Dichloromethane
Incident Management

Key Points

Fire
- combustible liquid
- reacts violently with metals such as aluminium powder, magnesium powder, strong bases and strong oxidants, causing a fire and explosion hazard
- emits toxic fumes of phosgene, carbon monoxide and hydrogen chloride when heated to decomposition or involved in combustion
- in the event of a fire involving dichloromethane, use fine water spray and normal fire kit with breathing apparatus

Health
- main routes of exposure are ingestion, inhalation and dermal contact
- ingestion may cause gastrointestinal burns, haemorrhage and necrosis
- inhalation causes dyspnoea, cough, respiratory tract irritation, pulmonary oedema and pneumonitis with bilateral exudative pleural effusions
- dermal contact causes a burning sensation, numbness, coldness and pain
- ingestion, inhalation and extensive or prolonged dermal contact can cause systemic effects including headache, light-headedness, blurred vision, fatigue, disorientation, confusion, drowsiness, agitation, ataxia, arthropathy, rash, skin flushing and diaphoresis
- eye contact with vapour can cause irritation, and with liquid may cause corneal burns

Environment
- avoid release to the environment; inform the Environment Agency of substantial incidents
Hazard Identification

Standard (UK) dangerous goods emergency action codes

<table>
<thead>
<tr>
<th>UN</th>
<th>1593</th>
<th>Dichloromethane</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAC</td>
<td>2Z</td>
<td>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</td>
</tr>
<tr>
<td>APP</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Hazards</td>
<td>Class</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td>Sub-risks</td>
<td>–</td>
</tr>
<tr>
<td>HIN</td>
<td>60</td>
<td>Toxic or slightly toxic substance</td>
</tr>
</tbody>
</table>

UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number

* 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

Reference

Classification, labelling and packaging (CLP)*

<table>
<thead>
<tr>
<th>Hazard class and category</th>
<th>Carc. 2</th>
<th>Carcinogenicity, category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard statement</td>
<td>H351</td>
<td>Suspected of causing cancer</td>
</tr>
<tr>
<td>Signal words</td>
<td>WARNING</td>
<td></td>
</tr>
</tbody>
</table>

* Implemented in the EU on 20 January 2009

Reference
### Physicochemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAS number</strong></td>
<td>75-09-2</td>
</tr>
<tr>
<td><strong>Molecular weight</strong></td>
<td>84.9</td>
</tr>
<tr>
<td><strong>Formula</strong></td>
<td>CH₂Cl₂</td>
</tr>
<tr>
<td><strong>Common synonyms</strong></td>
<td>Methylene chloride, DCM</td>
</tr>
<tr>
<td><strong>State at room temperature</strong></td>
<td>Clear, colourless liquid</td>
</tr>
<tr>
<td><strong>Vapour pressure</strong></td>
<td>349 mmHg at 20°C</td>
</tr>
<tr>
<td><strong>Specific gravity</strong></td>
<td>1.3 (water = 1)</td>
</tr>
<tr>
<td><strong>Vapour density</strong></td>
<td>2.9 (air = 1)</td>
</tr>
<tr>
<td><strong>Flammability</strong></td>
<td>Combustible liquid</td>
</tr>
<tr>
<td><strong>Lower explosive limit</strong></td>
<td>12%</td>
</tr>
<tr>
<td><strong>Upper explosive limit</strong></td>
<td>25%</td>
</tr>
<tr>
<td><strong>Water solubility</strong></td>
<td>Moderately soluble</td>
</tr>
<tr>
<td><strong>Reactivity</strong></td>
<td>Reacts violently with metals such as aluminium powder, magnesium powder, strong bases and strong oxidants, causing a fire and explosion hazard. Attacks some forms of plastic rubber and coatings</td>
</tr>
<tr>
<td><strong>Reaction or degradation products</strong></td>
<td>Decomposes on heating or on burning and on contact with hot surfaces, producing toxic and corrosive fumes including hydrogen chloride, phosgene and carbon monoxide</td>
</tr>
<tr>
<td><strong>Odour</strong></td>
<td>Sweet ether-like odour</td>
</tr>
</tbody>
</table>

### References

# Reported Effect Levels from Authoritative Sources

## Exposure by inhalation

<table>
<thead>
<tr>
<th>ppm</th>
<th>mg/m³</th>
<th>Exposure duration</th>
<th>Signs and symptoms</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>300–800</td>
<td>1,042–2,778</td>
<td>40 minutes</td>
<td>Psychomotor and sensory impairment</td>
<td>b</td>
</tr>
<tr>
<td>500–1,000</td>
<td>1,736–3,472</td>
<td>1–2 hours</td>
<td>Light-headedness and alterations in visual reflexes</td>
<td>b</td>
</tr>
<tr>
<td>2,300</td>
<td>7,987</td>
<td>5 minutes</td>
<td>Irritation and dizziness</td>
<td>b</td>
</tr>
<tr>
<td>2,300</td>
<td>7,987</td>
<td>30 minutes</td>
<td>Nausea</td>
<td>b</td>
</tr>
<tr>
<td>5,000</td>
<td>17,362</td>
<td>Acute</td>
<td>Headache, fatigue and irritation</td>
<td>b</td>
</tr>
<tr>
<td>7,200</td>
<td>24,290–34,700</td>
<td>8 minutes</td>
<td>Paraesthesia and eye irritation</td>
<td>b</td>
</tr>
<tr>
<td>8,000–20,000</td>
<td>27,779–69,447</td>
<td>30 minutes – 4 hours</td>
<td>Narcosis</td>
<td>a, b</td>
</tr>
<tr>
<td>&gt;50,000</td>
<td>&gt;173,620</td>
<td>Acute</td>
<td>Immediate danger to life or health</td>
<td>b</td>
</tr>
</tbody>
</table>

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

**References**


## Exposure by ingestion

<table>
<thead>
<tr>
<th>mL</th>
<th>Signs and symptoms</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Estimated adult fatal dose</td>
<td>a</td>
</tr>
</tbody>
</table>

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

**Reference**

## Published Emergency Response Guidelines

### Emergency response planning guideline (ERPG) values

<table>
<thead>
<tr>
<th></th>
<th>Listed value (ppm)</th>
<th>Calculated value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERPG-1*</td>
<td>300</td>
<td>1,060</td>
</tr>
<tr>
<td>ERPG-2†</td>
<td>750</td>
<td>2,648</td>
</tr>
<tr>
<td>ERPG-3‡</td>
<td>4,000</td>
<td>14,120</td>
</tr>
</tbody>
</table>

* 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

Reference

### Acute exposure guideline levels (AEGLs) (interim)

<table>
<thead>
<tr>
<th></th>
<th>ppm</th>
<th>10 min</th>
<th>30 min</th>
<th>60 min</th>
<th>4 hours</th>
<th>8 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEGL-1*</td>
<td>290</td>
<td>230</td>
<td>200</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>AEGL-2†</td>
<td>1,700</td>
<td>1,200</td>
<td>560</td>
<td>100</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>AEGL-3‡</td>
<td>12,000</td>
<td>8,500</td>
<td>6,900</td>
<td>4,900</td>
<td>2,100</td>
<td></td>
</tr>
</tbody>
</table>

* 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
NR Not recommended due to insufficient data

Reference
Exposure Standards, Guidelines or Regulations

Occupational standards

<table>
<thead>
<tr>
<th></th>
<th>LTEL (8-hour reference period)</th>
<th>STEL (15-min reference period)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ppm mg/m³</td>
<td>ppm mg/m³</td>
</tr>
<tr>
<td>WEL</td>
<td>100 350</td>
<td>300 1060</td>
</tr>
</tbody>
</table>

WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit

Reference

Public health guidelines

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO drinking water guideline</td>
<td>0.02 mg/L</td>
</tr>
<tr>
<td>Air quality guideline</td>
<td>3 mg/m³ (24-hour guideline)</td>
</tr>
<tr>
<td></td>
<td>0.45 mg/m³ (weekly average concentration)</td>
</tr>
</tbody>
</table>

Soil guideline values and health criteria values
No guideline values

References
Health Effects

Major route of exposure

- dichloromethane has direct solvent toxicity and may be toxic due to its carbon monoxide, formaldehyde, formic acid and carbon dioxide metabolites
- inhalation is the most common cause of toxicity

Immediate signs or symptoms of acute exposure

<table>
<thead>
<tr>
<th>Route</th>
<th>Signs and symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>Inhalation causes dyspnoea, cough, upper respiratory tract irritation, pulmonary oedema and pneumonitis; bilateral exudative pleural effusions have been documented. Systemic features may also develop</td>
</tr>
<tr>
<td>Ingestion</td>
<td>Ingestion may cause gastrointestinal burns, haemorrhage and necrosis. Acute pancreatitis has been reported. Systemic features may occur</td>
</tr>
<tr>
<td>Dermal</td>
<td>Dermal contact causes a burning sensation, numbness, coldness and pain. Second- and third-degree burns have been reported. Absorption leading to systemic features may occur if exposure is prolonged or extensive</td>
</tr>
<tr>
<td>Ocular</td>
<td>Eye contact with vapours causes irritation. Contact with liquid dichloromethane may cause corneal burns</td>
</tr>
<tr>
<td>Systemic</td>
<td>Systemic features include headache, light-headedness, blurred vision, fatigue, disorientation, confusion, drowsiness, agitation, ataxia, rash, arthropathy, skin flushing and diaphoresis. Gastrointestinal effects include nausea, vomiting and diarrhoea. Cardiovascular effects include syncope, tachycardia and hypertension. Optic neuropathy has been recorded Elevated carboxyhaemoglobin concentrations are common. Metabolic acidosis, electrolyte disturbances (hypernatraemia, hypokalaemia/hyperkalaemia, hypocalcaemia), temporary diabetes mellitus, leukocytosis, raised liver enzymes and elevated creatine phosphokinase concentration can occur In severe cases, hypotension, respiratory depression, coma, convulsions, pulmonary and cerebral oedema, acute kidney injury, cardiac arrhythmias and cardiac arrest may occur</td>
</tr>
</tbody>
</table>

References

Decontamination at the Scene

Summary

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 dichloromethane 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 Public Health England (Centre for Radiation, Chemical and Environmental Hazards) 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 (eg 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 etc) 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/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


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 – www.toxbase.org.

Important notes
- if the patient has not been decontaminated following surface contamination, secondary carers must wear appropriate NHS PPE for chemical exposure to avoid contaminating themselves
- carry out decontamination after resuscitation; resuscitate the patient according to standard guidelines

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
- 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
- the earlier irrigation begins, the greater the benefit
- pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears

Dermal exposure
- decontaminate (as above) following surface contamination
- monitor BP, pulse and oxygen saturation
- measure COHb
- administer 100% oxygen in individuals with respiratory symptoms, reduced oxygen saturations or elevated COHb concentrations
- patients may subsequently deteriorate due to carbon monoxide generation; consider serial COHb measurements in symptomatic patients
- burns totalling more than 15% of body surface 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. Excision or skin grafting may be required
• if features of systemic toxicity present, manage as per ingestion
• 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 oxybuprocaïne, 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 (eg by an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10–15 minutes irrespective of initial conjunctival pH. 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 discussed urgently with an ophthalmologist
• other supportive measures as indicated by the patient’s clinical condition

Inhalation
• maintain a clear airway and ensure adequate ventilation
• give oxygen
• monitor BP, pulse and oxygen saturation
• measure COHb
• administer 100% oxygen in individuals with respiratory symptoms, reduced oxygen saturations or elevated COHb concentrations
• patients may subsequently deteriorate due to carbon monoxide generation; consider serial COHb measurements in symptomatic patients
• perform a 12 lead ECG
• other supportive measures as indicated by the patient’s clinical condition

Ingestion
• maintain airway and establish haemodynamic stability
• in severely affected patients critical care input is essential. Urgent assessment of the airway is required. A supraglottic-epiglottic burn with erythema and oedema is usually a sign that further oedema will occur that may lead to airway obstruction
• do not attempt gastric lavage
• do not give neutralising chemicals as heat produced during neutralisation reactions may increase injury
• monitor BP, pulse, cardiac rhythm and oxygen saturation
• measure COHb
• administer 100% oxygen in individuals with respiratory symptoms, reduced oxygen saturations or elevated COHb concentrations
• patients may subsequently deteriorate due to carbon monoxide generation; consider serial COHb measurements in symptomatic patients
• perform a 12 lead ECG
• other supportive measures as indicated by the patient’s clinical condition

Clinical decontamination and first aid references

TOXBASE Methylene chloride (dichloromethane), 2014
TOXBASE Methylene chloride – features and management, 2014
TOXBASE Chemicals splashed or sprayed into the eyes, 2014

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First published: January 2016

Update: November 2016 Health Effects, Decontamination at the Scene & Clinical Decontamination and First Aid