

Chemical Emergency Medical Guideline

Information and recommendations for healthcare professionals

Acrylonitrile

CAS No: 107-13-1

GHS symbols:



GHS05
Corrosive



GHS06
Acute toxicity



GHS08
Health hazard

Signal word: Danger

Hazard statements:

H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H315	Causes skin irritation.
H317	May cause allergic skin reactions.
H318	Causes serious eye damage.
H331	Toxic if inhaled.
H335	May cause respiratory irritation.
H350	May cause cancer.

Overview

- There is no danger from contact with patients who have only been exposed to acrylonitrile gas. A patient who is wet with liquid acrylonitrile (boiling point 77°C) or whose clothing is contaminated with it may endanger other people through direct contact or through acrylonitrile gas emissions. The smell of acrylonitrile does not serve as a clear warning.
- Acrylonitrile irritates the skin, eyes and respiratory tract. It is readily absorbed through all routes of exposure and causes general symptoms of poisoning such as respiratory, cardiovascular, central nervous and liver dysfunction.
- Symptomatic treatment and immediate administration of oxygen. The administration of a specific antidote (N-acetylcysteine after inhalation) should be considered.

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1. Information on the substance

Acrylonitrile (CH₂=CH-CN), CAS 107-13-1

Synonyms: vinyl cyanide, propene nitrile

At room temperature (boiling point 77°C), acrylonitrile is a clear, slightly yellowish, volatile and flammable liquid with an unpleasant odor. Acrylonitrile is only slightly soluble in water, but highly soluble in many organic solvents.

Acrylonitrile is used in the production of acrylic fibers, plastics and adhesives. These fibers and plastics are used in the manufacture of clothing, furniture, building materials, food packaging and in the automotive industry.

2. Exposition

2.1. Inhalation

Exposure to acrylonitrile occurs mainly through inhalation. The odor of acrylonitrile does not serve as a clear warning. The sense of smell quickly becomes dull. Since acrylonitrile is heavier than air, there is a risk of suffocation in poorly ventilated, low-lying or enclosed spaces.

2.2. Skin/eye contact

High concentrations or liquid acrylonitrile are readily absorbed through the skin and can cause general symptoms of poisoning.

2.3. Ingestion

Ingestion of acrylonitrile leads to serious symptoms of poisoning via metabolization to cyanides; fatalities are possible.

3. Acute health effects

Acrylonitrile can cause general symptoms of poisoning via all routes of exposure, such as shortness of breath, tightness in the chest, headaches, cramps, loss of consciousness, cardiac arrhythmia, drop in blood pressure and jaundice. The toxicity of acrylonitrile may be due to the release of hydrocyanic acid during metabolism and to the toxicity of acrylonitrile itself. Symptoms may occur with a delay of up to 12 hours.

3.1. Dose-response relationships

Concentrations of 16ppm for 20-30 minutes can cause headaches, nausea and irritation. 400ppm for one hour or the absorption of relevant amounts through the skin can be fatal.

<u>Acrylonitrile concentration</u>	<u>Effect/effects</u>
1.5 ppm	- AEGL-1 (10 minutes, EPA, USA)
1.7 ppm	- AEGL-2 (60 minutes, EPA, USA)
8.6 ppm	- AEGL-2 (10 minutes, EPA, USA)
130 ppm	- AEGL-3 (10 minutes, EPA, USA)

AEGL-1 (acute exposure guideline levels): Guideline values for acute exposure. Concentration of a substance in the air above which the general population, including sensitive individuals, may experience noticeable discomfort, irritation or certain asymptomatic, non-sensory effects. However, the effects are not disabling and are temporary and reversible after exposure ceases.

AEGL-2: Concentration of a substance in the air above which the general population, including sensitive individuals, can be expected to suffer irreversible or other serious and long-lasting health effects or to be impaired in their ability to escape.

AEGL-3: Concentration of a substance in the air above which life-threatening health effects or death are expected for the general population, including sensitive individuals.

EPA: Environmental Protection Agency

3.2. Respiratory tract

Inhalation may cause respiratory irritation with sneezing, chest tightness, shortness of breath and coughing. Tachypnoea and deep breathing may progress to gasping with cyanosis as a sign of advancing poisoning.

3.3. Cardiovascular system

Cardiac arrhythmia and therapy-resistant drop in blood pressure may occur.

3.4. Skin/eye contact

Local exposure to high concentrations or liquid acrylonitrile can cause severe irritation of the skin and eyes, with tearing and corneal damage. Prolonged skin contact can lead to blistering after a latency period of several hours.

3.5. Central nervous system

Central nervous system disorders may occur immediately or with a delay. Initial symptoms include irritability, dizziness, nausea, vomiting, headache and muscle weakness. As the condition progresses, fatigue, convulsions, hallucinations, unconsciousness and coma may occur.

3.6. Liver/metabolism

Lactic acidosis and an increase in liver enzyme levels may occur. Jaundice may develop within the first 24 hours and persist for several hours.

3.7. Possible consequences

Acute poisoning can result in hypoxic brain damage. Inhalation can lead to increased susceptibility to irritant gases or destruction of lung tissue.

3.8. Carcinogenicity

According to Directive EC 1272/2008, acrylonitrile is classified as follows:
Carc. 1B (probably carcinogenic to humans; mainly based on findings in animals).

4. Measures

4.1. Self-protection of helpers

If there is suspicion that the area the helper must enter contains acrylonitrile, a self-contained breathing apparatus and a chemical protection suit must be worn.

There is no danger from contact with patients who have only been exposed to acrylonitrile gas. A patient who is wet with liquid acrylonitrile or whose clothing is wet with liquid acrylonitrile may endanger other people through direct contact or through acrylonitrile gas emissions.

4.2. Rescue

Patients should be removed from the danger zone immediately. If they are unable to walk unaided, they should be removed from the danger zone quickly using appropriate means, taking care to protect themselves. The "A, B, C procedure" has absolute priority.

- A) Clear the airways** (check for blockages caused by the tongue or foreign objects)
- B) Ventilation** (check the patient's breathing, if necessary, begin ventilation with adequate self-protection, e.g. breathing mask)
- C) Circulation** (begin resuscitation on any person who does not respond to verbal commands and is not breathing normally)

"CRASH" decontamination

- Rescue patients contaminated with acrylonitrile who are unconscious or immobile (critically ill/injured patients according to the ABCDE scheme) from the immediate danger zone, taking care to protect yourself with suitable personal protective equipment
- If necessary, perform emergency measures ("basic life support"; e.g. bleeding control using a tourniquet, chest compressions, etc.)
- At a suitable location outside the danger zone, completely undress the contaminated patient using an emergency rescue knife, taking care to protect yourself (duration: approx. 1 minute).
- Shower/rinse with plenty of water (duration: approx. 1 minute)
- Transfer to a clean stretcher. Ensure body heat is maintained. Transport/handover to the emergency services/emergency doctor (duration: approx. 1 minute)

4.3. Cleaning

Patients who have only been exposed to acrylonitrile gas and show no signs of skin or eye irritation do not require any special cleaning measures, unlike all others.

If possible, patients should assist with their own cleaning. If liquid acrylonitrile has been exposed and clothing is contaminated, it must be removed and securely wrapped.

Ensure that the affected skin and hair areas are rinsed with water for at least 15 minutes. Other important first aid measures must be continued during this time. Protect eyes while rinsing.

If the eyes have been exposed to acrylonitrile or if there is eye irritation, rinse with water or neutral saline solution for at least 15 minutes. Remove any contact lenses, if possible, without causing further irritation to the eyes. Continue with other important first aid measures during this time.

4.4. Initial treatment (preclinical or clinical)

Symptomatic treatment: the administration of a specific antidote should be considered.

The most important measures are to ensure adequate ventilation and the administration of additional oxygen. In case of respiratory insufficiency, endotracheal intubation or alternative airway management. If this is not feasible, perform a coniotomy if necessary. Establish intravenous access.

4.5 Antidote treatment

Antidote treatment should be considered in patients with severe signs of poisoning.

Antidote after inhalation exposure to acrylonitrile:

- For inhalation exposure, administer N-acetylcysteine (NAC) parenterally. The recommended initial dose for severe poisoning (air concentration of 15ppm or greater, or oral or dermal absorption and signs of poisoning such as breathing difficulties, cyanosis, convulsions, loss of consciousness) is 150mg/kg body weight intravenously over 60 minutes, followed by administration of 50mg/kg body weight over 4 hours and 100mg/kg body weight over 16 hours.
- If no parenteral preparations of N-acetylcysteine are available, oral doses corresponding to the treatment of paracetamol poisoning can be given (initially 140mg/kg body weight, then 70 mg/kg body weight every 4 hours over 72 hours).
- When administering N-acetylcysteine, liver function, serum bilirubin and Quick values should be monitored.

Antidote after oral acrylonitrile exposure:

- In the event of oral exposure and if signs of hydrocyanic acid poisoning appear, the administration of the appropriate antidotes should be considered. See the chemical emergency medical guidelines for cyanides (→ *CEMG Cyanide/Hydrocyanic Acid Professional*).
After administration of 4-DMAP and sodium thiosulphate, administer N-acetylcysteine (NAC) as described above.

For respiratory tract irritation and exposure concentrations of 15ppm or more, administer 8 sprays of beclomethasone (800µg beclomethasone dipropionate) from a metered dose inhaler. For exposure concentrations of 100ppm or more, administer 1g methylprednisolone or a comparable corticosteroid parenterally.

Note: The efficacy of corticosteroid administration has not yet been proven in controlled clinical trials.

Patients with clinical signs of severe poisoning (shortness of breath, cyanosis, convulsions, unconsciousness) and patients without clinical signs but for whom an exposure concentration of 15ppm or oral or dermal absorption must be assumed should be transported immediately to a hospital with intensive care facilities.

Skin contact with acrylonitrile can cause chemical irritation; this should be treated as a burn: adequate fluid administration, analgesic therapy, maintenance of body temperature, covering the affected skin area with a sterile dressing or clean cloth. Exposure of the eyes can also cause chemical irritation; this should also be treated as a burn. Consult an ophthalmologist immediately.

Note: Any contact with liquid acrylonitrile in the facial area can have serious consequences.

4.6. Further rules of conduct and treatment

In addition to taking medical history, performing a physical examination and checking vital signs, pulse oximetry, a chest X-ray and spirometry should be carried out.

The diagnosis of acrylonitrile poisoning is based primarily on the clinical signs of dyspnea and cyanosis. However, various laboratory tests can be performed to monitor and assess complications. Blood count, glucose and electrolytes should be determined routinely. Lactate, liver enzymes and ECG should also be monitored.

Chest X-ray and pulse oximetry may be appropriate in cases of acrylonitrile inhalation. In severe cases, venous pO₂ may be elevated, thereby reducing the normal difference between arterial and venous pO₂.

Clear radiological signs of pulmonary oedema – enlargement of the hili, typical, centrally emphasized, patchy shadows on the chest X-ray – are late signs that only become apparent 6 to 8 hours or even later after exposure. The X-ray is typically unremarkable on initial presentation at the hospital, even after inhalation of a relevant dose.

Patients with possible exposure should be monitored for an adequate period and undergo repeated follow-up examinations before any consequential damage to health can be ruled out.

After administration of methemoglobin-forming agents (e.g. 4-DMAP), the methemoglobin level should be monitored. The metabolic release of hydrocyanic acid can lead to a recurrence of the symptoms of poisoning. Cyanide or thiocyanide levels can be determined in the blood, but they do not correlate with the clinical symptoms. After 24 hours, jaundice may develop and persist for several days.

4.7. Biomonitoring

To estimate the systemic dose absorbed after exposure, biomonitoring can be performed by determining the concentration of cyanoethyl mercapturic acid (CEMA) in the urine.

4.8. Discharge of the patient / instructions for further action

Clinically asymptomatic patients who have been exposed to a concentration of less than 15ppm (depending on the duration of exposure) and who show no abnormal clinical findings and no signs of toxic effects after an appropriate follow-up period may be discharged under the following circumstances:

- Information and recommendations for patients with instructions for further action were provided verbally and in writing. The patient was advised to seek immediate medical attention if any health problems arise.
- The patient is aware of and understands the toxic effects of acrylonitrile.
- The attending physician has been informed that regular contact between the patient and the physician is possible in the following 24 hours.
- Heavy physical work should not be done in the following 24 hours.
- Do not smoke for at least 72 hours and avoid cigarette smoke; smoke can impair lung function.
- Patients with serious skin or eye injuries should be re-examined after 24 hours.
- Spirometry should be repeated at regular intervals after discharge until the values have returned to the patient's baseline values prior to exposure.

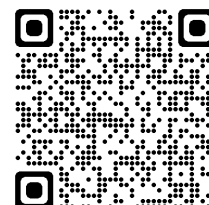
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Responsible Unit (Author)	ESG/CH ESG/AS
Contact	ESG/CH: Dr M. Conzelmann, T. Schröck ESG/AS: Dr D. Frambach

BASF SE
 Corporate Health Management
 Carl-Bosch-Straße 38
 67056 Ludwigshafen
 Germany



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