



Vinyl Chloride

Incident Management

Key Points

Fire

- extremely flammable
- reactive under light, contact with air, oxidising agents or metals
- emits toxic vapours of hydrogen chloride and phosgene when heated to decomposition
- in the event of a fire involving vinyl chloride, use fine water spray and normal fire kit with breathing apparatus

Health


- main route of exposure is likely to be via inhalation
- inhalation can cause weakness, ataxia, inebriation, headache, fatigue, numbness, 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

Environment



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

Hazard Identification

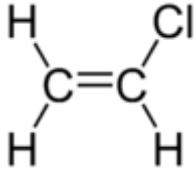
Standard (UK) dangerous goods emergency action codes

UN		1086	Vinyl chloride, stabilized	
EAC		2YE	Use fine water spray can be used. Wear normal fire kit in combination with breathing apparatus*. Danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and watercourses. There may be a public safety hazard outside the immediate area of the incident†	
APP		-	-	
Hazards	Class	2.1	Flammable gas	
	Sub-risks	–	–	
HIN		239	Flammable gas, which can spontaneously lead to violent reaction	
<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>† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</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)*

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		
* 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 06/2018).			

Physicochemical Properties

CAS number	75-01-4
Molecular weight	63
Formula	C ₂ H ₃ Cl
Common synonyms	Chloroethylene; Chloroethene; Ethylene monochloride; Monochlorethene; VC; VCM
State at room temperature	Gas
Volatility	Vapour pressure 2530 mm Hg at 20°C.
Vapour density	2.2 at 20°C (air = 1)
Flammability	Extremely flammable
Lower explosive limit	3.6%
Upper explosive limit	33%
Water solubility	Slightly soluble
Reactivity	Vinyl chloride readily polymerises due to heating and under the influence of air, light and on contact with a catalyst, strong oxidising agents and metals such as copper and aluminium, this generates a fire or explosion hazard.
Reaction or degradation products	Decomposes on burning, producing toxic vapours of hydrogen chloride and phosgene
Odour	Sweet
Structure	
References Hazardous Substances Data Bank. Vinyl chloride HSDB No. 169 (last revision date 31/12/2013). US National Library of Medicine: Bethesda MD. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed 06/2018). International Programme on Chemical Safety. International Chemical Safety Card entry for Vinyl chloride. ICSC 0082, 2017. World Health Organization: Geneva. Vinyl chloride (IBM HAZARDTEXT ©) In: IBM Micromedex® TOMES® System (electronic version). Truven Health Analytics, Greenwood Village, Colorado, USA. Available at: http://www.micromedexsolutions.com/ (accessed 06/2018).	

Reported Effect Levels from Authoritative Sources

Exposure by ingestion

ppm	mg/m ³	Duration	Signs and symptoms	Reference
12,000	30,720	5 minutes	Slight anaesthetic effects including dizziness, headache and/or nausea	a
70,000– 100,000	178,937– 255,624	-	Narcotic effects	b
120,000	306,748	-	Cardiac arrhythmias and potentially fatal	b

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

References

- a OECD Screening Information Data Set (SIDS) Vinyl chloride. 2001.
- b International Programme on Chemical Safety, Poisons Information Monograph 558: Vinyl chloride.

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	500 ⁽¹⁾	1,275
ERPG-2 [†]	5,000 ⁽²⁾	12,750
ERPG-3 [‡]	20,000 ⁽³⁾	51,000

* 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 threshold should be detectable near ERPG-1

(2) 10–49% lower explosive limit (LEL); LEL = 36,000 ppm

(3) 50–99% LEL

Reference
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 05/2018).

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	450	310	250	140	70
AEGL-2 [†]	2,800	1,600	1,200	820	820
AEGL-3 [‡]	12,000 ⁽¹⁾	6,800 ⁽¹⁾	4,800 ⁽¹⁾	3,400	3,400

* 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

Note (1): lower explosive limit (LEL) = 38,000 ppm to 293,000 ppm

(1) = >10% LEL; safety considerations against the hazard(s) of explosion(s) must be taken into account

Reference
US Environmental Protection Agency. Acute Exposure Guideline Levels. <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 05/2018).

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	3	7.8	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, 3rd Edition, 2018.</p>				

Public health guidelines

Drinking water standard	0.5 µg/L*
WHO guideline value	0.3 µg/L
Air quality guideline	Guideline value not given Exposure to 1 µg/m ³ equates to an estimated lifetime cancer risk of 1×10 ⁻⁶
<p>Notes</p> <p>* 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</p> <p>Reference</p> <p>The Water Supply (Water Quality) Regulations 2016 The Private Water Supplies (England) Regulations 2016 and The Private Water Supplies (Wales) Regulations 2010 WHO. Guidelines for Drinking-Water Quality, 4th Edition, 2011. World Health Organization: Geneva. Air Quality Guidelines for Europe. World Health Organization Regional Office for Europe, Copenhagen WHO Regional Publications, European Series, No. 91, Second Edition, 2000.</p>	

Health Effects

Major route of exposure

- inhalation and irritation via dermal and ocular exposure

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Features include weakness, ataxia, inebriation, headache, fatigue, paraesthesia, nausea, vomiting, 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, pain and possible frostbite and corneal injury
Reference	
TOXBASE. Vinyl Chloride, 02/2018. http://www.toxbase.org (accessed 06/2018).	

Decontamination at the Scene

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 Public Health England (Centre for Radiation, Chemical and Environmental Hazards) 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 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. Care should be given in a well ventilated area.

Dermal exposure

- treat dermal and cold injuries conventionally
- 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

- maintain a clear airway and ensure adequate ventilation
- give oxygen

- perform a 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 06/2018)
- TOXBASE Vinyl chloride – features and management, 02/2018
- TOXBASE Chemical splashed or sprayed into the eyes – features and management 06/2017

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.

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