BASF Chemical Emergency Medical Guidelines

Ammonia (NH_3) B 1

Information and recommendations for paramedics and doctors at the site

- **Before approaching the patient the paramedics and doctors at the site must make sure that they do not risk exposing themselves to ammonia.**
- **Patients exposed only to ammonia gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with ammonia-containing liquids can secondarily contaminate rescue and medical personnel by direct contact or through off-gassing ammonia.**
- **Ammonia gas or solution is highly irritating and can cause serious corrosive burns to eyes or skin.**
- **Irritation of the respiratory tract can result in rhinorrhea, coughing, and dyspnea. Laryngospasm and signs of pulmonary edema (shortness of breath, cyanosis, expectoration, cough) may occur.**
- **There is no antidote to be administered to counteract the effects of ammonia. Treatment consists of supportive measures.**

1. Substance information

Ammonia (NH_3), CAS 7664-41-7
Synonyms include ammonia gas, anhydrous ammonia and liquid ammonia. Ammonia dissolves readily in water to form a caustic alkaline solution of ammonium hydroxide.
Ammonia is lighter than air. In case of an accidental release of liquid Ammonia under pressure, rapid cooling down causes formation of a dense cloud that hugs the ground.
Ammonia is widely used as a catalyst and reagent in the manufacture of fertilizers, plastics, explosives, pesticides, other chemicals, and as a refrigerant. It is found in many household and industrial-strength cleaning solutions.

2. Routes of exposure

Inhalation

Inhalation is a significant route of exposure. Ammonia's odor and irritant properties may provide adequate warning of hazardous concentrations. However, olfactory fatigue may occur, making the presence of lower concentrations difficult to detect with prolonged exposure.

Skin/eye contact

Fairly low concentrations of ammonia produce rapid irritation of the eye and moist skin. **Direct contact with liquid ammonia or concentrated gas on moist skin or eyes causes severe chemical burns.**

Ingestion

Accidental ingestion of ammonia is unlikely. Ammonia solutions may cause corrosive injury to the mouth, throat, and stomach if ingested.

3. Acute health effects

Ammonia exposure usually causes eye, nose, and throat irritation.
Respiratory distress with coughing, dyspnea, upper airway obstruction, laryngeal edema, narrowing of bronchi and pulmonary edema may occur.
If the skin is wet or moist, contact with ammonia can cause burning pain, inflammation, blisters, and ulceration. Contact with liquid ammonia under pressure can result in frostbite.
Low gas concentrations cause burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, and tearing. After exposure to higher concentrations or liquid ammonia, corneal burns occur and may lead to blindness.

Dose-effect relationships Dose-effect relationships are as follows:

Ammonia concentration		Effect
1-20 ppm	-	Odor detection (some tolerance develops)
50 ppm	-	Mild mucous membrane irritation
300-500 ppm	-	Marked irritation of skin, eyes, upper respiratory tract with conjunctivitis, sore throat, coughing Increases of blood pressure and pulse rate Maximal concentration tolerated for up to 1 hour
700 ppm	-	Immediate eye injury possible
>1700 ppm	-	Chest pain, pulmonary edema, laryngospasm
2500-6500 ppm	-	Fatal within 30 minutes
10000 ppm	-	Fatal within a few minutes

4. Actions

Rescuer self-protection

In response situations that involve exposure to potentially unsafe levels of ammonia (> 500 ppm), pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn.
Rescuer exposure to a concentration lower than 500 ppm might be accepted without protective measures only for acute rescue operations. Patients exposed only to ammonia gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with ammonia-containing liquids can secondarily contaminate other people by direct contact or through off-gassing ammonia.

Patient recovery

Patients should be removed from the contaminated zone immediately. Patients who are unable to walk may be removed on backboards or stretchers; if these are not available, carefully remove/transport patients with appropriate action to a safe zone, taking into account your self-protection.
Immediate priorities must follow the "**A, B, C's**" (Airway, Breathing, Circulation) of resuscitation.

Decontamination

Patients exposed only to ammonia gas who have no evidence of skin or eye irritation do not need decontamination. All others require decontamination.
Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid ammonia and if clothing is contaminated, remove and double-bag the clothing.
Assure that exposed or irritated eyes have been irrigated with plain water or saline for at least 20 minutes, and that the pH of the conjunctival fluid has returned to normal (7.0). If not, continue eye irrigation during other basic care and transport. If eye irrigation is impaired by blepharospasm, one to two drops of oxybuprocaine 0.4% may be instilled into affected eyes to allow adequate irrigation. Remove contact lenses if present and easily removable without additional trauma to the eye.
Assure that exposed skin and hair have been flushed with plain water for at least 15 minutes. If not, continue flushing during other basic care and transport. Protect eyes during flushing of skin and hair.

Initial treatment

Therapy will be empiric; there is no antidote to be administered to counteract the effects of ammonia.
The following measures are recommended if the exposure concentration is 500 ppm or greater and if symptoms, e. g. eye irritation or pulmonary symptoms, have developed:

- **Administration of oxygen**
- **Administration of 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler.**

Patients with severe clinical respiratory symptoms (e.g. bronchospasms, stridor) should be treated as follows:
a) Nebulization of adrenaline (epinephrine): 2 mg adrenaline (2 ml) with 3 ml NaCl 0.9% and inhale through a nebulizer mask.

b) Administration of a ß2-selective adrenoceptor agonist, e.g., four strokes of terbutaline or salbutamol or fenoterol (one stroke usually contains 0.25 mg of terbutaline sulfate; or 0.1 mg of salbutamol; or 0.2 mg of fenoterol); this may be repeated once after 10 minutes. Alternatively, 2.5 mg salbutamol and 0.5 mg atrovent may be administered by nebulizer mask.
If inhalation is not possible, administration of terbutaline sulfate (0.25 mg to 0.5 mg) subcutaneously or salbutamol (0.2 mg to 0.4 mg over 15 minutes) intravenously.

c) Intravenous administration of 250 mg methylprednisolone (or equivalent steroid dose).

Patients with clinical signs of a toxic lung edema (e.g. foamy sputum, wet crackles) should be treated as follows:
a) Start CPAP-therapy (Continuous Positive Airway Pressure Ventilation).
b) Intravenous administration of 1000 mg methylprednisolone (or an equivalent steroid dose) is recommended.

Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.

Note: Efficacy of corticosteroid administration has not yet been proven in controlled clinical studies.
If ammonia has been in contact with the skin, chemical burns may result; treat as thermal burns: adequate fluid resuscitation and administration of analgesics, maintenance of the body temperature, covering of the burn with a sterile pad or clean sheet. If contact of the skin with liquid ammonia under pressure has occurred, evaluate for the presence of frostbite.
After eye exposure chemical burns may result; treat as thermal burns. Immediately consult an ophthalmologist.
Note: Any facial exposure to liquid ammonia should be considered as a serious exposure.
Symptomatic patients exposed to a concentration of 500 ppm or greater should be transferred to a hospital/emergency department.

Patient release/ follow-up instructions

Asymptomatic patients and patients exposed to a concentration less than 500 ppm as well as patients who have a normal clinical examination and no signs or symptoms of toxicity may be discharged after an appropriate observation period in the following circumstances:

a) The evaluating physician is experienced in the evaluation of individuals with ammonia exposure.
b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.
c) The physician is comfortable that the patient understands the health effects of ammonia and the provided follow-up instructions.
d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release.
e) Heavy physical work should be precluded for 24 hours.

f) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for paramedics and doctors at the site in assessing the condition and managing the treatment of patients exposed to ammonia. It is not, however, a substitute for the professional judgement of a paramedic or a doctor and must be interpreted in the light of specific information regarding the patient available to such a paramedic or doctor and in conjunction with other sources of authority.

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

BASF Corporation
Medical Department
100 Campus Drive, M/S F 221
Florham Park, NJ 07932
USA