



R7DHRE Hazardous Materials Guideline: **Aniline**



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

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

Hazardous Materials Guideline: Aniline

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

1.0 BACKGROUND

1.1 Description: Aniline is a clear to slightly yellow, oily liquid that darkens to a brown color on exposure to air. Its vapor has an aromatic or fishy odor and can be smelled at levels below established occupational safety limits. Thus, the odor usually provides an adequate warning of hazardous concentrations. The vapor is heavier than air and may accumulate in low-lying areas. Aniline is both an irritant and a systemic poison.

1.2 Mechanism of Injury: Aniline is a potent oxidizer, and it is by this mechanism that aniline exerts its systemic effects. Methemoglobinemia and hemolysis are the systemic effects which may result from exposure to aniline.

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

2.0 PROVIDER SAFETY

2.1 Personal Protective Equipment (PPE) – Decontamination Team: Aniline is a highly toxic systemic poison that is well absorbed by inhalation and through the skin. 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 aniline.
- 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 aniline 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.

2.2.1 The vomitus from persons who have ingested aniline is hazardous because it may off-gas aniline vapors or contaminate those coming in contact with the vomit. Prepare treatment areas for rapid clean up in case the patient vomits.

2.3 Patient Decontamination:

2.3.1 Persons exposed to only aniline gas and have no skin or eye irritation, dry skin, and dry clothes generally do not need decontamination since they do not pose a significant risk of secondary contamination. Those persons contaminated with condensed vapors or liquids do pose a risk of secondary contamination from off-gassing of aniline vapors and direct contact with the chemical.

2.3.2 If there is concern for a presence of solid (non-aniline) substances, brush any powder or solids from the skin, hair, and clothes of victims.

2.3.3 Remove ALL clothing and jewelry. Double bag clothing and jewelry to prevent off-gassing.

2.3.4 Decontamination is best accomplished by irrigation with copious amounts of water.

2.3.4.1 Wash skin and hair with plain water for a minimum of 5 minutes and then wash twice with soap after washing with plain water. Washing with water alone (for a longer period of time) is acceptable if soap is not available.

2.3.5 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).

2.3.6 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 aniline to which the person is exposed and the duration of exposure.

3.2 Inhalation: Irritation of the eyes, nose, throat, and upper airway; cough; difficulty breathing.

3.3 Dermal: Irritation, pain, and burns. Moderate skin irritation, sensitization and dermatitis have been reported. Patients who have methemoglobinemia can have a gray, bronze, or blue appearance to their skin.

3.4 Ocular: Mild to severe eye irritation and corneal damage. Discoloration of the eye can occur.

3.5 Ingestion: Nausea and vomiting. Severe cases may have oral lesions or persistent esophageal discomfort.

3.6 Systemic: Aniline is rapidly absorbed after inhalation and ingestion. Aniline liquid and vapor are also well absorbed through skin. Severe systemic toxicity can arise from these three routes of exposure. The effects from skin absorption can be delayed for several hours.

3.6.1 Methemoglobinemia: Aniline induces methemoglobinemia (Met Hb), which impairs the delivery of oxygen to tissues. Methemoglobin formation from aniline exposure may develop insidiously, and onset of symptoms may be delayed for hours. Production of MetHb may continue for up to 20 hours after exposure.

Methemoglobin Level	Signs and Symptoms
30-50%	Headache, fatigue, dizziness, tachycardia, mild shortness of breath
50-70%	Stupor, bradycardia, respiratory depression, irregular heart rhythm, metabolic acidosis
60-70%	Cardiac arrest, loss of consciousness, coma, death

Methemoglobin levels exceeding 70% are potentially lethal if untreated.

Patients who have underlying diseases may develop signs and symptoms at lower methemoglobin levels.

3.6.1.1 When methemoglobin levels are 15% to 30%, the patient's skin may become bluish in color, which is due to the dark color of methemoglobin and not to inadequate oxygen in the blood. Methemoglobin blood itself has a chocolate-brown appearance.

3.6.1.2 In pregnant women, the MetHb level is likely to be higher in fetuses than the mother.

3.6.1.3 *Pulse Oximetry and Co-Oximetry:* Methemoglobin causes absorption interference with standard pulse oximetry readings, making standard pulse oximetry unreliable.

3.6.1.3.1 Accurate oxygen saturation determinations require co-oximeter measurements. A co-oximeter is also needed to determine the methemoglobin level in the patient's blood.

3.6.2 Hemolysis: Aniline may also cause hemolysis, which manifests as an acute or delayed (2 to 7 days post exposure) hemolytic anemia. The heart, liver, and kidney may be affected secondary to hemolysis. Persons with glucose-6-phosphate dehydrogenase (G6PD) deficiency or alcoholism are at increased risk of aniline-induced hemolysis.

3.6.3 Cardiovascular Effects: Irregular heart rhythm, heart block, and acute congestive heart failure. Severe exposures can lead to progressive acidosis, ischemia, and cardiovascular collapse.

3.6.4 CNS Effects: Confusion, ringing in the ears, weakness, disorientation, dizziness, impaired gait, lethargy drowsiness, seizures, loss of consciousness, and coma.

4.0 DIAGNOSTICS

4.1 Aniline poisoning is a clinical diagnosis, but some diagnostic tests may be helpful in a symptomatic patient.

4.2 For a patient with shortness of breath, cyanosis, weakness, or hemodynamic abnormalities: CBC, CMP, co-oximetry, methemoglobin level, chest x-ray, EKG.

5.0 TREATMENT

5.1 Follow standard Basic and Advanced Life Support Guidelines. There is no specific antidote for aniline, but methylene blue may be indicated for treatment of symptomatic methemoglobinemia.

5.2 Inhalation: Maintain the patient's airway, with endotracheal intubation or cricothyroidotomy if necessary. Support oxygenation and ventilation as necessary. Use standard treatments for pulmonary edema (diuretics, PEEP, etc.) and bronchospasm (inhaled bronchodilators; consider corticosteroids).

5.3 Dermal: Treatment is the same as that for thermal burns. Patients developing hypersensitivity reactions may require treatment with systemic or topical antihistamines or corticosteroids.

5.4 Ocular: Irrigate eyes to a neutral pH. Perform a thorough eye exam: test visual acuity and perform fluorescein and slit lamp examinations. Ophthalmology consultation may be necessary. Immediately consult an ophthalmologist for patients who have corneal injuries.

5.5 Ingestion: Do **NOT** induce emesis. Consider activated charcoal (1 gram/kg, orally) **ONLY** if the patient is alert, asymptomatic, has a gag reflex, and is not at risk of losing consciousness or having seizures. Do not give activated charcoal if the patient either has a GI hemorrhage or there is a need for endoscopic evaluation of the GI tract. Endoscopic evaluation may be necessary.

5.6 Systemic:

5.6.1 Systemic symptoms are concerning for methemoglobinemia and/or hemolysis.

5.6.2 Methylene Blue is recommended for: patients with cardiopulmonary symptoms, signs and symptoms of hypoxia (other than cyanosis), or methemoglobin level >30%. Cyanosis alone does not require treatment.

5.6.2.1 Because methylene blue can cause or enhance hemolysis, the clinician needs to weigh the risks and benefits of administering methylene blue to patients exposed to aniline who have both methemoglobinemia and hemolysis.

5.6.2.2 Patients with methemoglobinemia can be treated with methylene blue, 1 to 2 milligrams/kilogram/dose, given intravenously over 5 minutes.

5.6.2.3 Consider hyperbaric oxygen therapy in patients whose methemoglobin levels are refractory to methylene blue therapy.

5.6.2.4 Consider exchange transfusions for severely poisoned patients who are deteriorating clinically despite methylene blue treatment.

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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DO NOT REVISE. Contact Kathy Jacobitz at the Nebraska Regional Poison Center (kjacobitz@nebraskamed.com) for permission to modify or to provide suggestions for updates. Check <https://www.regionviidhre.com/chemical-team> for the latest version.

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