
Information and recommendations for
paramedics and doctors at the site

- Patients whose clothing or skin is contaminated with nitric acid can cause secondary contamination of rescue and medical personnel by direct contact or by release of nitric acid vapor or fumes.
 - Nitric acid and its vapor or fumes are rapidly corrosive when they come in contact with tissues such as the eyes, skin, and upper respiratory tract causing irritation, burns, coughing, chest pain and dyspnea. Laryngospasm and pulmonary edema (shortness of breath, cyanosis, expectoration, cough) may occur.
 - Ingestion of nitric acid can cause severe corrosive injury to the lips, mouth, throat, esophagus, and stomach.
 - There is no antidote to be administered to counteract the effects of nitric acid. Treatment consists of supportive measures.
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1. Substance information

Nitric acid (HNO₃), CAS 7697-37-2

Synonyms: hydrogen nitrate

At room temperature nitric acid is a colorless to yellow or brownish-red liquid with a choking odor. The color is due to the release of oxides of nitrogen, especially nitrogen dioxide, into the air upon exposure to light. Depending on environmental factors the vapor or fumes of nitric acid may actually be a mixture of various oxides of nitrogen and nitric acid, even at temperatures well below the boiling point of 83°C (181°F). Nitric acid may be formed in photochemical smog from the reaction between nitric oxide and hydrocarbons.

Nitric acid itself is nonflammable, but it can increase the flammability or cause the spontaneous combustion of other materials. It is soluble in water.

Nitric acid is used in the manufacture of fertilizers, gunpowder and explosives, pesticides, dyestuffs, and pharmaceuticals, especially in the manufacture of organic and inorganic nitrates. It is also used for etching and cleaning of metals, and electroplating.

2. Routes of exposure*Inhalation*

Nitric acid's odor and irritant properties generally provide adequate warning of acutely hazardous concentrations.

Skin/eye contact

Direct contact with liquid nitric acid or concentrated vapor or fumes on wet or moist skin causes severe chemical burns. Nitric acid is poorly absorbed through the skin.

Ingestion

Ingestion of nitric acid can cause severe corrosive injury to the lips, mouth, throat, esophagus, and stomach.

3. Acute health effects*Respiratory*

Nitric acid exposure usually causes dryness of the nose and throat, and coughing. Inhalation of very high concentrations may result in laryngospasm and eventually in obstruction of the airways and death. Development of respiratory distress with chest pain, dyspnea and pulmonary edema (shortness of breath, cyanosis, expectoration) may occur after a delay of up to 24 hours.

Hematologic

Only after high-dose exposure methemoglobinemia may result, but usually to an extent that does not require treatment. For further information on methemoglobinemia see BASF Chemical Emergency Medical Guideline for ANILINE.

<i>Gastrointestinal</i>	Epigastric pain, nausea, and vomiting may occur. In cases of ingestion diffuse corrosive mucosal injury can involve the entire intestinal tract.
<i>Renal</i>	Acid-base imbalance and acute renal failure may occur.
<i>Dermal</i>	Deep burns of the skin and mucous membranes may be caused by contact with concentrated nitric acid; sometimes yellowing of the skin results. Contact with less concentrated nitric acid vapor or fumes can cause burning pain, redness, and inflammation.
<i>Ocular</i>	Severe eye burns with clouding of the surface, perforation of the globe, and ensuing blindness may occur from exposure to liquid nitric acid. Low concentrations of vapor or fumes cause burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, and tearing.

4. Actions

Rescuer self-protection

In response situations that involve exposure to potentially unsafe levels of nitric acid (see below), pressure-demand, self-contained breathing apparatus and chemical-protective clothing is recommended.

Patients whose clothing or skin is contaminated with nitric acid can secondarily contaminate other people by direct contact or through nitric acid vapor or fumes.

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.

„CRASH“-Decontamination

- Rescue with nitric acid contaminated, unconscious patients or patients who are unable to move (critically ill/injured patients according to the ABCDE approach) from the danger zone immediately. The use of appropriate personal protective equipment and self-protection have top priority
- Start Basic Life Support if necessary (e.g. bleeding control with Tourniquet, cardiac massage etc.)
- In a safe zone: fast and complete removal of clothing using a rescue knife or trauma shears (approx. 1 minute)
- Short rinsing off with plenty of water (approx. 1 minute)
- Place patient on a clean rescue sheet. Consider heat preservation. Transport the patient to the handover area to emergency medical services (approx. 1 minute)

Decontamination

All patients exposed to nitric acid require decontamination. Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid nitric acid 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 nitric acid.

The following measures are recommended if the airborne exposure concentration is 10 ppm or greater, if symptoms, e. g. eye irritation or pulmonary symptoms have developed, or if no exposure concentration can be estimated but exposure has possibly occurred:

- 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 β 2-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 nitric acid was 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.

After eye exposure chemical burns may result; treat as thermal burns. Immediately consult an ophthalmologist.

Note: Any facial exposure to liquid nitric acid should be considered as a serious exposure.

In case of ingestion of nitric acid, **do not induce emesis, do not perform gastric lavage.**

Patients exposed to an airborne concentration of 10 ppm or greater or with ingestion of nitric acid as well as patients without available exposure measurements but suspected of being exposed to concentrations of 10 ppm or greater should be transferred to a hospital/emergency department.

**Patient release/
follow-up instructions**

Patients exposed to an airborne concentration of **less than 10 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 nitric acid or irritant pulmonary exposures.
- 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 nitric acid and the provided follow-up instructions.
- d) Site physician 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 up to 24 hours.
- f) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs.

Patients who have serious skin or eye injuries should be reexamined in 24 hours.

In 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 nitric acid. 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.

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