.

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 crytalloid (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 final conjunctival pH of 7.0 to 8.0. The conjunctivae may be tested with indicator paper. Retest 20 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.

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

Inhalation

In the event of cardiac arrest in hospital or witnessed out of hospital cardiac arrest with prompt bystander CPR, resuscitation should be usually continued for at least 1 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.

Maintain a clear airway and ensure adequate ventilation.

If appropriate, remove from exposure and give oxygen.

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.

For comprehensive advice on clinical first aid, clinicians should consult TOXBASE directly.

Clinical decontamination and first aid references

- TOXBASE (viewed in March 2024).
- TOXBASE: ‘Vinyl Chloride’ (2023)
- TOXBASE: ‘Chemicals splashed or sprayed into eyes – features and management’ (2020)

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 and Environment 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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