

# Recommendations for fire brigade response when at risk through chlorine

Short title: Chlorine

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Change history:

**Version: 4 (November 2022)**

**Replaces Version 3 (July 2017)**

**Initial Version: April 2008**

Significant changes:

- Editorial changes
- Adjustment of terms (FwDV 500)

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**Note:**

A spelling that is equally fair to all genders is desirable. However, since corresponding newer spellings generally lead to major restrictions in readability, this has been dispensed with. Thus, for the entire document, the masculine form includes all genders, unless explicitly stated otherwise.

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## 1. General

Chlorine is an extremely poisonous, corrosive and oxidising gas that is commonly used in many technical applications.

### 1.1. Properties

- Liquefied gas under pressure (6.7 bar at 20 °C)
- Respiratory toxin with **irritant and corrosive effect**
- Hazardous to water
- Non-flammable
- Heavier than air (theoretical density ratio: 2.5)
- 1 litre of liquefied chlorine is equivalent to approx. 457 litres of chlorine gas in fully expanded state.
- If it escapes at temperatures **below -34 °C**, liquid chlorine is cold and contact results in **serious frostbite and destruction of normal chemical protective clothing**.
- AGM (German workplace threshold value; similar to TLV-TWA): **0.5 ppm**; ETW-1 (response tolerance value, for 1 hour): **2 ppm**; ETW-4 (for 4 hour): **1 ppm**
- **Potentially lethal** in concentrations above **50 ppm**, always lethal in concentrations of **1,000 ppm**
- In combination with water corrosive for almost all metals!

### 1.2. Recognition features

- Pungent (irritant) odour (odour threshold: 0.3 ppm)
- Gas has a green-yellowish colour in medium and high concentrations.
- Pressurised gas cylinder, yellow cylinder shoulder and grey casing (liquefied at 6.7 bar), cylinders up to 52 litres, drums with capacities of 400 and 800 litres)



- Chemically bound chlorine, e.g. in the form of chlorinated lime in tablet form (for swimming pool hygiene), dissolves upon contact with water.
- UN Number: 1017
- Hazard Identification Number: 265 (poisonous gas, oxidising)



- Hazard Placards 6.1 (white with black skull and crossbones), 8 (white/black with liquids, spilling from 2 glass vessels and attacking a hand a metal plate) and 5.1 (yellow with flame over circle)



### 1.3. Indications

- Odour
- Detection tube: chlorine
- **Potassium iodide starch paper** (moisten beforehand for testing in air, immerse only briefly for testing of liquids).
- Universal indicator paper (**pH paper**) is discoloured by chlorinated water and is therefore **not suitable** for detection.

#### 1.4. Use

- For the disinfection of drinking water, waste water and swimming pool water
- In the chemical industry, e.g. in the production of vinyl chloride (intermediate product for the production of PVC)
- Also transported in pipelines and in **60 m<sup>3</sup>** tank wagons.

#### 2. Measures

##### General measures

- Ensure personal safety.
- Isolate hazard zone immediately.
- Self-contained breathing apparatus (SCBA) and chemical protection suit (gastight)
- In the event of the leakage of liquid chlorine: wear thermal protective clothing
- Always observe the further spread of the leak.

##### 2.1. General tactical advice for response actions

- Keep a distance of at least 50 m.
- Take the wind direction into account when your vehicle is approaching; approach upwind.
- Evacuate the major risk area (hot zone) outdoors, and cordon off a large area depending on the amount of chlorine being stored.
- Close doors and windows! Switch off air conditioning.
- Do not evacuate neighbouring buildings.
- If applicable, monitor and seal off lower-lying rooms in residential and industrial buildings in the direction in which the gas is spreading.
- Take heed of the plant's emergency response plan.

##### 2.2. Leakage of gaseous chlorine

- Use water spray to contain chlorine gas cloud (this dissolve only a low volume of chlorine, but the cloud is mechanically stopped/diverted, swirled in air and therefore "diluted").
- This creates a solution (chlorine water) which has an acidic and oxidising effect and from which chlorine can continue to be released in small quantities.
- Consult the wastewater authority before discharging the wastewater into the sewers.
- If necessary, dilute occurring wastewater with flooding amount of water (several monitors!).
- Chlorine can be rendered harmless with sodium sulphate solution or hydrogen peroxide, for example.
- Close pressurised gas container valve, seal the leak (e.g. gas cylinder sealing kit or gas cylinder recovery container).
- Do not place leaking or emergency sealed containers in a container filled with water (such as a dumpster, bin, swimming pool), as even minor leaks can cause severe corrosion at the exit point. A heating of the container to the bursting pressure is possible.

##### 2.3. Leakage of liquefied chlorine (additional measures)

- Use water spray to contain chlorine gas cloud (this dissolve only a low volume of chlorine, but the cloud is mechanically stopped/diverted, swirled in air and therefore "diluted").
- Wear thermal protective clothing inside the chemical protection suit (warming overall, foot lets, gloves made of wool)

- Do not wear chemical protection suits made of PVC, as PVC becomes brittle if it is exposed to liquid ammonia.
- Try to seal the leak or place the cylinders in suitable gas cylinder recovery containers.
- Otherwise, cover the leakage area or the ammonia spill with medium expansion foam or PE foil, for example. The foam cover freezes and acts like a protective shell.

#### 2.4. First aid

- In case of contact with skin or eyes, rinse the affected areas immediately with plenty of water for at least 15 minutes.
- Remove contaminated clothing, rinse affected areas of the skin with plenty of water.
- In case of inhalation: medical treatment of the injured person by an emergency doctor
- Gas irritates the upper airways immediately
- Use ventilator! - Avoid direct rescue breaths (mouth-to-mouth, mouth-to-nose).
- Oxygen supply (intermittent positive pressure ventilation)
- Carefully thaw body parts that have been frozen through contact with liquefied gas using cold water.
- Total rest, prevent hypothermia (gold foil blankets).
- Call on additional personnel and resources if a large number of people are affected.

#### 2.5. Follow-up measures

- Proper disposal of recovered cylinders
- Decontaminate emergency personnel and equipment with water (cf. vfdb Guideline 10-04).
- Where possible, collect and dispose of contaminated water.

#### 2.6. Notifications

- Police
- Competent water authority
- Where applicable, TUIS - the German chemical industry's "Transport Accident Information and Emergency Response System"
- Where applicable, poison control centre
- Where applicable, gas cylinder supplier

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