



R7DHRE
Hazardous
Materials
Guideline:
Anhydrous
Ammonia



REGION VII DISASTER HEALTH RESPONSE ECOSYSTEM (R7DHRE) CHEMICAL SPECIALTY TEAM

Call Your Poison Center for Immediate Assistance: 1-800-222-1222

Hazardous Materials Guideline: Anhydrous Ammonia

This document is intended as a supplement for discussion with your local poison center or toxicologist.

1.0 BACKGROUND

1.1 Description: Anhydrous ammonia is a highly irritating gas that readily dissolves in water to form ammonium hydroxide, a strong alkaline corrosive. Anhydrous ammonia is used as a precursor to most manufactured nitrogen-containing compounds. These may include fertilizers, antimicrobial agents, refrigerants, and cleaning products.

1.2 Mechanism of Injury: Anhydrous ammonia is a highly water-soluble irritant gas. Injuries are primarily due to the effects of ammonium hydroxide (an alkali), which is the product of anhydrous ammonia dissolved in water. This leads to corrosive injury in nearby tissues. Anhydrous ammonia will dissolve in the water of the eyes, nose, mucous membranes and sweat (including in the axilla and groin). Anhydrous ammonia is frequently transported in cylinders as a liquefied compressed gas; contact with liquid anhydrous ammonia may result in frostbite injury.

1.3 Routes of Exposure: Inhalation, Dermal, Ocular, Ingestion.

2.0 PROVIDER SAFETY

2.1 Personal Protective Equipment (PPE) – Decontamination Team: Personnel decontaminating patients must wear **full-body chemical-resistant clothing and respiratory protection**. Respiratory protection may consist of either:

- 2.1.1** A positive pressure air or oxygen source, such as an air-line respirator or a Self-Contained Breathing Apparatus (SCBA) or
- 2.1.2** A filtered air respirator (including Powered Air Purifying Respirators (PAPRs)) with filters capable of adsorbing anhydrous ammonia.
- 2.1.3** A positive pressure air or oxygen source is preferred if there is doubt as to the identity of the chemical in question or if there may be exposure to a level of anhydrous ammonia which would overwhelm the filter.

2.2 Personal Protective Equipment (PPE) – Treatment Team: Personnel treating patients who have been adequately decontaminated need no additional PPE other **than universal precautions** since there is no serious risk of secondary contamination.

2.3 Patient Decontamination:

- 2.3.1** Persons exposed to only **ammonia gas** and have **no skin irritation, no eye irritation, dry skin, AND dry clothes generally do not need decontamination.** These patients do not pose a significant risk of secondary contamination.
- 2.3.2** Persons contaminated with **liquid ammonium hydroxide** do **pose a risk of secondary contamination** from off-gassing of ammonia vapors and direct contact with the chemical.
- 2.3.3** Remove contact lenses if it can be done without additional trauma to the eye. **Irrigate eyes for a minimum of 15 minutes.** Continue irrigation until eye pH is neutral (7 to 8).
- 2.3.4** Remove ALL clothing and jewelry. Double bag clothing and jewelry to prevent off-gassing.
- 2.3.5** Decontamination is best **accomplished by irrigation with copious amounts of water.** Wash skin and hair with plain water for a minimum of 5 minutes and then wash twice with soap & water after washing with plain water. Washing with water alone (for a longer period of time) is acceptable if soap is not available. **Neutralization is NOT recommended.** Skin pH can be checked to assure that all of the ammonia has been removed.
- 2.3.6** Watch for hypothermia in children and the elderly, when decontamination is done with un-heated water, or during cold weather.

3.0 SIGNS & SYMPTOMS

- 3.1** Severity of symptoms will depend upon the concentration of the ammonia to which the person is exposed and the duration of exposure.
- 3.2** Inhalation: **Irritation to moist mucous membranes** resulting in inflammation of the eyes, nose, throat, and upper airway as well as coughing, bronchoconstriction, wheezing, and shortness of breath. **Severe exposures can cause caustic burns of the upper airway leading to upper airway obstructions and damage to the alveoli leading to pulmonary edema, decreased oxygenation and systemic hypoxia.**
- 3.3** Dermal: **Irritation and burns to the skin.** Severe exposures can lead to full thickness skin burns. Exposure to compressed liquefied ammonia gas has caused frostbite and deep skin burns.
- 3.4** Ocular: Irritation and burns to the eyes. **Severe exposures can lead to blindness.** The full extent of eye damage may not be fully evident for several days.
- 3.5** Ingestion: Ingestion of ammonium hydroxide can cause nausea, vomiting, abdominal pain and corrosive burns to the mouth, esophagus and stomach.

3.4 Dermal: Irritation and burns to the mucous membranes and skin. Severe exposures can cause full thickness skin burns. Distal circulation should be repeatedly assessed in patients with circumferential burns.

3.5 Ocular: Irritation and burns to the eyes. **Severe exposures** can cause ulcerations of the cornea and eye and **can lead to blindness.**

3.5 Ingestion: Severe corrosive burns to the mouth, throat, esophagus, stomach. Nausea, vomiting, difficulty swallowing and abdominal pain. Severe exposures can cause bleeding and perforation of the GI tract. Metabolic acidosis can be caused by burns, bleeding, hypotension and perforation. Rarely, the acid itself has added to the metabolic acidosis caused by the burns, bleeding, etc.

4.0 DIAGNOSTICS

4.1 Anhydrous ammonia poisoning is a clinical diagnosis and there is no specific diagnostic testing. Any diagnostic evaluation should be based on sign and symptoms of irritation or corrosive effects.

4.2 Continuous monitoring of pulse oximetry and end-tidal carbon dioxide should be used in symptomatic patients to evaluate the need for supplemental oxygen and additional monitoring.

4.3 Consider a chest x-ray in patients with persistent symptoms and hypoxia.

5.0 TREATMENT

5.1 General: Treatment is mainly decontamination and supportive care including basic and advanced life support. There is no specific antidote for anhydrous ammonia poisoning.

5.2 Inhalation: Maintain the patient's airway as necessary. Early intubation should be considered for upper airway swelling. Endotracheal intubation should be performed under direct visualization because of edema and potential damage to the oropharynx. Cricothyroidotomy may be considered. **Support oxygenation and ventilation as necessary.**

5.3 Use standard treatments for pulmonary edema and bronchospasm. Consider the use of **PEEP and bronchodilators.** Corticosteroids can be considered.

5.4 Dermal: Treatment is the same as that for thermal burns. If frostbite is present, rewarm the affected area in the same manner as for environmentally induced frostbite.

5.5 Ocular: Irrigate eyes to a neutral pH. The pH of the conjunctiva should be checked every 30 minutes for 2 hours after irrigation is stopped to ensure that the measured pH is that of the tissue and not the irrigating fluid. Ensure that any particulate matter has been removed. Perform a thorough eye exam: test visual acuity and perform fluorescein and slit lamp examinations. Ophthalmology consultation is highly recommended. Immediately consult an ophthalmologist for patients who have corneal injuries.

5.6 Ingestion: Do NOT give activated charcoal or induce emesis. Consider dilution by giving 2 to 4 ounces of milk or water orally **ONLY** to patients who are conscious, able to swallow, and are able to protect their airway. Endoscopic evaluation may be necessary.

6.0 DISPOSITION

6.1 Initial mild symptoms may progress to corneal opacity, airway obstruction and pneumonitis. Patients with significant ocular or airway irritation should not be discharged. Patients with mild or no symptoms should be observed for a 4-hour period. If symptoms have resolved or are mild after 4 hours and pulse oximetry is normal, patients may be discharged with instructions to return if symptoms worsen.

Disclaimer: This guideline is intended to be an informational reference only and should not be used as a substitute for consultation with a poison center or toxicologist, and/or the clinical judgement of the bedside team.

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