SAN FRANCISCO EMERGENCY MEDICAL SERVICES AGENCY

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SAN FRANCISCO
CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL AGENT
MEDICAL TREATMENT PROTOCOLS

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GENERAL CONSIDERATIONS

1. STANDARD TREATMENT PROTOCOLS

These Chemical, Biological and Radiological Agent (CBR) Medical Treatment Protocols are designed to be utilized by all EMS personnel responding to a potential Weapon of Mass Destruction incident. They are formatted to comply with the EMS Agency Standard Treatment Protocols. These protocols consist of a Fact Sheet on each agent, an Information Needed section on patient medical history, an Objective Findings section on physical signs, a Treatment section divided into BLS and First Responder actions, ALS provider actions in the Hot Zone, or contaminated area, ALS provider actions in the Warm Zone, or decontamination area, and Hospital provider actions.

These protocols are designed for rendering the maximum appropriate care to each patient affected by these devices. In Multi-Casualty Incident situations, all of these assessments and treatments may not be able to be performed on each patient. Providers should follow established MCI procedures and attempt to do the greatest good for the greatest number of patients.

Remember that patients in potential HAZMAT/WMD incidents may also have non-poison related problems; e.g. head trauma, hypoglycemia, asthma exacerbation. Refer to Standard Treatment Protocols for assessment and treatment strategies related to these complaints.

For management of suspected biologic agent casualties, immediate consultation with the San Francisco Department of Public Health Communicable Disease Control and Prevention Section is strongly recommended. Their telephone consultation number, available 24 hours a day/7 days a week is (415) 554 2830.

2. ROUTINE MEDICAL CARE

Routine Medical Care (RMC) consists of a set of assessments/treatments that should be performed on every patient regardless of presenting complaint. These include:

- Primary Survey and initial treatment and stabilization of life-threatening airway, breathing and circulation difficulties.
- Spinal stabilization as needed.
- Beginning transport in the potentially unstable or critical patient.
- A Rapid Trauma Assessment in the case of significant trauma.
- Investigation of the chief complaint and associated complaints, signs or symptoms
- An initial set of vital signs:
  - Pulse
  - Blood Pressure
  - Respiration

Lung Sounds
Mental Status

- Cardiac rhythm (if indicated)
- Pulse oximetry (if available)
- Consider orthostatic vital signs to assess volume status
- Protect patients against temperature extremes

Give initial treatment including oxygen, ventilation if indicated, hemorrhage control if needed, basic wound/fracture care, and IV access if indicated/capable. IV access refers to an intravenous line, with isotonic crystalloid solution (Normal Saline or Ringer's Lactate) at a keep vein open rate unless otherwise noted in the individual protocol.

For victims of Weapons of Mass Destruction, the following additional factors should be considered:

- **Under no circumstances should responding personnel at any level of expertise use Personal Protective Equipment or assist in patient decontamination without completing the required training**
- The first priority for patients in a Hot Zone is likely to be evacuation to a decontamination area. All examinations and treatment are likely to be provided by personnel in complete PPE, rendering complete exposure of the patient and utilization of such assessment tools as a stethoscope impossible. Hot zone assessments are limited to those that can be conducted rapidly through PPE. These may include:
  - Observation of the patient's mental status
  - Observation of the patient's skin signs
  - Observation/testing of neurologic response, including GCS and pupils
  - Observation of the patient's airway, secretions, and any vomiting or other bodily fluids
  - Pulse check
  - Pulse oximetry reading
- Patients need to be removed from the contaminated environment as soon as practical to prevent further contamination.
- The order of RMC may be affected by Incident-specific considerations, e.g. primary survey may be followed by evacuation and decontamination, or in the case of entrapped, live victims RMC may be followed by decontamination in place. In all cases, decontamination of contaminated victims should be considered a vital part of their treatment.
- The removal of contaminating materials, such as clothing, from the patient is at the discretion of the Incident Commander. This should be done as rapidly as practically feasible and should include full patient decontamination.
- Assessments and treatments in the Warm Zone include those that need patient exposure, such as stethoscope exam or initiation of IV therapy.

- Identification of the material released may be difficult. Utilize all resources at your disposal, as outlined in the MMTF Concept of Operations Document. These include (but are not limited to) Hazmat Databases, Poison Control Center, and Base Station Physician consultation.
- DECONTAMINATION: With announced threats, any person coming in direct physical contact with a substance alleged to be a biologic agent should perform thorough washing of the exposed skin and articles of clothing with soap and water. Further decontamination of directly exposed persons or of others is not necessary. Consult the Department of Public Health Emergency Operations Plan, or the CDCP Section for further guidance.

3. LEVELS OF CARE

BLS/FIRST RESPONDER

- Employees such as transit drivers, station attendants or building security personnel
- Public safety agency workers such as police or Emergency Medical Technicians

ALS HOT ZONE

- Paramedics or other advanced life support providers
- Conditions of operations include contaminated patients and providers fully outfitted with PPE

ALS WARM ZONE

- Paramedics or other advanced life support providers
- Conditions of operations include access to patients in a more optimal care-giving environment (patients undressed, decontaminated, providers in lower levels of PPE such as universal precautions, access to full ALS medical equipment/supplies)
- May occur at the scene of the incident, en route to a definitive care facility, at a decontamination station within a definitive care facility

HOSPITAL

- Occurs at a definitive care facility capable of emergency department level care
- May be a designated special receiving facility, or a regular receiving hospital or trauma center
- Hospitals should utilize all existing resources, including California Poison Control Center.

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BIOLOGIC AGENTS

Fact Sheet (Generic)

1. **Military Designation:** None

2. **Description:** There are many potential biologic agents that can be used as Weapons of Mass Destruction. Ideal properties of such agents include rapid dispersion, high rate of infectivity, high degree of virulence, short incubation time, low resistance among the population, and high rate of morbidity and mortality. Examples are listed in the chart below along with their health effects.

3. **Non-military uses:** Biologic agents are used in a wide variety of medical research and some types are easily available from biological supply warehouses. Other biologic agents occur endemically (in normally small numbers in certain patient populations) making the early detection of biologic agent use as a weapon potentially difficult.

4. **Military use:** Biologic agents were allegedly used during the Gulf War by the Iraqis against the Kurdish population. While no country currently admits to the use or storage of biologic agents, defensive research occurs at the U.S. Army Medical Research Institute at Fort Detrick Maryland.

5. **Health Effect:** see chart:

6. **Environmental Fate:** Varies by nature of agent. Most agents are not persistent Outside of their natural reservoirs. Refer to source document for further information.

   For management of suspected biologic agent casualties, immediate consultation with the San Francisco Department of Public Health Communicable Disease Control and Prevention Section is strongly recommended. Their telephone consultation number, available 24 hours a day/7 days a week is (415) 554 2830.

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Summary Chart of Biologic Agents

For Further Details Consult "Infections Disease Emergencies: A Preparedness and Response Guide for San Francisco Clinicians, SF Department of Public Health 2005"

AGENT	Agent Type / Incubation Period	Primary signs and symptoms	Diagnosis (in Emergency Care Setting)	Likely mode of acquisi-tion
Anthrax (Inhalational)	Bacteria/ 1-60 days	Biphasic illness: influenza-like illness (ILI) then abrupt onset of fever, chest pain, respiratory distress, cyanosis, occasional stridor, occasional meningismus, progression to shock and death within 24-36 hours.	CXR: widened mediastinum, gram + bacilli in sputa or blood, definitive testing through public health laboratory (PHL) network.	Inhalation
Botulism	Toxin from bacteria/ 12-72 hours	Acute bilateral descending flaccid paralysis beginning with cranial nerve palsies: ptosis, dry mouth, blurry vision, diplopia, dysarthria, dysphagia, normal mental status. (Do not confuse with nerve agent poisoning, which has copious secretions and miotic pupils or atropine overdose, which has CNS excitation with dry mucous membranes & mydriasis);	CSF protein normal, EMG with repetitive nerve stimulation shows augmentation of muscle action potential; Toxin assays of serum, feces, or gastric aspirate available through PHL network.	Inhalation or ingestion
Brucellosis	Bacteria/ 2-8 weeks	Fever, sweats, malaise, anorexia, headache and back pain; sometimes "undulant" fever, sometimes focal complications.	Cultures of blood, bone marrow or other tissue (hold blood cultures for $\geq$ 30 days), serology	Inhalation, oral ingestion
Plague (Pneumonic)	Bacteria/ 1–6 days	Fever, cough, dyspnea, hemoptysis, cyanosis, often prominent GI symptoms, rapid deterioration to shock and death.	Gram – bacilli or cocco-baccilli in sputa or blood (often bipolar staining), definitive testing through PHL network. CXR often bilateral infiltrates with consolidation.	Inhalation

Ricin	Biologic toxin/ Dependant on dose: some immediate symptoms, then 18-36 hours	Immediate nausea/vomiting, apthous-like oral lesions. Then, acute onset of fever, chest pain and cough, progressing to respiratory distress and hypoxemia (18-36 hours); not improved with antibiotics; hepatic and renal failure (24-48 hours); death in 36-72 hours.	Clinical, CXR with pulmonary edema; definitive testing check with CDCP	Inhalation, ingestion
Smallpox	Virus 7-19 days	ILI then continued fever and papular rash that begins on the face and extremities and uniformly progresses to vesicles and pustules; headache, vomiting, back pain and delirium are common.	Clinical with laboratory confirmation; Testing through PHL network; Call DPH Immediately and Before obtaining specimens. Vaccinated, gowned and gloved person obtains specimens (scabs or swabs of vesicular fluid).	Inhalation
Tularemia (Pneumonic)	Bacteria/ 1-14 days	Fever, chills, headache, malaise, sore throat, cough, dyspnea, chest pain, abdominal pain, anorexia, vomiting diarrhea. 20% may have generalized maculo-papular rash with progression to pustules or erythema-nodosum type rash	Clinical; CXR with variable abnormalities: infiltrates, hilar adenopathy, pleural effusions; Culture with specialized media from blood, pleural fluid, lymph nodes, sputa. Notify laboratory staff of suspicion of tularemia. Cultures are dangerous to lab personnel. Serology	Inhalation
T-2 Mycotoxins	Biologic toxin/ minutes	Abrupt onset of mucocutaneous and airway irritation including skin (pain, blistering, sloughing), eye (pain and tearing), gastrointestinal (bleeding, vomiting and diarrhea), and airway (dypspnea and cough), can progress to shock.	Clinical; definitive testing check with CDCP.	Inhalation, ingestion, skin exposure
Viral Hemorrhagic Fever (e.g., Ebola)	Virus/ 2-21 days	Fever, headache, myalgias, severe prostration with mucous membrane bleeding, petechiae, and hypotension in a patient without underlying malignancy	Thrombocytopenia, leukopenia, proteinuria, hematuria, and a positive tourniquet test are common. Specialized testing through PHL network.	Inhalation and ingestion (fomites)

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Treatment Protocols for Biologic Agents

Anthrax

FIELD: Supportive care (for shock and hypoxia)

HOSPITAL:

	Adult*:	Pediatric:
IV ciprofloxacin	400 mg q 12 hrs, or	10-15 mg/kg q 12 hrs (not to Exceed 1 gr/day), or
IV doxycycline	100 mg q 12 hrs; and	>8 yrs and >45 kg: 100 mg bid >8 yrs and <45 kg: 2.2 mg/kg Bid <8 yrs: 2.2 mg/kg bid; and
IV penicillin G	4 million U q 4 hrs	<12 yrs: 50,000 U/kg q 6 hrs ≥12 yrs: 4 million U q 4 hrs

MASS CASUALTY and PROPHYLAXIS:

	Adult*:	Pediatric
PO ciprofloxacin	500 mg q 12 hrs, or	10-15 mg/kg q 12 hrs, or amox
PO doxycycline	100 mg q 12 hrs, or	Not recommended in children
PO amoxicillin	500 mg q 8 hrs	< 20 kg: 13 mg/kg q 8 hrs ≥ 20 kg: 500 mg q 8 hrs
Vaccine		

Therapy for treatment should be continued for 60 days. Oral therapy should be substituted for IV when patient condition improves. Ideally post-exposure prophylaxis will include vaccine. In this case, antibiotics should be given for 30 days concurrent with vaccination. If no vaccine is available antibiotic therapy should continue for 60 days for post-exposure prophylaxis.

* Immunosuppressed persons receive the same as nonimmunosuppressed persons.
The appropriate regimens for pregnant women should be determined at the time using the consensus recommendations published in JAMA 2002; 287(17):2236-2252.

(Ciprofloxacin is the only drug with an FDA indication for prophylaxis against aerosol anthrax. It has been studied in animals but little experience in humans exists; other flouroquinolones are also assumed to be effective.)

INFECTION CONTROL: (Transmission via direct contact is possible; however, there are no data to suggest patient-to-patient transmission occurs.)

Observe standard barrier precautions. Measures for airborne protection are not indicated. Use standard disinfectants (e.g., hypochlorite) to clean surfaces. Notify

laboratory of suspicion of anthrax so safe specimen handling can occur under biosafety level 2 conditions. Cremate bodies if possible

Botulism

FIELD: Supportive care

HOSPITAL:

Supportive care
Polyvalent antitoxin, 10 ml over 20 minutes after skin testing.
Call SF DPH Communicable Disease Control and Prevention for antitoxin
If wound botulism: debride wound
administer appropriate antibiotics (e.g., penicillin)

PROPHYLAXIS: Consider antitoxin for those who have been exposed to toxin.

INFECTION CONTROL:

Observe universal precautions. Wash hands after handling soiled diapers.

Brucellosis

FIELD: Supportive care

HOSPITAL:

	Adult
Doxycycline	100 mg bid; and
Rifampin	600-900 mg q day; or
Streptomycin	1 gm q day, or
Gentamicin	5 mg/kg bid

Combination therapy is recommended (e.g., doxycycline + rifampin).
Therapy should be continued for 6 weeks.
Utilize Trimethoprim/Sulfamethoxazole (TMX) bid + rifampin for pregnant patients and children < 8 years of age.

PROPHYLAXIS: None recommended at present. SFDPH will provide situational guidelines

INFECTION CONTROL: (Transmission via direct contact is possible.)

Observe standard barrier precautions and drainage and secretion precautions for open lesions. Clean or decontaminate rooms with standard disinfectants. Launder clothing

and linens as per hospital protocol. Notify laboratory of suspected plague so safe specimen handling can occur. Cremate bodies if possible.

Plague

FIELD: Supportive care (strict respiratory isolation)

HOSPITAL:	Adult*:	Pediatric:
Preferred		
IM Streptomycin, or	1 g bid	15mg/kg bid (max 2 g/d)
IM or IV Gentamicin	5 mg/kg q day or 2 mg/kg then 1.7 mg/kg tid	2.5 mg/kg tid
Alternate		
IV Ciprofloxacin, or	400 mg bid	15 mg/kg bid
IV Doxycycline, or	200 mg IV q dayor 100 mg bid	< 45 kg: 2.2 mg/kg bid > 45 kg: give adult dosage
IV Chloramphenicol	25 mg/kg q 6 hrs#	25 mg/kg q 6 hrs#

Therapy should be continued for 10 days. Oral therapy should be substituted for IV when patient condition improves.

MASS CASUALTY or PROPHYLAXIS:

	Adult	Pediatric
Preferred		
PO doxycyline, or	100 mg bid	< 45 kg: 2.2 mg/kg bid ➢ 45 kg: give adult dosage ➢ Max dose 200 mg/day
PO ciprofloxacin	500 mg bid	20 mg/kg bid Max dose 1 gram/day
Alternate		
PO chloramphenicol	25 mg/kg q 6 hrs#	25 mg/kg q 6 hrs#

Therapy for mass casualty should be continued for 10 days; for post-exposure prophylaxis therapy should be continued for 7 days.

* Immunosuppressed persons receive the same as nonimmunosuppressed persons. Ciprofloxacin regimens are acceptable for pregnant women.
# Maintain concentration between 5 – 20 mcg/mL; concentrations of greater than 25 mcg/ml can cause reversible bone marrow suppression. Max dose 4 gr/day.

INFECTION CONTROL: (Transmission via respiratory droplets is possible.)

Identify and isolate all cases in whom pneumonic plague is suspected. Identify contacts of cases and provide prophylactic antibiotics and contact surveillance (especially those refusing antibiotics). Provide antibiotic prophylaxis to all health care workers and all

other essential disaster response personnel (police, firefighters, transit workers, public health, medical examiner and mortuary staff) that might encounter close contact (< 2 meters) with patients with confirmed pneumonic plague. Personnel with close contact to cases should also wear disposable surgical masks. In hospital, observe strict or standard respiratory droplet precautions (gown, gloves, mask (surgical mask), and eye protection) and isolation rooms with negative pressure and high-efficiency particulate air filtration during the first 48 hours of therapy. If patient isolation is not possible, cohort patients. Clean or decontaminate rooms with standard disinfectants. Launder clothing and linens as per hospital protocol. Notify laboratory of suspected plague so safe specimen handling can occur. Cremate bodies if possible.

Ricin

FIELD: Supportive care

HOSPITAL:
Supportive care
If toxin was ingested, decontamination of GI tract

PROPHYLAXIS: None recommended

INFECTION CONTROL: None recommended

Smallpox

FIELD: Supportive care

HOSPITAL:
Supportive care
Antibiotics as indicated for secondary bacterial infections.

PROPHYLAXIS: Vaccination

INFECTION CONTROL: (Person to person transmission possible via aerosol)
Immediately isolate all individuals in whom smallpox is suspected, preferably at home. Vaccinate and place under contact surveillance all household and other face-to-face contacts of smallpox cases. Vaccinate all health care workers at clinics or hospitals that might receive patients and all other essential disaster response personnel, such as police, firefighters, transit workers, public health staff and medical examiner and mortuary staff. Furlough employees for whom vaccination is contraindicated. If admitted to a hospital, confine patients to negative pressure rooms with high-efficiency

particulate air filtration. Consider designating a specific hospital for patients requiring hospitalization. Observe standard precautions using gloves, gowns and masks. Adopt a special protocol for decontaminating rooms using consensus recommendations in JAMA2002; 287(17):2235-52. Place all laundry and waste in biohazard bags and autoclave before laundering or incinerating. Launder in hot water with added bleach. Clean surfaces with standard (hypochlorite and quaternary ammonia) disinfectants. Cremate bodies.

Tricothecene Mycotoxins (T2)

FIELD:

Supportive care
Eye irrigation if needed

HOSPITAL:

Supportive care
Decontamination of patients

PROPHYLAXIS: None recommended

INFECTION CONTROL:

Observe universal precautions. Clean or decontaminate rooms with standard disinfectants. Launder clothing and linens as per hospital protocol

Tularemia

FIELD: Supportive care

HOSPITAL:

Preferred:	Adult	Pediatric	
IM streptomycin, or	1 g bid	15 mg/kg bid	
IM or IV gentamicin	5 mg/kg once daily	2.5 mg/kg IM/IV tid	Alternatives:
IV doxycycline,or	100 mg bid	≥ 45 kg: 100 mg bid	
		<45 kg: 2.2 mg/kg bid	
IV chloramphenicol, or	15 mg/kg 4 X daily	15 mg/kg 4 X daily	
IV ciprofloxacin	400 mg twice daily	15 mg/kg twice daily	

Therapy with streptomycin, gentamicin, or ciprofloxacin should continue for 10 days.
Therapy with doxycycline or chloramphenicol should continue for 14 – 21 days.
The treatment of pregnant women is similar to other adults excepting the use of chloramphenicol.

See consensus recommendations in JAMA 2001; 285(21):2763-73 for additional information and for treatment of immunosuppressed persons.

MASS CASUALTY or POSTEXPOSURE PROPHYLAXIS:

Preferred:	Adult	Pediatric
PO doxycycline, or	100 mg bid	≥ 45 kg: 100 mg bid < 45 kg: 2.2 mg/kg bid
PO Ciprofloxacin	500 mg bid	15 mg/kg bid

Therapy with all agents should continue for 14 days.

INFECTION CONTROL: (Transmission via direct contact is possible.)

Observe standard barrier precautions and drainage and secretion precautions for open lesions. Clean or decontaminate rooms with standard disinfectants. Launder clothing and linens as per standard hospital protocol. Notify laboratory of suspected tularemia so safe specimen handling can occur. Cremate bodies if possible.

Viral Hemorrhagic Fevers

FIELD: Supportive care

HOSPITAL (for VHF of Unknown Cause or known to be caused by an Arenavirus or bunyavirus):

Adults and Children:

IV Ribavirin	1st dose: 30 mg/kg, then 16 mg/kg q 6 hrs (max 1 gram/day) x 4 days then 8 mg/kg q 8 hrs (max 500 mg/day) x 6 days

MASS CASUALTY

Adults:	Loading dose 2 grams Ribavirin PO, then >75 kg: 1200 mg bid po for 10 days <75 kg: 1000 mg/day in divided doses (400 mg q am, 600 Mg q pm) for 10 days
Children:	Loading dose 30 mg/kg Ribavirin PO, then 15 mg/kg/day in 2 divided doses for 10 days

PROPHYLAXIS: None recommended

INFECTION CONTROL: (Transmission via direct contact with blood, secretions, organs and semen. Airborne transmission among humans has not been documented.)

Implement immediate strict barrier precautions in a private room. A negative pressure room is preferred. Restrict entry of nonessential staff and visitors. Restrict testing to the

minimum required. Alert laboratory staff of the nature of specimens. Laboratory tests should be done with maximum possible precautions using gloves and biological safety cabinets. Patients' secretions, sputum, blood and all objects with which the patient has had contact, including laboratory equipment used to carry out tests on blood, should be disinfected with 0.5% sodium hypochlorite solution or 0.5% phenol with detergent and as far as possible with appropriate heating techniques (e.g., autoclaving, incineration or boiling). Identify contacts of cases and place under contact surveillance. Cremate bodies.

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7. Principles and Practice of Infectious Diseases, Edited by G.L. Mandell, J.E. Bennett, R.Dolin, 6th Edition, 2005.
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CHEMICAL AGENTS

Chlorine

FACT SHEET

1. **Military designation:** None

2. **Description:** Chlorine is found as an amber liquid or greenish-yellow gas with a very characteristic irritating, pungent odor. Chlorine is severely irritating to the skin, eyes, and respiratory tract. Although generally stored as a liquid, when released, the resulting gas is about two times heavier than air.

3. **Non-military Uses: Chlorine** is used widely in industrial settings. These may include the organic synthesis and manufacture of antifreeze agents, solvents, refrigerants, resins, bleaching agents, and other inorganic chemicals. There is an exceptionally wide use of chlorine in non-commercial and home settings as a cleaning agent, bleaching agent, bacteriostatic, and disinfecting agent. Storage of this substance in a variety of liquid and granular forms is widespread.

4. **Military Use: Chlorine** was first used by the German military on 22 April 1915 in a cylinder-released gas attack that resulted in an estimated 15,000 Allied wounded and 5,000 Allied deaths. Because of its tendency to dissipate rapidly, very large concentrations were required. Chlorine was weaponized in projectiles, mortars and bombs. There is no current chlorine weaponry.

5. **Health Effects: Chlorine** exposure causes an immediate severe irritation to the eyes and mucous membranes. The upper airways are first involved with nose, throat, and sinus irritation. The lower airways are irritated with severe cough and chest pain. There may be nausea, vomiting, and fainting. Very high doses may cause pulmonary edema. Wheezing is likely to occur in individuals with a history of pre-existing asthma. Bronchitis often occurs, sometimes progressing to pneumonia. High concentrations also irritate the skin, causing burning, itching and occasional blister formation. There is no animal or human epidemiological data to suggest that chronic chlorine exposure may cause cancer or the occurrence of adverse developmental effects in the unborn fetus.

6. **Environmental Fate: Chlorine** is not persistent in surface water, ground water, or soil. Oxidation of environmental organic materials occurs rapidly, reducing its concentration rapidly. Dispersal of chlorine gas is rapid into the atmosphere.

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TREATMENT PROTOCOL

1. INFORMATION REQUIRED

- History: exposure to a greenish—yellow gas with a pungent, acrid odor
- Symptoms: low dose—cough, eye irritation & lacrimation, choking sensation
  Higher dose—hoarseness, wheezing, severe cough, sudden collapse due to laryngospasm

2. OBJECTIVE FINDINGS

- Lacrimation
- Voice hoarse
- Skin erythema
- Increased work of breathing
- Wheezing
- Cough
- Cyanosis

3. TREATMENT

BLS/FIRST RESPONDER	• Routine Medical Care. • Eyes: flush with copious amounts of water. • Skin: flush with copious amounts of water. • High flow O2 if respiratory symptoms.
ALS HOT ZONE	• If bronchospasm present, administer Epi (1:1,000) 0.3 mg IM or SQ X 1 in severe cases if the patient has no known history of coronary artery disease or stroke and is under 40 years of age.
ALS WARM ZONE	• Inhaled Beta-2 agonist bronchodilator via nebulizer if evidence of bronchospasm; repeat as necessary. • Consider oral intubation for stridor/severe dyspnea/hypoxia/chest pain. • Consider needle cricothyroidotomy for laryngospasm if unable to maintain airway with BLS maneuvers or intubation. • Continue inhalational Beta-2 agonist bronchodilator therap. • IV access with Normal Saline at a keep vein open rate.
HOSPITAL	• Continue inhalational Beta-2 agonist bronchodilator therapy. • If hypoxia continues, consider intubatation. • Be prepared for Adult Respiratory Distress Syndrome (ARDS); treat Pulmonary Edema with intubation and consider Positive End Expiratory Pressure (PEEP). Use diuretic therapy with caution due to risk of hypotension. • Utilize morphine sulfate or codeine for pain/cough suppression.

4. PRECAUTIONS AND COMMENTS

- All patients who have had a moderate or high level of exposure (respiratory distress or airway symptoms upon exam by EMS personnel) should be referred to a medical facility for examination and treatment.
- If utilized, the ETT's placement and patency must be maintained at all times. Confirm ETT position (reassessed and documented) with any patient transfer. Confirm by direct visualization and/or esophageal detection device.

Hydrogen Cyanide and Cyanogen Chloride

FACT SHEET

Military Designations: AC (hydrogen cyanide) and CK (cyanogen chloride)

Description: Both of these substances are liquids, but they vaporize (evaporate) at about 73 degrees F, so they will be in gaseous form under most temperate conditions. AC has an odor of bitter almonds (which a percentage of the U.S. population cannot smell); CK is pungent. AC is lighter than air, whereas CK is heavier than air. Cyanogen chloride is quickly metabolized to cyanide once absorbed into the body, and causes the same biological effects as hydrogen cyanide. In addition, CK is irritating to the eyes, nose and throat (similar to riot control agents), whereas AC is nonirritating.

Non-military Uses: Large amounts of cyanide (most in the form of salts) are produced, transported and used by U.S. industry. Cyanide is used in fumigation, photography, extraction of metals, electroplating, metal cleaning, tempering of metals, and the synthesis of many compounds. Hydrogen cyanide is released when wool, synthetic fibers and plastics burn.

Military Uses: The French and English used small amounts of cyanide during World War I, but the compound was not effective as a weapon because the amount needed is large and because cyanide, being lighter than air, drifted away from the target. Japan allegedly used cyanide against China before World War II, and Iraq allegedly used cyanide against the Kurds in 1988. The U.S. once had cyanide munitions, but all known stocks are believed to have been destroyed.

Health Effects: Cyanide blocks the use of oxygen in cells of the body and thus causes cellular asphyxiation. The cells of the brain and heart are most susceptible to its effect. High concentrations of vapor may cause a brief increase in rate and depth of respirations (in 15 seconds), seizures (30 seconds) and cessation of breathing (3-5") and cardiac arrest and death (4-10"). A smaller concentration will cause headaches, flushing, lightheadedness and other non-specific complaints. In addition, CK produces irritation of the eyes, nose and airway.

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Antidote (thiosulfate) is very effective if administered in time. A large exposure may result in prolonged neurologic damage, secondary to hypoxia.

Environmental Fate: Because of their volatility, these substances are not expected to persist in surface water or soil.

TREATMENT PROTOCOL

1. INFORMATION NEEDED

Exposure to a vapor or liquid that some patients may complain had a "bitter almond" smell or upper airway and eye irritation. Other patients may not notice anything unusual in their environment and may complain of:

- nausea
- headache
- anxiety
- agitation
- weakness
- muscular trembling

2. **OBJECTIVE FINDINGS**

- Altered LOC: anxiety, agitation, stupor, coma
- Transient hyperpnea, followed by seizures, apnea and cardiovascular collapse
- Tremor
- Normal pupils
- diaphoresis

3. **TREATMENT**

BLS/FIRST RESPONDER	• Routine Medical Care.
ALS HOT ZONE	• High flow O2 if available. •
ALS WARM ZONE	• Cardiac monitor • IV access • Sodium thiosulfate IV: Adult dose: 12.5 grams (50 ml) Peds dose: 0.4 mg/kg • Intubate and ventilate if apneic. •
HOSPITAL	• Supportive care, including: Intubation & ventilation if necessary Bicarbonate for acidosis ABG monitoring.

4. PRECAUTIONS AND CONSIDERATIONS

- Do not remove PPE to check for "bitter almond" smell
- Pulse oximetry is of limited use in CN poisoning. If the patient is symptomatic and O2 saturation is high, this may indicate either severe poisoning or the absence of CN. If the patient is symptomatic and the O2 saturation is low, this may indicate another co-intoxicant or concurrent medical problem along with CN that may be amenable to other treatment, such as bronchodilation.
- Nitrate therapy, such as amyl nitrite or sodium nitrite has significant side effects and is not useful in emperic treatment. Most CN treatment kits contain these drugs. Do not use them.

Methylene Diphenyl Isocyanate (MDI), Methylene Diioscyanate, and Methyl Isocyanate (MIC)

FACT SHEET

Military Designations or Military Unique Use: None

Description: MDI is found as a solid in white to yellow flakes. Various liquid solutions are used for industrial purposes. There is no odor to the solid or liquid solutions. The vapor is approximately eight times heavier than air. This chemical is a strong irritant to the eyes, mucous membranes, skin and respiratory tract. It is also a very potent respiratory sensitizer.

Non-military Uses: Very large quantities of MDI are produced, transported, and used annually in the U.S. Various industrial processes utilize MDI in production of polyurethane foams, lacquers and sealants. MDI is a commonly used precursor in the industrial production of insecticides. Noncommercial uses of polyurethanes such as in isocyanate paints or in cutting of uncured urethanes may also cause exposure. Thermal degradation of these substances may produce MDI as a byproduct of combustion.

Health Effects: MDI as either a solid or liquid solution is a strong irritant to the eyes and the skin, resulting in discomfort and burning sensation. Severe inflammation may occur, along with irritation of the respiratory tract and bronchospasm. Very high concentrations may result in severe respiratory distress and pulmonary edema. MDI vapor is a strong sensitizer of the respiratory tract and may result in asthma in individuals both with and without a prior history of the disease. This sensitization may persist indefinitely. Repeated or long term exposure may result in permanent respiratory or skin problems.

Environmental Fate: MIC is expected to remain almost entirely in vapor phase when released into the atmosphere.

TREATMENT PROTOCOL

1. INFORMATION NEEDED

- Exposure to a white or yellow solid, or a heavier than air vapor
- Eye, mucous membrane or skin irritation
- Allergic symptoms such as wheezing, shortness of breath or urticaria

2. **OBJECTIVE FINDINGS**

- Increased work of breathing
- Wheezing
- Cough
- Increased secretions and lacrimation
- Erythema of skin

3. **TREATMENT**

BLS / FIRST RESPONDER	• Routine Medical Care. • Eyes or skin irritation: flush with copious amounts of water as feasible. • High flow O2 if respiratory symptoms.
ALS HOT ZONE	• If bronchospasm present, administer Epi (1:1,000) 0.3 mg IM or SQ x 1 in severe cases if the patient has no known history of coronary artery disease or stroke and is under 40 years of age.
ALS WARM ZONE	• Inhaled Beta-2 agonist bronchodilator via nebulizer if evidence of bronchospasm; repeat as necessary. • Consider oral intubation for stridor/severe dyspnea/hypoxia/chest pain. • Consider needle criothyroidotomy for laryngospasm if unable to maintain airway with BLS maneuvers or intubation • Continue inhalational Beta-2 agonist bronchodilator therapy. • IV access.
HOSPITAL	• Continue inhalational Beta-2 agonist bronchodilator therapy. • Solumedrol 125 mg IV. • If hypoxia continues, intubate and maintain oxygenation • Be prepared to treat ARDS; treat pulmonary edema with PEEP. Use diuretic therapy with caution due to risk of hypotension. • Utilize morphine sulfate or codeine for pain/cough suppression.

4. PRECAUTIONS AND COMMENTS

- All patients who have had a moderate or high level of exposure (respiratory, GI or Cardiovascular signs or symptoms upon exam by EMS personnel) should be referred to a medical facility for examination and treatment.

- If utilized, the ETT's placement and patency must be maintained at all times. Confirm ETT position (reassessed and documented) with any patient transfer. Confirm by direct visualization and/or esophageal detection device.

Mustard (Sulfur Mustard)

FACT SHEET

Military Designations: H; HD; HS

Description: Mustard is a "blister agent" that causes cellular damage by interfering with DNA function. It is a colorless to light yellow to dark brown oily liquid with the odor of garlic. It is not derived from, or chemically related to edible mustard. It does not evaporate readily, but may pose a vapor hazard in warm weather. It is a vapor and liquid hazard to skin and eyes, and a vapor hazard to airways. Its vapor is five times heavier than air.

Non-military Uses: Sulfur mustard has been used as a research tool to study DNA damage and repair. A related compound, nitrogen mustard, was the first cancer chemotherapeutic agent and is still used for some purposes.

Military Uses: Mustard was used extensively in World War I and was the largest producer of chemical agent casualties during that war. Mustard was used by Iraq against Iran in the 1980's. The U.S. has a variety of munitions filled with sulfur mustard, including projectiles, mortars and bombs.

Health Effects: Mustard damages DNA in cells, which leads to degradation of cellular functions and cell death. Mustard penetrates skin and mucous membranes very quickly, and cellular damage begins within minutes. Despite this cellular damage, clinical effects may not become apparent until hours later; the range is 2 to 24 hours. The initial effects are in the eyes, skin and airways. After high doses, the effect is progressive from irritation to ulceration (cornea), blistering (skin), alveolar damage (lungs), gastrointestinal tract (vomiting & diarrhea) and suppression of bone marrow (pancytopenia). There is no specific antidote. Mustard may have carcinogenic, developmental damage, airway stenosis and other long term effects.

Environmental Fate: Persistence of mustard may last for weeks in the soil; deeper levels may be contaminated for years. Mustard is relatively insoluble in water; once dissolved, however, it breaks down into non toxic byproducts.

TREATMENT PROTOCOL

1. INFORMATION NEEDED

- Exposure to a colorless to light yellow or dark brown oily liquid
- Odor of garlic
- Onset of signs and symptoms usually 4 to 8 hours after exposure

2. **OBJECTIVE FINDINGS**

- Eyes: irritation, redness, foreign body "gritty" sensation
- Skin: erythema progressing to clear vesicles and blisters
- Mucous membranes/airway: hoarseness/stridor
  Sinus pain
  Cough
  Dyspnea

3. TREATMENT

BLS/FIRST RESPONDER	• Routine Medical Care.
ALS HOT ZONE	• High flow O2 if available. •
ALS WARM ZONE	• Thorough decontamination especially important. • Intubation, ventilation if needed. • Flush eyes if symptomatic. • Standard burn treatment for blistered areas. • Preserve body temperature if blistered area is large.
HOSPITAL	• Utilize mydriatic with sunglasses if photophobia is present. Topical antibiotic if evidence of significant conjunctivitis or ketatitis may be useful. • Control pain with systemic analgesic such as morphine sulfate or codeine. • Continue burn treatment for blistered areas of skin • Humidified O2, bronchodilators, codeine for cough suppression if symptomatic. Intubation and preservation of oxygenation if chemical pneumonitis develops. • Monitor CBC for bone marrow suppression.

4. PRECAUTIONS AND COMMENTS

- Liquid or vapor mustard penetrates the skin and mucous membranes and damages cells within minutes of exposure, so decontamination must be done immediately after exposure.
- Mustard agent can be very persistent; all surfaces with potential contamination must be carefully cleaned before being assumed to be decontaminated.

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Nerve Agents

FACT SHEET

Military Designations: GA (Tabun); GB (Sarin); GD (Soman); GF and VX.

Description: Nerve agents are very toxic organophosphorus compounds that have biological activity similar to that of many insecticides. There is variable volitility, with some agents more likely than others to pose a toxic hazard by inhalation, and some agents likely to persist longer than others. All are well-absorbed across the skin. Under temperate conditions, the liquids are clear, colorless, and mostly odorless. They cause biologic effects by inhibiting acetylcholinesterase, thereby allowing acetylcholine to accumulate and cause hyperactivity in the muscles, glands and nerves.

Non-military Use: None

Military Use: Nerve agents were first synthesized pre-World War II but were not used during that war. They were allegedly used by Iraq in its war with Iran. The U.S. has a large stockpile of GA and VX weapons that are in the process of being destroyed.

Health Effects: Nerve agents are the most toxic chemical agents. Initial effects from small amounts of agent differ depending on the route of exposure. After a small vapor exposure, there is the immediate onset of effects in the eyes (miosis), the nose (rhinorrhea), and airways (dyspnea due to wheezing and increased secretions). After a small skin exposure, there may be an asymptomatic interval of a few minutes to a few hours before the onset of sweating and fasciculations at the site of the droplet, which may be followed by nausea, vomiting and diarrhea. After exposure to a large amount of nerve agent by either route, there may be sudden loss of consciousness, fasiculations, seizures, copious secretions, paralysis, apnea and death. There is usually an asymptomatic interval of minutes after liquid exposure before these occur; effects from vapor occur almost immediately. Antidotes (atropine and pralidoxime) are effective if administered before circulation fails.

Environmental Fate: GB will react with water to produce toxic vapors. Most GB spilled will be lost to evaporation. VX is moderately persistent in soil, and because it has low water solubility and low volitility it could be mobile in surface and ground water systems.

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TREATMENT PROTOCOL

1. INFORMATION NEEDED

- Eyes: blurry or dim vision
- Nausea, abdominal pain, cramps, diarrhea
- Dyspnea
- Tremors
- Weakness

2. OBJECTIVE FINDINGS

- Mild: Miosis
  Rhinorrhea
  Excess secretions
  Diaphoresis
  Vomiting
  Diarrhea
- Severe: Decreased level of consciousness
  Fasciculations and muscle weakness
  Seizures
  Muscle paralysis leading to apnea

3. TREATMENT

	MILD EXPOSURE	SEVERE EXPOSURE
BLS/FIRST RESPONDER	• Routine Medical Care	• Routine Medical Care
ALS HOT ZONE		• Atropine: Adult: 2 mg IM Infant: 0.04 mg/kg IM, Minimum dose 0.1 mg, Repeat as needed • 2-PAM 1 gram IM • Ativan 2 mg IM for seizures
ALS WARM ZONE	• IV access • Atropine: Adult: 1 mg IV or IM • Infant: 0.02 mg/kg, minimum dose 0.1 mg, repeat in 5" Repeat atropine as needed IV • Pralidoxime (2-PAM) Adult: 1-2 gram Infant & child: 20 - 40 mg/kg	• IV access • Repeat atropine as needed IV • 2-PAM Adult: 1-2 gram IM or IV; infant & child: 20 – 40 mg/kg • Treat seizures with **Midazolam** • <u>Adult:</u> • **Midazolam** 5 mg IN (2.5 mg each nostril) or, 2.5 mg slow IV push to a maximum dose of 5 mg (may be repeated every five minutes). <u>Infant & child:</u> **Midazolam:** Utilize length based tape measurement to determine dose. For all route of administration utilize anti-seizure/sedation dosing not rapid sequence induction dosage. Maximum single dose is 2 mg IV, 4 mg IM, or 5 mg IN.

HOSPITAL	• Continue atropine and 2-PAM as needed (2-PAM infusion is preferred over repeat boluses; give 200-500 mg/hr titrated based on improvement in muscle weakness)	• Continue atropine and 2-PAM as needed • Treat acidosis as needed

4. PRECAUTIONS AND COMMENTS

- Nerve agent poisoning can be very toxic. Large amounts of atropine may need to be utilized (in the 100's of mg's). If the patient is initially symptomatic and no response is seen to the initial doses of medication, continue giving until a response is achieved.
- In MCI nerve agent poisioning, consider the following dosage scheme for atropine administration via autoinjectors in the hot zone:

3 AUTO INJECTORS	**BETWEEN 1 AND 3 AUTOINJECTORS** (attempt to titrate dose) One or more signs of life, 2 or more organ signs and:	**DO NOT USE AUTOINJECTORS**
At least one sign of life (breathing, pulse, or conscious)	Elderly appearing	No sign of life
Exhibiting 2 or more organ signs (in addition to miosis)	Children appearing under age 14	Ambulatory
Non-ambulatory	Prolonged extracation (if not expectant) May need more than 3 autoinjectors	Fits non-resuscitation group (expectant) due to other, concomitant injury
Seizures	No seizures	No seizures

- Bronchospasm and respiratory secretions are the best acute symptoms to monitor response to atropine/2-PAM therapy.

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RADIATION INJURY

Fact Sheet

Military designation: None.

Description: Radiation Injury can be classified into two distinct scenarios: Detonation of a **nuclear bomb** (fission or fusion device) and **contamination** of an individual with radioactive material by a mechanism other than a nuclear bomb (e.g. a conventional explosive with radioactive covering or spilled radioactive materials).

Non-military Uses: Radioactive materials (isotopes) are utilized by hospitals and other health care facilities in many medical procedures, such as bone scans, and many research laboratories. Nuclear fission materials are utilized for power generation in electrical generating plants. Isotope materials are more easily accessible, in general, than fissionable materials.

Military Use: Nuclear bombs utilize fission (the splitting of an atomic nucleus) or fusion (the union of atomic nuclei to form heavier nuclei) to rapidly produce an enormous release of energy from a small amount of material. The resulting blast devastates both the physical environment and the human population that is exposed to it. The only wartime uses of these devices were during World War II on Hiroshima and Nagasaki. Multiple nuclear device testing has been done since that time, mainly underground to minimize health effects.

Health Effects:
Nuclear Bomb: Health effects would be cataclysmic, and proportional to the explosive power of the device expressed as equivalent tons of TNT. Most current bomb devices are in the 1 to 100 kiloton range (1,000 to 100,000 tons of TNT). Explosion of such a device would result in large numbers of immediate deaths vaporizing human remains. Blast injuries (pnuemothoraces, closed head injuries, blunt abdominal trauma, spine and limb injuries, tympanic membrane ruptures) would be common, along with severe burns due to the thermal energy released by the device. Health effects due to radiation are related to the amount of radioactive energy absorbed by the body, expressed as “Rads”, which are units of energy absorbed. Radioactive energies released by nuclear bombs are mainly gamma rays, which are short lived (they do not cause residual contamination once the blast is over) but very powerful and can penetrate most materials. Protective factors are distance from the center of the explosion, material between the patient and the explosion (the more solid, the better) and parts of the body exposed to the radioactive effects.
Fallout occurs when radioactive particles stirred up by or resulting from a nuclear explosion descend through the atmosphere creating a potential adiation hazard hours later and downwind from the site of the explosion.

Contamination: Health effects from exposure to a radioactive contamination are more variable, and likely to be more survivable. Most radioactive contaminants are isotopes; these materials give off some gamma radiation but more commonly alpha and beta rays, which are easily stopped by physical barriers such as clothing. Radioactive contaminants may be persistent, however, and may pose a threat to the rescuer (ex. shrapnel wounds contaminated with isotopes, or liquid radioactive material on the skin). Strict decontamination procedures, similar to those described in the Chemical Agent protocols, are an important part of therapy, along with isolating any bodily secretions that may contain contaminants such as patient vomitus.

The symptoms of radiation exposure are outlined in the following chart:

AMOUNT OF RADIATION EXPOSURE	ORGAN SYSTEM PREDOMINANTLY AFFECTED	SYMPTOMS
800 Rads and above	Central Nervous System	Coma and rapid death
600 – 800 Rads	Central Nervous System	Altered level of consciousness, seizures, coma
400 – 600 Rads	Gastro-intestinal tract	Nausea, Vomiting, Diarrhea
200 – 400 Rads	Skin	Partial and Full Thickness Burns
200 Rads	This is the LD 50, or 50% of patients exposed to this amount of radiation will eventually die	
100 – 200 Rads	Hematopoetic system (bone marrow, blood cells)	Anemia, easy bruising and bleeding (including internal bleeding), secondary infection due to immunocompromise several days after exposure
Less than 100 Rads	Endocrine and other systems (carcinogenesis, or excessive development of cancers)	Tumor development months to years after exposure; thyroid cancer particularly common
0.1 Rad	Exposure from a typical Chest Radiograph	

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Radiation InjuryTreatment Protocol

INFORMATION REQUIRED

History: type of exposure (bomb or contamination scenario)
Pre-existing medical conditions (pregnancy, iodide allergies, renal failure)
Time since exposure
Type of decontamination performed (decontaminate prior to treating patient in contamination scenarios)
Symptoms: as outlined in the chart

OBJECTIVE FINDINGS

Burns
Blast injuries (pneumothorax, rib pain, abdominal tenderness to palpation, external signs of head trauma plus altered level of consciousness, ruptured tympanic membranes)
Spine injury
Long bone fractures
Vomiting (may be bloody)
Diarrhea
Altered level of consciousness

TREATMENT

BLS/FIRST RESPONDER	• Routine Medical Care • Skin: Cover any burned areas with clean dressing materials if available • High flow O2 if respiratory symptoms
ALS HOT ZONE ***Consult Radiation Safety Officer for entry into areas above 5 RADS.**	• Decontamination of skin per Chemical/HAZMAT protocols • Respiratory support
DECONTAMINATION OF PATIENTS/PERSONNEL OCCURS IN HOT ZONE	
ALS WARM ZONE	• Consider oral intubation for stridor/severe dyspnea/hypoxia/chest pain • Consider needle decompression of chest if blast injury and signs/symptoms of pneumothorax • Continue burn and other wound dressing • IV access with Normal Saline at a bolus rate
HOSPITAL	• Institute appropriate burn and wound care (be aware of possible radioactive contamination of penetrating trauma wounds) • **Potassium Iodide 130 mg P.O**.(1 tablet qd) for all symptomatic patients, or those exposed to significant amounts of radiation per Safety Officer or County Health Officer. • For children, age 8 or below, pregnant women and patients

	with history of renal failure: **Potassium Iodide 65 mg P.O.;** repeat only as directed by Safety Officer or County Health Officer. • Pain management • CBC, including absolute lymphocyte count early post exposure and repeat in 2 days. • Supportive treatment for CNS and GI symptoms • Prophylactic antibiotics not recommended

PRECAUTIONS AND COMMENTS

Follow facility radiation exposure plan for patient decontamination and disposal of all contaminated waste.

In the nuclear bomb scenario casualty load is likely to be excessive. Utilize austere care protocol and strict triaging to maximize available resources.

Protective measures against fallout radiation exposure include bathing and staying indoors.

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BLAST INJURY

Fact Sheet

Military designation: None.

Description: Blast injury results from the high-speed chemical decomposition of explosive materials resulting in a primary pressure wave and the distortion of any surrounding structural materials or small fragments of the explosion source impacting the victim.

Non-military Uses: Blast can occur from accidental explosions, such as volatile petrochemicals (e.g. gasoline) or intentional acts. Blast energy can be transmitted through both air and water. Blast effect is larger in enclosed spaces.

Military Use: Explosive devices are designed to maximize either structural damage or casualty effects. They can include both projectiles embedded into the device (such as nails or washers) or various dirty components (see Radiation Injury protocol). Secondary effects can occur from structural collapse or falling debris, smoke and fire, toxic gases and hazardous materials, and dust.

HEALTH EFFECTS:
Primary Blast Effects:

- **Ears**: tympanic membrane hemorrhage or rupture, with possible ossicular disruption or fracture.
- **Lungs**: severe pulmonary contusions, pneumothorax, hemothorax and mediastinal air possibly leading to failure of adequate ventilation.
- **Bowel**: bowel wall contusions or acute or delayed rupture.
- **Circulatory**: air embolism, due to a tear in the lungs and entry of air into the pulmonary veins and subsequent potential catastrophic organ failure such as a cerebral air embolus.

Secondary Blast Effects:

- **Shrapnel:** causing penetrating trauma similar to gunshot or knife wounds.
- **Human displacement**: acceleration/deceleration injuries such as blunt trauma to abdominal organs, aortic disruption or other internal injuries.
- **Structural collapse**: potential crush injuries.
- **Smoke/fire**: inhalational injury to the lung, thermal injury to lungs and skin.
- **Toxic gases and hazardous materials**: cyanide, carbon monoxide, asbestos and other materials may cause health effects from inhalational exposure. See relevant protocols.

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Blast Injury Treatment Protocol

INFORMATION REQUIRED

- History: type of exposure (bomb or accidental explosion scenario)
- Possibility of shrapnel
- Open or closed space explosion
- Pre-existing medical conditions (pregnancy, iodide allergies, renal failure)
- Distance from blast
- Symptoms: especially hearing problems

OBJECTIVE FINDINGS

- Burns
- Blast injuries (pneumothorax, rib tenderness, hemoptysis, dyspnea, abdominal tenderness to palpation, external signs of head trauma plus altered level of consciousness, ruptured tympanic membranes)
- Spine injury
- Long bone fractures

TREATMENT

BLS/FIRST RESPONDER	• Routine Medical Care. • Skin: Cover any burned areas with clean dressing materials if available. • High flow O2 if respiratory symptoms. • Stop external hemorrhage using RMC techniques or extremity tourniquets if necessary (see P-033 Extremity Trauma protocol.
ALS HOT ZONE	• Decontamination of skin per Chemical/HAZMAT protocols. • Respiratory support.
DECONTAMINATION OF PATIENTS/PERSONNEL OCCURS IN HOT ZONE	
ALS WARM ZONE	• Consider oral intubation for stridor/severe dyspnea/hypoxia/chest pain. • Consider needle decompression of chest if blast injury and signs/symptoms of pneumothorax. • Continue burn and other wound dressing. • Consider the use of approved hemostatic dressings (e.g. Quick Clot) on shrapnel injuries with continuing hemorrhage and evidence of shock. Do NOT apply to mucous membrane surfaces. • IV access with Normal Saline at a bolus rate. • Pain control per pain protocol.

HOSPITAL	• Institute appropriate burn and wound care. • ENT exam for Tympanic Membrane damage (consider antibiotic prophylaxis for rupure). • For those with TM rupture or pulmonary symptoms, obtain a chest radiograph. • Pain management. • Evaluation for intra-abdominal (including bowel) injury. This may consist of serial CBC's, FAST ultrasound, acute abdominal radiographs or CT scan. • Consider head CT for CNS symptoms. • Evaluate renal function and provide liberal hydration for crush injury victims (see crush injury protocol). • Update tetanus status. • Evaluate shrapnel injuries for radioactive debris (see radiation protocol) and life and limb threats, such as occult vascular injury, with CT scanning, ABI index BP measurements, and vascular studies as needed. • Irrigate the eyes of patients who have visual and eye foreign body complaints, and examine for the presence of retained foreign bodies.

PRECAUTIONS AND COMMENTS

- Do NOT apply hemostatic dressings to mucous membrane surfaces.
- Burn patients need additional consideration, such as adequate fluid resuscitation, pain control and evaluation for inhalational injury.
- Prevent hypothermia and acidosis in blast victims with adequate warming and hydration.
- Patients with tympanic membrane damage are at high risk of severe injury. Frequent re-triage is critical to detect occult injury.

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DRUG APPENDIX

2 PAM Chloride

ACTION
Cholinesterase reactivator:
1. Removes the organophosphate agent from cholinesterase and reactivates the cholinesterase
2. Re-establishes normal skeletal muscle contraction

INDICATIONS
- Antidote for organophosphate (nerve agent) poisoning (in combination with atropine)

CONTRAINDICATIONS
- None

POTENTIAL SIDE EFFECTS
- Pain at injection site
- Hypotension
- Respiratory Arrest
- Cardiac Arrest
- Blurry Vision
- Diplopia
- Tachycardia
- Nausea
- Increases atropine effects

DOSAGES
- One auto-injector dose of 2-PAM (600 mg). May repeat every 10" times two if symptoms persist to a maximum of 3 doses. If symptoms are severe, all three doses should be adminstered in rapid succession. Adult total dose is 1 to 2 grams IV over :30; may repeat once in one hour.

PEDIATRIC USAGE
- Below age 8, the recommended total dose is 20 – 40 mg/kg IV to a maximum of 1 gram given over :30, may repeat once in one hour. Since autoinjectors deliver a total dose of 600 mg, unless the child's estimated weight is greater than 30 kg do not utilize the autoinjector.

NOTES
- Diazepam, midazolam, ativan or other approved benzodiazepine can be given cautiously if seizures are not controlled by atropine.
- Atropine must be given first until its effects become apparent before giving 2-PAM.
- Peak effect is in :05 to :15 after IM injection; half life of the drug is :75
- If the patient has enough organophosphate symptoms to require atropine treatment, they should also receive 2 PAM (per nerve agent protocol).

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Sodium Thiosulfate

ACTION
Donates sulfur to the enzyme rhodanese, which converts cyanide to thiocyanate. Thiocyanate is excreted in the urine.

INDICATIONS
- Suspicion of cyanide toxicity

CONTRAINDICATIONS
- None (although renal failure will limit thiocyanate clearance)

POTENTIAL SIDE EFFECTS
- None

DOSAGES
- 50 ml of a 25% solution (12.5 grams) IV push

PEDIATRIC USAGE
- 1.65 ml/kg up to 50 ml of a 25% solution (0.4 mg/kg)

NOTES
- Always use in combination with high flow O2
- Use crystalloids and vasopressors to treat hypotension due to cyanide