

Recommendations for fire brigade response when at risk through ammonia

Short title: Ammonia

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Change history:

Version: 4 (November 2022)

Replaces Version 3 (November 2017)

Initial Version: April 2008

Significant changes:

- Editorial changes
- Adjustment of terms (FwDV 500)

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

Ammonia is an extremely poisonous, corrosive gas that is commonly used often in large quantities in many technical applications.

1.1. Properties

- Liquefied gas under pressure (8.6 bar at 20 °C)
- Respiratory toxin with **irritant and corrosive effect**
- Hazardous to water
- Flammable in the presence of heat, ignition temperature: >630 °C
- **Explosive range: 15-34 percentage by volume** (for example there is sufficient ignition energy of a light bulb that bursts due to the effect of cold temperatures)
- Pure substance is lighter than air (theoretical density ratio: 0.6).
- 1 litre of liquefied ammonia is equivalent to approx. 1.000 litres of gaseous ammonia in fully expanded state.
- Highly soluble in water, also forms a corrosive liquid when highly diluted (ammonia solution)
- If it escapes at temperatures **below -33 °C**, liquid ammonia is cold and contact results in **serious frostbite and destruction of normal chemical protective clothing**.
- AGM (German workplace threshold value; similar to TLV-TWA): **20 ppm**; ETW-1 (response tolerance value, for 1 hour): **160 ppm**; ETW-4 (for 4 hour): **110 ppm**
- Odour threshold: 0.02 - 70 ppm;
- There is a risk of panic reactions even with harmless concentrations due to the low odour threshold.

N.B.



Leaking ammonia reacts with humidity and then becomes a “fog” that is heavier than air.

This “fog” gathers close to the ground. The higher the humidity in the vicinity of the leakage is, the greater the volume of ammonia will be that spreads along ground and may be showing typical “heavy gas” behaviour (collects in low or confined areas).

1.2. Recognition features, storage and transport

- Pungent odour
- Colourless in gaseous and liquid state
- Pressurised gas cylinder, yellow cylinder shoulder and grey casing (liquefied at 8.6 bar)



- UN-Nr.: 1005 (in solution :1043, 2073, 2672)
- Hazard Identification Number: 268 (poisonous gas, corrosive)



- Hazard Placards 2.3 (white with black skull and crossbones) and 8 (white/black with liquids, spilling from 2 glass vessels and at-tacking a hand a metal plate))



1.3. Indications

- Odour
- Detection tube: ammonia
- Electrochemical sensor
- PID (Photoionization Detector)
- Ammonia turns moistened universal indicator paper (pH paper) blue.

1.4. Use

- Ammonia is used for the production of fertilizers, in plants for flue gas purification, for nitric acid extraction and as a heat transfer medium in cooling systems and refrigerating plants.
- Is sometimes stored in pressurised containers >> 20 t (collector, separator).
- Is transported in large quantities via all modes of transport.

2. Measures

General measures

- Ensure personal safety.
- Isolate hazard zone immediately.
- Self-contained breathing apparatus (SCBA) and chemical protection suit (gastight)
- Eliminate ignition sources.
- Perform measurements with detection tubes / explosive meters
- Always observe the further spread of the leak.

2.1. General tactical advice for response actions

- Keep a distance of at least 50 m.
- Consider the wind direction 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 ammonia 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.
- Use water spray to reduce vapours.
- Take heed of the plant's emergency response plan.

2.2. Leakage of gaseous ammonia

- If the gas leaks in rooms, evacuate the rooms and the building, seal them off as airtight as possible, eliminate sources of ignition and turn off electricity.
- Use water spray with plenty of water to reduce vapours; if necessary, use hydro shield(s) or water monitors.
- N.B.! Water only dissolves a maximum of 0.2% per weight out-doors, which means that the dilution caused by the air carried in the spray (approx. 0.5 m³/kg extinguishing water) also has to be taken into account.
- In the event of ammonia fog clouds, seal off sewers (gullies) and monitor low-lying areas.
- Test the pH of water run-off and collect if necessary.
- Notify the wastewater authority if ammonia water or heavy gas (fog) enters the sewers.
- Seal leak and if necessary move the container outside.

2.3. Leakage of liquefied ammonia (additional measures)

- If liquefied ammonia escapes, do not spray water on spills, the point of leakage or the container, as this would accelerate vaporisation and gas formation.
- Wear thermal protective clothing inside the chemical protection suit (warming overall, footlets, 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.
- 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
- 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). The success of cleaning measures can be effectively monitored using universal indicator paper (pH paper).
- 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

3. References

- CIMOLINO (HRSG.): EINSATZLEITERHANDBUCH FEUERWEHR; ECOMED VERLAG, LANDSBERG/LECH, 2022
- BAYERISCHES LANDESAMT FÜR BRAND- UND KATASTROPHENSCHUTZ: MERKBLATT GEFÄHRLICHE STOFFE UND GÜTER
- HOMMEL: HANDBUCH DER GEFÄHRLICHEN STOFFE
- EMERGENCY RESPONSE INTERVENTION CARD (ERIC) - STAND 2022, BLATT 2/24, KOHLHAMMER VERLAG UND INTERNETVERSION
- SCHWEDISCHE FEUERWEHRSSCHULE LANDSKRONA: LEHRFILM
- GEMEINSAMER STOFFDATENPOOL DES BUNDES UND DER LÄNDER (GSBL)
- GESTIS-STOFFDATENBANK (DGUV)