

Just the Facts...

Chlorine Improvised Explosive Devices and Preventive Medicine Actions

Purpose: This fact sheet is a preventive medicine reference tool and checklist (see back) for pre-deployment and response actions.

Background: Chlorine (Chemical Abstract Services (CAS) No. 7782-50-5) is an acutely toxic industrial compound (TIC) that can cause severe coughing, pulmonary, eye and skin irritation, and even death at higher concentrations. Because of its toxic properties and wide availability, insurgents in Iraq have increasingly used chlorine in improvised explosive device (IED) attacks. Although attacks thus far have resulted in limited releases, more sophisticated efforts involving chlorine as well as other TICs could result in more devastating effects.



Uses: Chlorine is used extensively in common commercial industries to include water treatment processes (e.g., swimming pools, drinking water) and paper and cloth manufacturing. It is often stored at commercial facilities in 1- and 2-ton cylinders or large tanks and is frequently transported via truck and rail. Chlorine cylinders are often but not always yellow; color coding should NOT be used to identify contents.



Physical and Chemical Characteristics: In most conditions, chlorine is a yellow-green gas with a suffocating bleach-like odor. If present, liquid solutions will likely volatilize quickly. Chlorine gas is heavier than air and will generally move downhill and downwind. It may concentrate in poorly ventilated, enclosed, or low-lying areas. The gas should generally dissipate to levels below health concern within an hour if released outside; though extremely large volumes, colder climates, and confined areas can require longer periods of time. Chlorine is also a strong oxidizer that can react explosively with compounds such as acetylene, fuel gas, ammonia, and hydrogen.

Exposure Signs and Symptoms: Liquid can produce skin burns/frostbite and eye irritation/conjunctivitis/corneal burns. Effects from exposures to chlorine gas depend on the dose and health condition of the exposed individuals (for example, asthmatics may be more sensitive to exposure than others). The latency is immediate to hours depending on dose. The severity of acute effects associated with approximately 1 hour of exposure is generalized below in conjunction with the military exposure guidelines (MEGs) provided in USACHPPM Technical Guide (TG) 230:

No adverse effects 1-8 hrs at <0.5 ppm	Minimal effects 1-hr at 0.5 - 2 ppm	Significant effects 1-hr at 2 - 20 ppm	Severe effects (1-hr at > 20 ppm)	Very severe effects (1-hr exposure at ≥ 34 ppm)
Bleach-like odor is possible but no irritation anticipated in most personnel	strong odor, slight irritation of nose/throat/eyes	burning of eyes or throat, some cough and choking sensation	sense of suffocation, chest pain, shortness of breath (dyspnea), nausea, vomiting, hoarseness	pulmonary edema, sudden death bronchospasm (closure of larynx)
1-hr and 8-hr MEGs are 0.5 ppm	1-hr minimal MEG 0.5 ppm (1.5 mg/m ³)	1-hr significant MEG 2 ppm (5.8 mg/m ³)	1-hr severe MEG 20 ppm (58 mg/m ³)	Lethality has been reported after 1 hour 34-51 ppm

After non-fatal exposures, recovery is generally rapid; however, symptoms such as a cough may last for up to 2 weeks. Long-term medical monitoring is not necessary for most persons who recover from minimal to marginal effect. Persons who are treated/recover from severe illness could possibly develop chronic pulmonary problems.

Protection Against Exposures: If there is a release, **MASK AND MOVE** as far upwind as possible, ideally to a minimum distance of 240 meters (m) (the Emergency Response Guideline protection distance), then **REASSESS**.

The M40-protective mask should only be considered an escape device. Normal combat uniform will provide skin protection against chlorine vapors. The Joint Service Lightweight Integrated Suit Technology and the collective protection M48A1 Gas Particulate Filter protect against chlorine-limited chlorine exposure. For occupational/long-term exposures to chlorine, personnel may need to obtain Level A fully encapsulated suits and National Institute of Occupational Safety and Health-approved respirators (e.g., self-contained breathing apparatus).

Decontamination and Treatment: Victims exposed only to chlorine gas who have no skin or eye irritation do not need decontamination. If skin or eyes are affected, flush with water or saline. There is no specific medical test for chlorine injury. After being removed from exposure, limit exertion of all exposure victims. Provide supportive care (oxygen) and monitor (e.g., pulse oximetry) symptomatic individuals, and treat more severe effects accordingly, particularly securing airway. Asymptomatic patients should be directly observed for 1 hour and under lesser observation for 6 hours before being medically cleared because symptoms may be delayed and bronchospasm may appear later.

Preventive Medicine Actions for Chlorine IED Attacks

Pre-deployment Preventive Medicine Planning Actions:

- Be aware of potential chlorine exposure scenarios and/or sites within the scope of your mission (e.g., water treatment plants, industrial facilities, railroad cars); contact The Armed Forces Medical Intelligence Center. (<http://www.afmic.detrick.army.mil/>), USACHPPM (<http://chppm-www.apgea.army.mil/>), and your intelligence staff.
- Train personnel to be aware of chlorine and other TIC gases of opportunity and how to avoid potential hazards.
- Train personnel to appropriately respond to chlorine/TIC attacks (see Response Actions below).
- Ensure personnel maintain the M40-protective mask and are proficient in donning all protective equipment.
- Be familiar with detection capabilities available in theater, and know how to use the equipment.
- Plan egress routes, and know weather conditions while on patrols.
- Know how to document exposure data (see Documentation Requirements below).

Response Actions and Considerations:



If an attack occurs and chlorine is identified (via odor and/or visual cues):

→ **MASK AND MOVE**

- Don M40 mask and evacuate the area immediately.

NOTE: The M40-protective mask provides limited protection against chlorine and should only be considered an escape device.

- Move as far away as possible upwind from the release—at least 240 m; if this is not possible, consider other options (e.g., move to higher ground or up to a second story or rooftop as chlorine will concentrate along the ground).
- Move away from and report any unexploded canisters or cylinders in the area as these may detonate in a collateral fire.
- **Reassess conditions:** determine need for mask or additional evacuation.
- If the eyes or skin are irritated, flush with water.
- Ensure appropriate medical treatment for those more severely affected.
- Replace the canister (C2A1) on mask worn during a chlorine gas event.
- Notify higher headquarters per unit standard operating procedure.

Documentation Requirements:

DOD policy requires that exposure to hazardous substances like chlorine, be documented to support medical surveillance and follow-up treatment efforts:

- Document the following exposure incident information:
 - Unit name.
 - Unit rosters of all personnel involved (affected or possibly exposed).
 - Summary of treatment provided to any individuals (list names of treated).
 - Personal protective equipment or countermeasures used; effectiveness of and compliance with countermeasures; any other exposure incident response activities.
 - Results of any chemical sampling/monitoring including type of monitor and sample location.
 - Description of any health risk communication materials provided.



→ In coordination with the Joint Task Force and Combatant Command Surgeons, forward all the above documentation to the USACHPPM Environmental Surveillance Integration Program (ESIP) using either classified or unclassified channels:

Secure e-mail: oehsdata@usachppm.army.smil.mil
Secure FAX: DSN: 312.584.4244
COMM: 410.436.4244

Unsecured e-mail: oehs@apg.amedd.army.mil
Unsecured phone: DSN: 312.584.4230
COMM: 410.436.4230

Classified Mail:

USACHPPM; ATTN: MCHB-CS-OC (OEHS Data Archive)
5158 Blackhawk Road, Building E1930
Aberdeen Proving Ground, MD 21010-5403

Unclassified Mail:

USACHPPM; ATTN: MCHB-TS-RDD
5158 Blackhawk Road, Building E1675
Aberdeen Proving Ground, MD 21010-5403

References:

- USACHPPM Technical Guide 273, [Diagnosis and Treatment of Diseases of Tactical Importance to US Central Command](#), October, 2003.
- USACHPPM Technical Guide 230, [Chemical Exposure Guidelines for Deployed Military Personnel](#), October, 2003.
- Emergency Response Guidebook, 2006; Department of Transportation.
- Bartlett JG & Greenberg MI. Physician's Desk Ref (PDR) Guide to Terrorism Response. Thomson PDR, Montvale NJ. 2005.
- Weinstein RS & Alibek K. Biological and Chemical Terrorism: A Guide for Health Care Providers and First Responders. Thieme Medical Publishers, NY. 2003.
- ATSDR Medical Management Guidelines for Chlorine and Tox FAQs; Rtrvd 3/5/ 2007, 2007: <http://www.atsdr.cdc.gov>.
- CDC Facts about Chlorine, Rtrvd 3/5/ 2007: <http://www.bt.cdc.gov/agent/chlorine/basics/facts.asp>.
- OSHA, Occupational Safety and Health Guideline for Chlorine, , Rtrvd 3/5/ 2007: <http://www.osha.gov/SLTC/healthguidelines/chlorine/recognition.html>.
- Department of Defense Instruction 6490.03, Deployment Health, August 11, 2006.