MSSNY

Medical Society of the State of New York

BIOLOGICAL, CHEMICAL, AND RADIOLOGICAL TERRORISM:

An Overview of Indicators and Response

INTRODUCTION

This guide provides physicians and other healthcare providers with basic information to help identify and respond to patients affected by biological, chemical, or nuclear/radiological agents. Healthcare workers should be alert to illness patterns and reports of biological, chemical, or radiological exposure that might signal an act of terrorism. This guide is intended to provide an overview of some of those potential threats.

RECOGNIZING A TERRORISM RELATED EVENT

Biological Agents

- Unusual numbers of sick or dying people and/or animals, especially over a short period
- Severe disease in previously healthy people
- Out-of-season or region disease outbreaks
- Outbreak of previously rare disease
- Unscheduled and unusual aerial spraying
- Abandoned spray devices

Chemical Agents

- Mass casualties
- Definite pattern of casualties and physical syndromes
- Illness associated within a confined geographic area
- Dead insects/animals/birds/fish
- Vegetation dies out of season
- Unusual liquid droplets
- Unexplained odors
- Unexplained low-lying clouds
- Unusual metal debris, especially if wet and no rain

Radiological Events

- Acute radiation sickness unfolds over days or weeks
- Within 2-3 weeks, cluster of people presenting with nausea, vomiting, skin redness (in the absence of a known heat source), tendency to bleed, and/or hair loss

INFECTION CONTROL

Standard Precautions

For procedures likely to generate splash or contact with blood or body fluids/secretions/excretions: gowns, masks, protective eyewear, gloves, hand washing after gloves are removed

Contact Precautions

Standard precautions; plus gown if clothing will contact patient or if patient has diarrhea, ileostomy, colostomy, or uncontained wound drainage; gloves when entering patient room; medicated handwashing agent

Droplet Precautions

Standard precautions; plus mask for those entering room of patient, surgical mask on patient during transport

Airborne Precautions

Standard precautions; plus N95 mask or respirator for those entering room of patient, surgical mask on patient during transport

REPORTING

Report suspected or confirmed cases of any of the biological, chemical, or nuclear agents listed in this brochure immediately to your local or state department of health.

New York State Department of Health, Office of the Commissioner: **518-474-2011**

New York City Department of Health, Office of Communicable Diseases: **212-788-9830**
If not in New York City, locate your local health department in New York.

New York State Association of County Health Officials: **518-456-7905**
http://www.nysacho.org/i4a/pages/index.cfm?pageid=3713

RESOURCES

New York State Department of Health (NYSDOH): *www.health.state.ny.us/home.html*
ESP, 651 Corning Tower, Albany, NY 12237-0627

Bureau of Environmental Radiation Protection: **518-402-7550**

Bureau of Toxic Substance Assessment: **518-402-7800**

Communicable Disease Control: **518-473-4439**
Fax: 518-474-7381 email: *bcdc@health.state.ny.us*

Wadsworth Center Laboratories: **518-474-4177**

After hours NYSDOH Duty Officer: **518-465-9720**

After hours State Emergency Management Office (SEMO) State Warning Point: **518-457-2200**

New York City Department of Health (NYCDOH):
Office of Radiological Health: **347-396-6000**
NYC Public Health Laboratories: **212-447-2679**
Questions concerning the availability of tests not listed, specimen requirements, or other information should be directed to the laboratory listed below:
Microbiology - 212-447-6783
Virology & Immunology - 212-447-2864
Environmental Sciences & Toxicology - 212-447-2694
Biothreat Response - 212-447-1091
Chemical Threat - 212-447-1149

Poison Control Center: 212-764-7667

Medical Society of the State of New York (MSSNY): *www.mssny.org*
Phone: **518-465-8085** (Albany)
Phone: **516-488-6100** (Westbury)

Armed Forces Institute of Pathology (Joint Pathology Center):
http://*www.jpc.capmed.mil/*
Customer Service: 1-855-393-3904

Centers for Disease Control and Prevention (CDC):
http://*emergency.cdc.gov/bioterrorism/*
800-CDC-INFO (800-232-4636)

Federal Emergency Management Agency (FEMA):
www.fema.gov
General Operator: **202-646-2500**

Poison Control Centers:
Hotline: **1-800-222-1222**

State public-health locator for officials, agencies, and public hotlines:
www.statepublichealth.org
www.cdc.gov/other.htm#states

Strategic National Stockpile (SNS):
www.bt.cdc.gov/stockpile
Phone: **404-639-0459**

U.S. Army Medical Research Institute of Chemical Defense (USAMRICD):
ccc.apgea.army.mil
Phone: **410-436-2230**

U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID):
www.usamriid.army.mil
Response Line: **888-USA-RIID (888-872-7443)**

U.S. Department of Health and Human Services:
www.hhs.gov
Phone: **1-877-696-6775**

U.S. Department of Homeland Security:
www.whitehouse.gov/homeland
Homeland Security state contact list:
www.whitehouse.gov/homeland/contactmap.html

U.S. Food and Drug Administration (FDA):
www.fda.gov, www.fda.gov/oc/opacom/hottopics/bioterrorism.html
Phone: **1-888-INFO-FDA (1-888-463-6332)**

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Originally produced under a federal grant from the Centers for Disease Control and Prevention and the New York State Department of Health

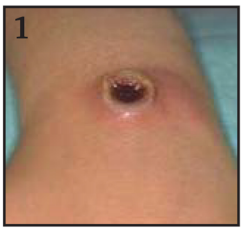
Anthrax

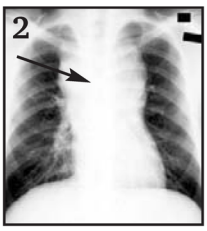
Biological Agent
The bacteria *Bacillus anthracis*

Indications of Terrorist Release
The sudden appearance in a region of a large number of patients with flulike illness (particularly off flu season), respiratory symptoms, and a high fatality rate, with nearly ½ of all deaths occurring w/in 24-48 hrs from time that symptoms begin, would suggest a release of inhalation anthrax as a biological weapon.

Possible Means of Exposure
Inhalation, ingestion, and cutaneous

Incubation
Cutaneous: 1-12 days
Gastrointestinal: 3-7 days
Inhalational (most likely in bioterror attack)**:** 1-60 days





(1) Cutaneous anthrax lesion on hand, about 5 days after exposure. (2) Inhalational anthrax; arrows point to the widened mediastinum.

Primary Symptoms of Inhalational Anthrax
Flulike symptoms (e.g., fever, malaise, myalgias, headache, abdominal pain, vomiting, coughing, chest pain) but no nasal congestion; increasingly severe respiratory symptoms, including dyspnea, stridor, and cyanosis, and expansion of the mediastinum seen on chest X-ray.

Diagnostic Tool of Choice
Tissue/blood culture

Treatment
Immediate initiation of IV antibiotics:
(1st choice = ciprofloxacin or doxycycline)

Post-Exposure Prophylaxis
Antibiotic therapy P.O.
(1st choice = ciprofloxacin)

Vaccine
Available

Infection Control
- Use standard precautions.
- Isolation of patient not indicated.
- Note that anthrax spores are resistant in the environment and decontamination efforts will be difficult.

Botulism

Biological Agent
Botulinum toxin produced by the bacteria *Clostridium botulinum*

Indications of Terrorist Release
In a bioterrorism attack, botulinum toxin would likely be released as an aerosol, hence respiratory symptoms could accompany neurological manifestations (GI symptoms may be present as well).

Possible Means of Exposure
Inhalation, ingestion of contaminated food or untreated water, contamination of an open wound by live bacteria

Incubation
Foodborne: 2 hrs to 8 days
Inhalational: 12-72 hrs

Primary Symptoms/Foodborne Botulism
Begins as acute, afebrile, symmetric, descending paralysis. Effects always begin at the head; prominent findings include ptosis, diplopia, blurred vision, dilated or sluggishly reactive pupils (only <50% of pts), dysarthria, dysphonia, and dysphagia. Mouth may appear dry and pharynx injected. Loss of head control, hypotonia, and generalized weakness become prominent. Dysphagia and loss of protective gag reflex may follow. Deep tendon reflexes may diminish or disappear. If untreated, paralysis will travel symmetrically down body, affecting arms, torso, legs, and respiratory muscles. Other symptoms include fatigue, constipation, urinary retention, dizziness, anorexia, nausea, and vomiting. There are no sensory deficits.

Primary Symptoms/Inhalational Botulism
Symptoms similar to foodborne form but could include chest pain, nonproductive cough, and other respiratory symptoms.

Diagnostic Tool of Choice
Mouse bioassay (must be sent to state health department or CDC)

Treatment
Antitoxin: trivalent (types A, B, E) equine serum

Post-Exposure Prophylaxis
To preserve scarce supplies of antitoxin, asymptomatic exposed persons should delay prophylactic Rx and remain under observation

Vaccine
Under development

Infection Control
- Use standard precautions.
- The toxin is not dermally active and secondary aerosols are not a hazard.

Brucellosis

Biological Agent
Bacteria of the genus, *Brucella*

Indications of Terrorist Release
In a bioterrorism attack, brucellae would likely be released as an aerosol and inhaled; terrorism indicators are a number of brucellosis cases within a short period and without animal contact or other risk factors.

Possible Means of Exposure
Ingestion of/or contact with contaminated animals or animal products, or by inhalation; person-to-person transmission possible but unlikely

Incubation
5-60 days (usually 2-3 wks)

Primary Symptoms
Flulike symptoms including intermittent fevers, myalgias, arthralgias, back pain, generalized weakness, fatigue, cough, pleuritic chest pain; nausea, vomiting, diarrhea, and/or constipation may also be present.

Diagnostic Tools of Choice
Blood or bone marrow culture; serologic testing

Treatment
This review evaluates different drug regimens for treatment of brucellosis in terms of treatment failure and side effects:doxycycline plus rifampicin, doxycycline plus streptomycin, quinolones plus rifampicin or doxycycline plus gentamycin.

Based on currently available evidence, there is probably a lower incidence of total drug treatment failure in people that takedoxycycline plus streptomycin instead of doxycycline plus rifampicin to treat brucellosis. However, we are uncertain whether either one of these two treatment regimens results in people having fewer adverse drug reactions.

Post-Exposure Prophylaxis
Doxycycline (+ rifampin if large exposure suspected)

Vaccine
Not available

Infection Control
- Use standard precautions.
- Rare cases of person-to-person transmssion noted but considered insignificant.

Glanders

Biological Agent
The bacteria *Burkholderia mallei*

Indications of Terrorist Release
Occurrence in the absence of animal contact and/or in a human epidemic form is strong evidence of a bioterror attack.

Possible Means of Exposure
Inhalation (most likely in bioterror attack), through mucous membranes or abraded skin; person-to-person unlikely but possible; animal exposure

Incubation
10-14 days

Primary Symptoms of Pulmonary Glanders
High fever, chills, sweats, myalgias, rigors, headache, pleuritic chest pain, cervical adenopathy, pneumonia; bloody nodules or ulcers may form on mucous membranes.

Diagnostic Tools of Choice
Complement fixation test, Gram stain, chest X-ray

Treatment
Since human cases of glanders are rare, there is limited information about antibiotic treatment in humans. Sulfadiazine has been found to be effective in experimental animals and in humans.

In addition, the bacterium that causes glanders is usually susceptiple to:

- Tetracyclines
- Streptomycin
- Gentamicin
- Ceftrazidime
- Ciprofloxacin
- Novobiocin
- Imipenem
- Sulfonamides

Post-Exposure Prophylaxis
TMP / SMX

Vaccine
Under development

Infection Control
- Use standard precautions.
- Use contact precautions when caring for patients with skin involvement.

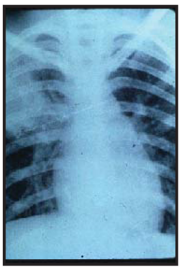
Melioidosis

Biological Agent
The bacteria *Burkholderia pseudomallei*

Indications of Terrorist Release
Occurrence in the absence of animal contact and/or in a human epidemic form is strong evidence of a bioterror attack.

Possible Means of Exposure
Inhalation (most likely in bioterror attack), through skin abrasions; person-to-person rare but possible

Incubation
2 days to years



Chest X-ray showing melioidosis infection involving the right upper lung.

Primary Symptoms of Pulmonary Melioidosis
High fever, chills, sweats, myalgias, rigors, headache, chest pain, cough (productive or non-productive), cervical adenopathy, anorexia, pneumonia; cutaneous abscesses may appear months later.

Diagnostic Tool of Choice
Complement fixation test, Gram stain, chest x-ray

Treatment
Antimicrobial agents that have been effective against melioidosis include:

Intravenous therapy consists of:

- Ceftazidime administered every 6-8 hours, **OR**
- Meropenem administered every 8 hours

Oral antimicrobial therapy consists of:

- Trimethoprim-sulfamethoxazole taken every 12 hours, **OR**
- Doxycycline taken every 12 hours

Post-Exposure Prophylaxis
Ciprofloxacin, doxycycline, or amoxicillin-clavulanate

Vaccine
Not available

Infection Control
- Use standard precautions.
- Use contact precautions when caring for patients with skin involvement

Plague

Biological Agent
The bacteria *Yersinia pestis*

Indications of Terrorist Release
In a bioterrorism attack, *Y. pestis* would likely be released as an aerosol and inhaled; a large number of previously healthy persons rapidly progressing from flulike symptoms to cough, dyspnea, chest pain, to severe pneumonia and death suggestive of attack; most natural cases in the U.S. occur in southwestern states.

Possible Means of Exposure
Inhalation; person-to-person

Incubation
Bubonic: 2-8 days
Pneumonic (most likely in bioterror attack): 1-8 days

Bubonic plague patient with swollen, ruptured inguinal lymph node ("bubo").

Right hand of a plague patient displaying acral gangrene.

Primary Symptoms of Pneumonic Plague
Fulminant onset w/ high fever, chills, headache, extreme malaise, and myalgias; cough and hemoptysis w/in 24 hrs; nausea, vomiting, and abdominal pain may also occur; rapidly progresses to dyspnea, stridor, cyanosis, respiratory failure, and circulatory collapse.

Diagnostic Tool of Choice
Culture, serology, Gram/Wright stain, chest x-ray

Treatment
When plague is suspected and diagnosed early, a health care provider can prescribe specific antibiotics (generally streptomycin or gentamycin). Certain other antibiotics are also effective.

Post-Exposure Prophylaxis
Doxycycline or ciprofloxacin

Vaccine
No longer available (discontinued by its manufacturers in 1999)

Infection Control
- Use standard precautions.
- Mask suspected pneumonic plague patients in ER/transport; isolate confirmed patients, using strict droplet precautions.
- Decontaminate surfaces, clothing, and bedding thoroughly.

Q Fever

Biological Agent
The bacteria *Coxiella burnetii*

Indications of Terrorist Release
In a bioterrorism attack, *C. burnetii* would likely be released as an aerosol and inhaled; a bioterrorist release would cause disease similar to that occurring naturally.

Possible Means of Exposure
Inhalation, ingestion, bites from infected ticks, contact with infected animals; person-to-person (rare)

Incubation
14-40 days

Primary Symptoms of Inhalational Exposure / Pneumonic Q fever
Flulike symptoms including high fever and severe headache; fatigue, weight loss, myalgias, pleuritic chest pain, abdominal pain, vomiting, diarrhea; pulmonary presentation, sometimes of rapid progression, is atypical with dry, non-productive cough, or may present as pneumonia w/o pulmonary symptoms; hepatitis may also develop; there are many clinical syndromes that Q fever can present with, though not likely to occur after an aerosol attack; in rare circumstances it progresses to culture-negative endocarditis and chronic disease.

Diagnostic Tool of Choice
Serology, PCR

Treatment
Vaccination during the incubation period does not prevent the disease.

Post-Exposure Prophylaxis
Not recommended

Vaccine
A vaccine is currently under investigation; previous Q fever patients should not receive the vaccine

Infection Control
- Use standard precautions.
- Person-to-person transmission is rare.

Ricin

Biological Agent
Toxin from the castor bean plant (*Ricinus communis*)

Indications of Terrorist Release
Ricin intoxication should be considered in any cluster of patients with acute, un-explained, pulmonary injury or GI bleeding.

Possible Means of Exposure
Inhalation, ingestion, injection

Incubation
2 hours to 3 days

Primary Symptoms of Inhalational Ricin Intoxication
Fever, chest tightness, cough, dyspnea, nausea, arthralgias, progressive respiratory insufficiency, leading to cyanosis, necrotizing pneumonitis, and pulmonary edema; could be fatal within a few days. (Note that limited data exists, primarily animal studies.)

Primary Symptoms of Ingested Ricin
Abdominal pain, nausea, vomiting, profuse bloody diarrhea; severe GI lesions with irritation of the oropharynx, esophagus, or stomach; in severe cases shock may develop. Late-phase complications can include cytotoxic effects on the liver, CNS, kidney, and adrenal glands.

Diagnostic Tool of Choice
ELISA (serum and respiratory)

Treatment
Supportive

Post-Exposure Prophylaxis
Under development

Vaccine
Under development

Infection Control
- Use standard precautions.
- The toxin is non-volatile and secondary aerosols are not expected to be a hazard.

Smallpox

Biological Agent
The Variola major virus

Indications of Terrorist Release
Since smallpox has been eradicated in the world since 1977, even one confirmed case would indicate a probable terrorist attack.

Possible Means of Exposure
Inhalation of airborne droplets; contact with skin sores, secretions, or clothing or bedding

Incubation
7-17 days

1 2

1) Chickenpox patient with pustules (day 5), 2) Smallpox patient with pustules (day 5).

Primary Symptoms
Initial symptoms are flulike, including fever, vomiting, myalgias, physical exhaustion; rash appears ~ day 12 post-exposure, at which point patient becomes highly contagious; then formation of macular rash → papules → vesicles → pustules → scabs, most densely on face and limbs, including palms and soles of feet (i.e., centrifugal distribution, unlike chickenpox, in which lesions are distributed evenly over the body, beginning on the trunk); lesions go through stages at the same time (unlike chickenpox, in which new lesions form and scab over at different times).

Diagnostic Tool of Choice
Culture followed by PCR and RFLP (by BSL-4 laboratory(, electron microscopy

Treatment
Vaccination up to 4 days after exposure

Post-Exposure Prophylaxis
Vaccination

Vaccine
Currently available to high-risk groups (First responders, etc.)

Infection Control
- Use standard, contact, droplet, and airbourne precautions.
- Patients and contacts should wear N95 mask or better.
- Consider bedding and clothing of patients potentially infectious.
- Quarantine/respiratory isolation/vaccination program for patients and secondary contacts will be necessary in the event of an outbreak.

Staphylococcal Enterotoxin B

Biological Agent
The toxin Staphylococcal enterotoxin B (SEB), produced from a strain of the bacteria *Staphylococcus aureus*

Indications of Terrorist Release
In a bioterrorism attack, SEB could be released as an aerosol and inhaled; unlike natural food poisoning caused by SEB, pulmonary symptoms would be present and the source would not be traced to a common food source.

Possible Means of Exposure
Inhalation, ingestion

Incubation
Foodborne: 1-6 hrs
Inhalational: 3-12 hours

Primary Symptoms of Foodborne SEB
Begins abruptly with acute salivation, nausea, and vomiting, followed by abdominal cramps and diarrhea, which can be hemorrhagic; usually resolves within 8 hrs.

Primary Symptoms of Inhalational SEB
Flulike symptoms such as high fever, headache, chills, myalgias; nonproductive cough; conjunctivitis may be present; severe exposure may produce dyspnea, chest pain, nausea, vomiting, diarrhea, dehydration, hypotension; could progress to pulmonary edema and ARDS.

Diagnostic Tool of Choice
Obtain urine sample as soon as possible, as well as respiratory secretions and/or nasal swabs; antigen detection on environmental and clinical samples (ELISA, ECL)

Treatment
Supportive

Post-Exposure Prophylaxis
Experimental only

Vaccine
Under development

Infection Control
- Use standard precautions.

SEB is not dermally active and secondary aerosols are not a hazard.

Tularemia

Biological Agent
The bacteria *Francisella tularensis*

Indications of Terrorist Release
In a bioterrorism attack, *F. tularensis* would likely be released as an aerosol and inhaled; due to its low incidence in the U.S., an outbreak of pneumonic or typhoidal tularemia should bring suspicion of an attack; natural cases in the U.S. are virtually all rural and/or involve animal contact.

Possible Means of Exposure
Inhalation, ingestion, through abraded skin and mucous membranes, insect bites, animal contact

Incubation
Pneumonic (most likely in bioterror attack): 1-21 days (average is 3-5 days)

General Symptoms
Abrupt onset of fever, chills, headache, anorexia, malaise, fatigue; other Sx include cough, myalgias, chest discomfort, vomiting, sore throat, abdominal pain, diarrhea.

Primary Symptoms/Pneumonic Tularemia
General Sx + localized lymphadenopathy, no or minimal sputum production, chest tightness and pain, rales; may have no symptoms of clinical pneumonia; lung abscesses may occur; can progress to severe respiratory symptoms, including respiratory failure.

Primary Symptoms/Typhoidal Tularemia
Defined as a febrile illness caused by *F. tularensis* w/o lymphadenopathy and that does not fit into other categories; immune-deficient or people w/ other medical disorders especially prone; Sx similar to general Sx; possible severe, fulminant pneumonia.

Diagnostic Tool of Choice
Direct fluorescent antibody stain, PCR, antigen detection

Treatment
Antibiotics (streptomycin or gentamicin) as early as possible

Post-Exposure Prophylaxis
Doxycycline or ciprofloxacin

Vaccine
Previously available for laboratory personnel; currently under review by FDA

Infection Control
- Use standard precautions.
- No patient isolation required due to lack of person-person transmission.

Viral Hemorrhagic Fevers (VHFs)

Biological Agents
Viruses from 4 major families: filoviruses (Ebola, Marburg fevers), arenaviruses (Lassa, New World fevers), bunyaviruses (Rift Valley fever, hantavirus infection), and flaviviruses (yellow fever)

Indications of Terrorist Release
In a bioterrorism attack, VHFs would likely be released as an aerosol and inhaled; any outbreak outside the area of a virus's natural occurrence should be highly suspect of a bioterror attack, particularly w/ no known risk factors (e.g., travel to Africa or Asia, handling of animal carcasses, contact w/ sick animals or people, or arthropod bites w/in 21 days of onset of symptoms).

Possible Means of Exposure
Inhalation, through mucous membranes; mosquito bite or direct contact with an infected person or animal or their secretions, depending on the VHF

Incubation
2-21 days

Primary Symptoms
Flulike symptoms such as high fever, headache, malaise, myalgias, and nausea; other possible symptoms, depending on syndrome, are extreme weakness, conjunctivitis, hypotension, edema, lymphadenopathy, rash, flushing of the skin, petechiae and bruising, hemorrhaging, renal dysfunction, tremors, jaundice, deafness.

Diagnostic Tool of Choice
ELISA, RT-PCR

Treatment
Ribavirin for some (used under IND protocol); for others, supportive care only

Post-Exposure Prophylaxis
Prophylactic post-exposure ribavirin is not recommended

Vaccine
With the exception of yellow fever and Argentine hemorrhagic fever, for which vaccines have been developed, no vaccines exist that can protect against these diseases.

Infection Control
- Use strict standard precautions.
- For some, contact, droplet, and/or airborne precautions also required.
- Patients generally have significant amounts of virus in their blood and other secretions (hantavirus is an exception).

Chemical Agents Overview

Examples of Chemical Agents

Nerve Agents; **Blister Agents** (also known as "vesicants" or "mustard agents"); **Chemical Asphyxiants** (also known as "blood agents"); **Pulmonary Irritants** (also known as "choking agents")

Indications of Terrorist Release

Most chemical agents work relatively fast, hence the presence of one would initially primarily be detected by the symptom pattern victims were experiencing.

PRIMARY CHARACTERISTICS

Nerve Agents

See next panel of this brochure.

Blister Agents

Examples: Lewisite (military code name L), mustards (HD, HN, HT), phosgene oxime (CX); **Common odors:** Odorless, garlic, mustard, onion, geraniums, pepper; **Onset of symptoms:** Immediate (L, CX) to 2-48 hrs (HD); **Symptoms:** Erythema, pruritus, burning of the skin, large blister formation, eye and airway irritation, sore throat, cough, chest pain, profuse rhinorrhea, copious pulmonary secretions, nausea and vomiting can also occur; **Rx:** Iodophors for skin; dimercaprol for L

Chemical Asphyxiants

Examples: Hydrogen cyanide (AC), cyanogen chloride (CK), arsine (SA); **Common odors:** Bitter almonds, garlic; **Onset of symptoms:** Most immediate, SA may be delayed by hrs; **Symptoms:** AC/CK—Irritation to eyes, nose, and airways; dyspnea, agitation, weakness, nausea, vomiting, muscular trembling; SA—Conjunctival redness, garlic breath odor, headache, thirst, shivering, weakness, abdominal pain; **Rx:** Sodium nitrite/sodium thiosulfate for AC and CK; supportive

Pulmonary Irritants

Examples: Phosgene (CG), chlorine (CL), diphosgene (DP), chloropicrin (PS), and ammonia; **Common odors:** Green corn, newly mown hay; **Onset of symptoms:** Usually rapid, effects of CL may be delayed; **Symptoms:** Burning eyes, nose, and throat; conjunctival injection, lacrimation, rhinorrhea, laryngal spasm, chest pain and tightness, dyspnea; after 3 hrs to days, respiratory symptoms may progress to pulmonary edema and respiratory failure; **Rx:** Supportive

Nerve Agents

Examples of Nerve Agents

Sarin (military code name GB), tabun (GA), soman (GD), cyclosarin (GF), VX, VE, VG, VM

Indications of Terrorist Release

Since nerve agents in their pure form are odorless and colorless, an attack would initially primarily be identified by the symptoms victims were experiencing.

Possible Means of Exposure

Inhalation, absorption through mucous membranes; dermal absorption upon contact with the liquid form (particular danger for VX, which is most commonly an oily, amber-colored liquid)

Time from Exposure to Illness

Inhalation: Seconds to minutes
Dermal absorption: 1 minute to 18 hours

Primary Symptoms of Inhalational Exposure

Miosis (13% will have dilated pupils); dimmed or blurred vision; lacrimation; rhinorrhea; sudden excess oral, nasal, and respiratory secretions; headache; dyspnea/wheezing; sweating; sneezing; urinary and fecal incontinence; vomiting; sudden loss of consciousness; muscle fasciculations; seizure; flaccid paralysis.

Primary Symptoms of Dermal Exposure

May include localized sweating, fasciculations, nausea, vomiting, diarrhea, generalized diaphoresis, generalized weakness, miosis; large exposure will resemble inhalational exposure.

Diagnostic Tool of Choice

Clinical syndrome + percent reduction of RBC-cholinesterase

Treatment

Atropine and pralidoxime

Prophylaxis

The Army has awarded a $156.6 million contract to the DynPort division of Computer Sciences Corp. for development of an anti-nerve gas agent that protects against a wide range of nerve gases for up to 60 days.

Decontamination

Thorough decontamination of patient is important as risk of secondary contamination is high.

Nerve agent antidote kits (NAAK), also known as Mark-1 kits, contain 1 dosage of the antidotes atropine and pralidoxime.

Nuclear / Radiation Emergencies

Examples of N/R Events

DIRTY BOMBS: Conventional explosive dispersing radiological substances. Most injuries would occur from the blast itself. Acute radiation poisoning extremely unlikely after dirty-bomb detonation since radioactive materials would most certainly be low grade.
AEROSOL RELEASE: Radioactive materials would likely be low-grade.
NUCLEAR REACTOR BREACH: Could result in radioactive fallout, including radioactive iodine.
NUCLEAR BOMB: Massive explosion of atomic, hydrogen, or neutron bomb. Widespread radioactive fallout could occur, including radioactive iodine. Neutron bombs create minimal blast and heat but a high degree of penetrative radiation.

Indications of Terrorist Release

The determination of radiation dispersal will likely be made rapidly after a suspected event. See **Symptoms** below for physical effects.

Possible Means of Exposure

Inhalation, ingestion, dermal absorption

Time from Exposure to Illness

Hours to years

Symptoms of Severe Radiation Exposure

Signs of severe radiation exposure ("radiation poisoning") include burning of skin with redness, blistering, and peeling; inflammation of skin and mucous membranes; dehydration; nausea; vomiting; diarrhea; convulsions; exhaustion. Delayed symptoms include open sores on skin and in mouth or along intestinal tract; bloody diarrhea; hematemesis; bleeding from the nose, mouth, and gums; bruising; and hair loss.

Diagnostic Tools of Choice

Geiger counters/dose-rate meters for external radiation measures; difficult to determine individual absorption but tests are available; WBC count helpful

Treatment

Some medical treatments are available for limiting or removing internal contamination depending on the type of radioactive material involved. Medical professionals will determine if treatments are needed.

- Potassium Iodide (KI)
- Prussian Blue
- DTPA (Diethylenetriamine pentaacetate
- Neupogen

Decontamination

External and internal decontamination should take place. For external, gently wash wounds and orifices first; chelating agents can be used for internal. At minimum, remove clothes, wash with soap and water, flush eyes. Use standard precautions when caring for patients.