R7DHRE Hazardous Materials Guideline: Chlorine

Region VII Disaster Health Response Ecosystem

REGION VII DISASTER HEALTH RESPONSE ECOSYSTEM (R7DHRE)

CHEMICAL SPECIALTY TEAM

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

Hazardous Materials Guideline: Chlorine

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

1.0 BACKGROUND

1.1 Description: **Chlorine is an intermediately water-soluble irritant gas. It is a yellow-green, noncombustible gas with a pungent, irritating odor.** Chlorine is heavier than air and may collect in low-lying areas. It is widely used as a household cleaning agent, in the maintenance of swimming pools, and in chemical synthesis.

1.2 Mechanism of Injury: Chlorine reacts with moisture to generate reactive molecules leading to corrosive injury in nearby tissues. It is also a strong oxidizing agent and can react explosively or form explosive compounds with many common substances. Chlorine is frequently transported in cylinders as a liquefied compressed gas which poses a risk for frostbite injury due to exposure to decompressing gas.

1.3 Routes of Exposure: **Inhalation**, **Ocular**, Dermal, Ingestion. Significant dermal absorption is unlikely, but ingestion of chlorine-containing solutions does occur.

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 chlorine.

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 chlorine 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 **chlorine 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 chlorine** solutions do **pose a risk of secondary contamination** from off-gassing of chlorine 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 chlorine has been removed.

2.3.6 Watch for hypothermia (1) in children and the elderly, (2) when decontamination is done with un-heated water, or (3) during cold weather.

3.0 SIGNS & SYMPTOMS

3.1 Severity of symptoms will depend upon the concentration of the chlorine to which the person is exposed and the duration of exposure. **Patients should ideally be monitored for at least 6 hours from the time of exposure, particularly if they have pre-existing pulmonary disease.**

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 upper airway obstructions, hemoptysis, bronchopneumonia, and pulmonary edema.** Pulmonary edema typically peaks in 1 to 3 days. Exposure to chlorine can lead to reactive airways dysfunction syndrome (RADS), a chemical irritant-induced type of asthma. An unusual complication of massive chlorine inhalation is an excess of chloride ions in the blood resulting in an acid-base imbalance.

3.3 Dermal: **Irritation, pain, and burns particularly in moist areas**. Severe exposures can lead to blistering and full thickness skin burns. Exposure to compressed liquefied chlorine gas has caused frostbite.

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: While an infrequent occurrence, ingestion of chlorine-containing solutions (i.e. concentrated bleach) can cause nausea, vomiting, abdominal pain, and corrosive burns to the mouth, esophagus and stomach.

4.0 DIAGNOSTICS

4.1 Pulse oximetry should be used in symptomatic patients to evaluate the need for supplemental oxygen and additional monitoring.

4.2 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 chlorine poisoning.

5.2 Maintain the patient's airway as necessary. Endotracheal intubation should be performed under direct visualization because of edema and potential damage to the oropharynx. **Support oxygenation and ventilation as necessary**. Use standard treatments for pulmonary edema and bronchospasm. Consider the use of **PEEP, bronchodilators, and inhaled sodium bicarbonate**. Corticosteroids can be considered.

5.3 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.

5.4 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 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.

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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