

**MEDAVIE**

**HealthEd**

**ÉduSanté**



# BIOTERRORISM AND WEAPONS OF MASS DESTRUCTION

Advanced Care Paramedicine

Module: 12

Section: 06c



- List five types of weapons of mass destruction (WMDs).
- Identify actions, signs and symptoms, methods of distribution, and management of biological weapons of mass destruction.
- Identify actions, signs and symptoms, methods of distribution, and management of chemical weapons of mass destruction.

- Identify actions, signs and symptoms, methods of distribution, and management of nuclear weapons of mass destruction.
- Describe security threat levels as defined by the Department of Homeland Security.
- Identify measures to be taken by paramedics who respond to incidents with suspected weapons of mass destruction involvement.

- Use of biological agents as weapons has occurred throughout history
  - Dates back to 184 BC when Hannibal ordered that pots filled with venomous snakes be thrown onto decks of enemy ships
  - Many countries agreed to stop biological weapons research and development in 1972
    - United States
    - Previous Soviet Union
    - Canada
    - United Kingdom

- Use of biological agents as weapons has occurred throughout history
  - Some countries continue to have biological warfare programs
  - Use of biological agents against civilians through acts of bioterrorism recently has appeared
    - United States in 2001 when anthrax cases occurred following exposure to contaminated mail in New York, New Jersey, and Washington, D.C

- Centers for Disease Control and Prevention has published a list of critical biological agents
  - Divided into categories A, B, and C

- Category A agents are highest priority
  - Pose risk to national security
  - Can be spread easily by person-to-person contact
  - Cause high death rate and have potential to cause major public health problem
  - Might cause public panic and disruption
  - Agents require special action for public health preparedness
  - Example: *Bacillus anthracis* (anthrax)

- Category B agents are second highest priority
  - Fairly easy to disseminate
  - Cause moderate illnesses and have lower death rate than Category A agents
  - Call for specific enhancements of diagnostic capacity and disease surveillance
  - Example: *Coxiella burnetii* (Q fever)



- Category C agents are third highest priority
  - Include new pathogens that could be engineered for mass dissemination in future
  - Widely available
  - Easy to produce and dispense
  - Have potential to cause high rate of death and sickness
  - Example: Nipah virus

- CDC in conjunction with NIOSH have developed Emergency Response Safety and Health Database (ERS-HD)
  - Developed for emergency response community
  - Database contains accurate and concise information on high-priority chemical, biological, and radiological agents that could be encountered by personnel responding to terrorist event

- Objectives of ERSH-DB are to
  - Rapidly disseminate information to emergency response personnel on specific agents that may
    - Be used in terrorist events
    - Pose occupational hazard of injury, illness, death
  - Provide information to be incorporated into management systems of emergency response operations to reduce work-related injuries and illnesses
  - Provide information that may be used in continuing education and training programs for emergency response community

- Information contained in ERSH-DB represents compilation of material from many sources
  - Intended to address safety and health information needs of wide range of emergency response personnel
    - Fire and rescue
    - Emergency medicine
    - Law enforcement
    - Emergency management
    - Public health
    - Safety and health
    - Mortuary and funeral services

- Information contained in ERSH-DB represents compilation of material from many sources
  - Central source of information allows different segments of emergency response community to share information that is not readily accessible
    - Helps to avoid duplication of effort

- Most biological agents used in bioterrorism are designed to enter body through one of three ways
  - Inhalation of small particles into lungs
  - Ingestion of contaminated food or water
  - Contamination of skin that allows for absorption of toxins
    - Because all Category A agents can be disseminated through aerosolization, inhalation route is of greatest concern

- Aerosols can be delivered in wet or dry form in closed or open spaces
  - Equipment used to disseminate aerosols
    - Crop-dusting planes for open spaces
    - Aerosol-generating devices for enclosed areas
    - Ventilation systems in buildings
    - Contamination of items in environment with fine powders that are aerosolized easily when disrupted

Why would aerosolized agents of mass destruction pose a great risk to first responders?

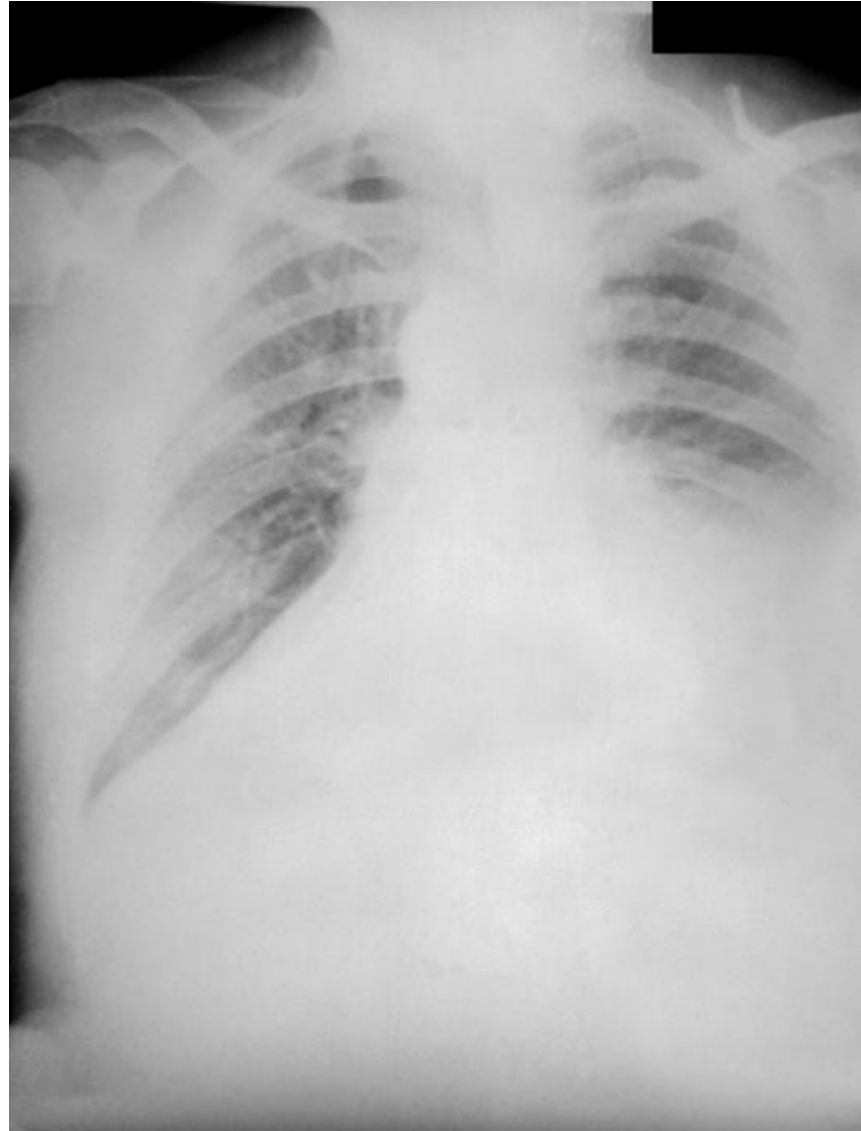


- Hundreds of biological and chemical agents can be used in bioterrorism attack
  - Most common biological threats are thought to be
    - Anthrax
    - Botulism
    - Plague
    - Ricin
    - Tularemia
    - Smallpox
    - Viral hemorrhagic fevers

- Acute infectious disease caused by spore-forming bacterium *B. anthracis*
  - Most often occurs in warm-blooded animals
  - Can infect human beings
  - Symptoms of disease vary
    - Usually appear within 7 days after exposure
  - Most common form is cutaneous anthrax
    - Results from direct contact with spores or bacilli
    - Can occur from exposure to contaminated soil; is not necessarily associated with WMD incident

- Cutaneous anthrax causes localized itching
  - Followed by papular lesion that turns vesicular and subsequent development of black eschar within 7 to 10 days of initial lesion
  - Symptoms of inhalational anthrax often resemble common cold in initial stages
    - Followed by severe respiratory distress and sepsis
    - Inhalational anthrax usually results in death within 36 hours after onset of acute symptoms
  - Other, less common, forms of anthrax
    - Intestinal anthrax from consuming contaminated meat
    - Oropharyngeal anthrax when mouth and throat are infected (rare)





- Direct person-to-person spread of anthrax most likely does not occur
  - Immunization or treatment of persons who have come in contact with patient unnecessary
  - Do not need to be treated unless also exposed to aerosol at time of attack
  - Disease is diagnosed by
    - Isolating *B. anthracis* from blood, skin lesions, or respiratory secretions
    - Measuring specific antibodies in blood of suspected cases

- Treatment with antibiotics should be early
  - If left untreated, disease can be fatal
  - Human anthrax vaccines (controversial) are available and are reported to be 93 percent effective against cutaneous anthrax
  - Vaccination to protect against inhalational anthrax is recommended only for those at high risk
    - Military personnel
    - Workers in research laboratories that routinely handle anthrax bacteria

- Rare but serious paralytic illness
  - Bacterium *Clostridium botulinum* produces nerve toxin that causes paralysis
  - *Botulinum* toxin is one of most potent and lethal substance known to man
  - Three main types
    - Food-borne botulism
    - Wound botulism
    - Infant botulism





- Wound botulism
  - Caused by toxin produced from wound infected with *C. botulinum*
- Infant botulism
  - Caused by consumption of spores of botulinum bacteria
  - Grow in intestines and release toxin
- All forms can be fatal and are considered medical emergencies

- In bioterrorism attack, inhaling toxin as aerosol weapon or ingesting toxin via contaminated food or water are likely routes of exposure for serious illness
  - Food-borne can be especially dangerous
    - Small amounts of bacterium in contaminated food can poison many persons
  - Signs and symptoms
    - Nausea
    - Dry mouth
    - Blurred vision
    - Dysphagia
    - Fatigue
    - Dyspnea that may begin several hours to several days after exposure

- Not spread from person to person
  - If diagnosed early, food-borne and wound botulism can be treated with antitoxin
    - Blocks action of toxin circulating in blood
    - Recovery may take several weeks
    - As result of paralysis and respiratory failure that occur, patient may be placed on ventilator

What kind of resources would your community need to support hundreds of patients who need care on a ventilator?

- Plague is caused by bacteria *Yersinia pestis*
  - Bacteria are found in rodents and their fleas in many areas of world
  - Bacteria also can be grown in large amounts and disseminated by aerosol in bioterrorism attack
    - Would result in epidemic of pneumonic form of disease (pneumonic plague) with potential for secondary contamination

- Signs and symptoms
  - Fever
  - Extreme weakness
  - Shortness of breath
  - Chest pain
  - Cough
  - Bloody sputum

- GI symptoms often accompany others, including
  - Nausea
  - Vomiting
  - Abdominal pain
  - Diarrhea
- Illness can lead to septic shock within 2 to 4 days
- Without treatment, has high mortality rate



- Bioterrorism attack with bacteria would be characterized by pneumonic plague occurring at same time in persons following common exposure
  - Secondary outbreak would occur in others who had close contact with infected person's respiratory droplets

- Diagnosed through testing for bacteria
  - Must be treated early (within 24 hours) with antibiotic or antimicrobial agents
  - Persons in close contact with patient should be identified
    - Must be evaluated for postexposure drug therapy
  - Spread through respiratory droplets of infected person
    - Patients should be isolated
    - Universal precautions and personal respiratory protection for all caregivers critical

Your service notices a sudden increase in patients with severe respiratory distress. These patients also have pneumonia-like signs and symptoms. Would you initially consider bioterrorism as a cause of the outbreak?

- Potent protein cytotoxin
  - Derived from beans of castor plant (*Ricinus communis*)
  - Castor beans are widely available throughout world
  - Toxin also is relatively easy to extract
  - Can be made into mist, powder, pellet
  - When ricin is inhaled as aerosol, results in pulmonary toxicity with severe respiratory symptoms within 8 hours
  - Followed by acute hypoxic respiratory failure in 36 to 72 hours

- Potent protein cytotoxin
  - Nonspecific findings in large number of patients suggest exposure to several respiratory pathogens
    - Weakness
    - Fever
    - Vomiting
    - Cough
    - Hypoxemia
    - Hypothermia
    - Hypotension

- If ricin is ingested, severe GI symptoms occur with rapid onset of
  - Nausea
  - Vomiting
  - Abdominal cramps
  - Severe diarrhea
    - Followed by vascular collapse and death



- No antidote exists for ricin poisoning
  - Treatment is aimed at avoiding exposure and eliminating toxin from body as quickly as possible
  - Patients who have inhaled ricin should be moved to area with fresh air
  - Remove clothing contaminated with the toxin
  - Decontaminate patient
  - Prehospital care may include airway, ventilatory, and circulatory support
  - Anticipate hypotension and respiratory failure



- Smallpox was declared extinct by World Health Organization in 1980 because of near-universal vaccination
  - Virus could be used as biological weapon
  - Variola virus that causes smallpox is fairly stable
  - Infectious dose also is small
  - Aerosol release of virus would be widely spread
  - Incubation period for smallpox is about 12 days following exposure
  - Virus usually is spread by infected person releasing infected saliva from mouth into air

- Persons in close or prolonged contact to infected person inhale virus
  - Can be spread through direct contact with infected body fluids or contaminated objects such as bedding or clothing
  - Signs and symptoms
    - High fever
    - Fatigue
    - Head and back aches

- Persons in close or prolonged contact to infected person inhale virus
  - Followed within 2 to 3 days with smallpox rash and skin lesions
    - Lesions finally form crusts
    - Upon healing, lesions leave depressed, depigmented scars
    - Permanent joint deformities and blindness may follow recovery
    - Death rate from smallpox is about 30 percent in unvaccinated persons



- Vaccine immunity may prevent or modify illness
  - Federal government does not recommend prophylactic vaccination for health care workers or general public because of possibility of toxic or allergic reactions
  - If attack is known or imminent, smallpox response teams whose members have received vaccine will administer vaccine to others
  - Will care for victims who have been exposed
  - Currently, U.S. has enough smallpox vaccine in storage to vaccinate everyone in country who might need it in event of emergency
  - Production of new vaccine is also underway

- There is no proven treatment for smallpox
  - Several antiviral drugs are being studied
  - Patients with smallpox should receive supportive care provided by vaccinated personnel
  - Personnel must use universal precautions
    - Includes appropriate respiratory protection
  - Objects that come in contact with patient require disinfection
    - Disinfection must be by fire, steam, sodium hypochlorite solution

Your employer asks you to get the smallpox vaccination. Where can you look to find information about the side effects and risks of immunization with this vaccine?

- Serious illness caused by bacterium *Francisella tularensis*
  - Found in animals (especially rodents, rabbits, and hares)
  - Illness can be caused by skinning fresh carcass of rabbits ["rabbit fever"] if bacterium is introduced through broken skin
  - Rubber gloves should be worn when handling animals that might harbor bacterium
  - Disease is highly infectious
  - Some strains are resistant to antibiotics



- Bacterium responsible for tularemia can be delivered in bioterrorism attack by aerosol
  - Infection may result from
    - Inhalation of aerosol
    - Skin
    - Mucous membranes
    - Respiratory tract
    - GI tract (via contaminated soil, water, food, or animals)
  - Transmission from person to person does not occur
  - Development of signs and symptoms varies widely (from 1 day to 2 weeks)
  - Based on strength of strain and route of exposure

- Following bioterrorism attack with agent, patients may complain of abrupt onset of acute febrile illness (headache, chills, general malaise)
  - May complain of GI illness that includes nausea, vomiting, diarrhea
  - If left untreated, septic tularemia may lead to
    - Disseminated intravascular coagulation with bleeding
    - Acute respiratory failure
    - Death

- Managed with antibiotics
  - Patient may require airway, ventilatory, and circulatory support
  - Although funding has been made for development of a vaccine for civilian use, one is not currently available in U.S.
  - U.S. Department of Defense has developed experimental tularemia vaccine
  - To date, health officials have limited use of this vaccine to laboratory and other high-risk workers

- Viral hemorrhagic fevers (VHFs) refer to group of illnesses caused by several distinct families of viruses that include
  - Arenaviruses
  - Filoviruses
  - Bunyaviruses
  - Flaviviruses

- Have limited geographic ranges and are found mostly across
  - Eastern and southern Africa
  - South America
  - Pacific islands
- Most are highly infectious if spread as aerosol

- Naturally reside in animals (e.g., cotton rat and deer mouse) or arthropods (e.g., ticks and mosquitoes)
- Fully dependent on these living hosts for reproduction and survival

- Viruses that cause hemorrhagic fever usually are transmitted to human beings during contact with
  - Urine
  - Fecal matter
  - Saliva
  - Other body excretions from infected rodent or from bite from infected mosquito or tick

- Some (e.g., Ebola and Marburg) can be spread from person to person following initial infection
  - Most often results from close contact with infected persons through their body tissues and fluids



- Cause multisystem syndrome
  - Syndrome is characterized by hemorrhage and life-threatening disease
  - Signs and symptoms vary by the type of VHF
    - Fever
    - Fatigue
    - Dizziness
    - Muscle aches
    - Loss of strength
    - Exhaustion

- Patients with severe cases may bleed from
  - Mucous membranes
  - Internal organs
  - Mouth, eyes, or ears

- Affects from severe infection
  - Shock
  - Renal failure
  - CNS dysfunction
  - Coma
  - Seizures
    - May lead to fatal outcome

- Therapy is supportive
- With exception of yellow fever and Argentine hemorrhagic fever, for which vaccines have been developed, no vaccines exist
- Goals of therapy are to maintain vital functions
  - May allow for recovery in some patients

- Nuclear explosions can cause deadly effects from
  - Blinding light
  - Intense heat (thermal radiation)
  - Initial nuclear radiation
  - Blast
  - Fires started by heat pulse
  - Secondary fires caused by destruction

- Radiological dispersion device (RDD) is also called “dirty nuke” or “dirty bomb”
  - Use as terrorist weapon is considered far more likely than use of a true nuclear device
    - True nuclear device uses weapons-grade uranium or plutonium

- Dirty bombs appeal to terrorists
  - Require little technical knowledge to build and deploy compared with that of true nuclear device
  - Radioactive materials are used widely in
    - Medicine
    - Agriculture
    - Industry
    - Research
  - Readily available and easy to obtain

- Main type of radiological dispersion device (RDD) combines explosive with radioactive material
  - Extent of contamination would depend on number of factors
    - Size of explosive
    - Amount and type of radioactive material used
    - Weather conditions (e.g., wind)



- Detonation of an RDD releases radioactive fallout, could cause
  - Radiation sickness
  - Severe burns
  - Long-term cancer fatalities

- In most cases, conventional explosive itself would result in more deaths than from exposure to radioactive material
  - Second type of RDD might involve powerful radioactive source hidden in public place
    - May be hidden in trash can in busy train or subway station
    - Persons passing close to source might receive significant dose of radiation

What emergency medical services groups or divisions should you consider setting up if there is a report of a dirty bomb explosion?

- Principles of time, distance, shielding should be used for personal protection and for protection of others
  - Limit amount of time at radiological scene
    - Fallout radiation loses its intensity fairly rapidly
    - Use or wear radiation detection monitors
  - Increase distance between you and scene
  - Shield yourself with appropriate personal protective equipment, geography, or structural materials whenever possible
    - More heavy, dense materials between you and fallout particles, better

- After dealing with initial blast, top priorities are
  - Treatment of radiation sickness
  - Containment and monitoring of radioactive fallout
  - Evacuation
  - Decontamination

- Incendiary devices are firebombs
  - Range from simple Molotov cocktail (bottle containing a rag soaked in gasoline that is ignited) to much larger and sophisticated device
  - Main use in terrorism is to generate panic (weapon of mass disruption)
    - Also capable of causing loss of life and property damage from fire

- Depending on severity of attack, primary concerns may include
  - Possibility for large numbers of injured victims and fatalities
  - Significant damage to buildings and infrastructure of community
  - Overwhelming of local resources (emergency response agencies, hospitals, mental health agencies)
  - Involvement of law enforcement at local, state, and federal levels because of criminal nature of event

- Primary concerns
  - Closing of workplaces and schools
  - Possible restrictions on domestic and international travel
  - Need for evacuation and extended cleanup
  - Public fear that can continue for prolonged period



- Depends on nature of attack
  - Care may include providing initial wound care for injured victims at a small-scale event
  - Care also may include managing scene with multiple patients at large-scale event
  - EMS crews should not approach scene until it has been made safe by proper personnel
  - Following initial explosion, detonation of second device is possible

- Second device may be designed to injure or kill emergency response personnel or bystanders
  - Biological, chemical, or nuclear materials may have been used in explosion
  - Critical to personal safety not to enter scene until area is determined to be safe
  - CDC has issued required resource guidelines and recommendations for EMS response to terrorist bombing attacks

- Specific chemicals that may be used in war and acts of terrorism
  - Nerve agents
  - Poisonous gases
  - Blister agents
- Deliberate release of these chemicals in form of toxic gas, liquid, or solid can poison persons or environment

- Nerve agents were used in military conflicts in Persian Gulf in 1980s
  - Also used in terrorist attacks in Japan in 1995
  - Most toxic and rapidly acting of known chemical warfare agents
  - Nerve agents are similar to organophosphates in terms of how they work and what kinds of harmful effects they cause
    - More potent

- Nerve agents inhibit effects of acetylcholinesterase, which causes cholinergic “overdrive” (cholinergic crisis)
  - Disrupts nerve transmissions in central and peripheral nervous systems
  - Extent of poisoning caused by nerve agents depends on
    - Amount
    - Route
    - Length of exposure
  - Mildly or moderately exposed persons usually recover fully
  - Severely exposed persons are not likely to survive

Would you expect a fast or slow heart rate if the patient has been exposed to a nerve agent?

- Sarin (also known as “BG”)
  - Clear, colorless, tasteless liquid that has no odor in pure form
  - Can evaporate into vapor (gas) and spread into environment
  - Mixes easily with water
    - Allows for contamination by persons touching or drinking water

- Sarin (also known as “BG”)
  - Symptoms may begin within minutes to hours after exposure
    - Headache
    - Salivation
    - Chest pain
    - Abdominal cramps
    - Wheezing
    - Fasciculations
    - Seizure
    - Respiratory failure that possibly can lead to death



- Soman (also known as “GD”)
  - Clear, colorless, tasteless liquid with slight camphor odor
  - Odor is similar to smell of Vicks Vapo-Rub or rotting fruit odor
  - Can vaporize if heated
  - Compared with other nerve agents, is more volatile than VX but less volatile than sarin
    - Higher the volatility of chemical, more likely it will evaporate and disperse into the environment

- Persons can be exposed to vapor even if they do not come in contact with liquid form
  - Symptoms may begin within seconds to hours after exposure
    - Headache
    - Salivation
    - Chest pain
    - Abdominal cramps
    - Wheezing
    - Fasciculations
    - Seizure
    - Respiratory failure that possibly can lead to death

- Tabun (also known as “GA”)
  - Clear, colorless, tasteless liquid with faint fruity odor
  - Can vaporize if heated
    - Persons can be exposed to nerve agent by skin or eye contact or by inhalation
    - Agent also mixes easily with water
    - Allows for possible cutaneous exposure and exposure to GI tract if contaminated food or water is ingested
    - Secondary contamination is possible

- Secondary contamination would occur from clothing or personal articles that have been contaminated by tabun vapor
  - Symptoms generally appear
    - Within few seconds after exposure to tabun vapor
    - Within 18 hours after exposure to liquid tabun

- Signs and symptoms of mild to moderate exposure to tabun
  - Watery eyes
  - Blurred vision
  - Headache
  - Weakness
  - Cough
  - Drooling
  - Polyuria
  - Excessive sweating
  - Fasciculations
  - Hypotension or hypertension
  - Cardiac abnormalities

- Secondary contamination would occur from clothing or personal articles that have been contaminated by tabun vapor
  - With severe exposure, patients may experience
    - Loss of consciousness
    - Seizures
    - Cardiorespiratory arrest
  - Severely poisoned patients are not likely to survive

- VX (O-ethyl S-[2-(diisopropylamino)ethyl] methylphosphonothioate)
  - Thick, amber-colored, odorless liquid
  - Resembles motor oil and is most potent of all nerve agents
  - Considered to be much more toxic when absorbed through skin and somewhat more toxic by inhalation than are other nerve agents
  - Primarily liquid exposure hazard.
  - However, if heated to very high temperatures, it can turn into small amounts of vapor

- Following release of VX into air, persons can be exposed through
  - Skin contact
  - Eye contact
  - Inhalation
- Can be released into water
  - Allows for exposure by ingestion or absorption



- Symptoms will appear
  - Within few seconds after exposure to vapor form
  - Within few minutes to up to 18 hours after exposure to liquid form
- Signs and symptoms of exposure are same as for other nerve agents

- Treatment for exposure to nerve agents consists of quickly removing agent from body and supporting patient's vital functions
  - If vapor exposure has occurred, patient should be moved quickly to area of fresh air
  - If exposure occurred in an open-air environment, patient should be moved uphill and upwind from contamination site

- Many nerve agents are heavier than air and will settle in low-lying areas
  - Patient's clothing should be removed and patient should be decontaminated by trained personnel
  - Person's clothing and other contaminated surfaces can release nerve agents for about 30 minutes after exposure
    - Secondary contamination is possible

- Atropine and pralidoxime chloride are antidotes for nerve agent toxicity
  - Available in autoinjector kits, e.g., MARK I and Duodote kits
  - Work by blocking effects of acetylcholine
  - Large doses of these drugs and repeated administration may be required

- Diazepam or lorazepam may be indicated if seizures are present
  - Consult with medical direction before administering if muscle twitching is present
  - Once seizures begin, can be almost impossible to stop
  - Caring for patients who have ingested nerve agent should be guided by
    - Medical direction
    - Poison control center
    - Other authority

- Poisonous gases were popular weapons in World War I
  - Have not been used as toxic pulmonary inhalants by military since 1918
  - Produced in large quantities worldwide for use in industrial sector
  - Widely available
    - Use of these gases for acts of terrorism is possibility

- Chlorine
  - Yellow-green gas with odor that described as mixture of pineapple and pepper
  - Can be pressurized and condensed to change into liquid
    - In liquid form, chlorine can be shipped and stored
    - When liquid chlorine is released, quickly vaporizes into gas that stays close to ground and spreads rapidly

- Chlorine
  - If released into air, persons may be exposed through skin or eye contact or by inhalation
    - If chlorine liquid is released into water, exposure can occur by
      - Touching or drinking contaminated water
      - Ingesting food prepared with contaminated water
  - Extent of poisoning depends on
    - Amount
    - Route
    - Duration of exposure to agent



- Chlorine
  - Signs and symptoms
    - Cough
    - Chest pain
    - Burning sensation in nose, eyes, or throat
    - Watery eyes
    - Blurred vision
    - GI disturbances
    - Dermal burns from skin contact
    - Shortness of breath and dyspnea
    - Pulmonary edema can develop within 2 to 4 hours following inhalation

- Phosgene (also known as “CG”)
  - Poisonous gas that appears as grayish white cloud and smells of newly mowed hay
  - With cooling and pressure, gas can be condensed into liquid so it can be shipped and stored
  - When liquid phosgene is released, quickly vaporizes into gas that stays close to ground and spreads rapidly
  - Inhaled phosgene damages lungs, producing burning sensation, cough, labored breathing
  - Pulmonary edema with frothy sputum production may develop

- Phosgene
  - Cutaneous exposure to gas can result in skin or eye injury
  - Exposure also can occur by
    - Touching or drinking water contaminated with gas
    - Ingesting food that was prepared with contaminated water
  - Signs and symptoms same as chlorine exposure
  - May cause hypotension and heart failure
  - In lethal doses, death can occur within 48 hours

- No antidotes exist for chlorine or phosgene poisoning
  - Treatment for exposure to these gases consists of removing from body as soon as possible and providing supportive medical care
  - All patients should be moved to area of fresh air and to highest ground possible (if exposure occurred in open air space)
  - Patient's clothing should be removed
  - Patient should then be decontaminated by trained personnel

- Blister agents or vesicants are chemicals with highly irritating properties that produce fluid-filled pockets on skin and damage to eyes, lungs, other mucous membranes
- Can cause
  - Loss of vision
  - Convulsions
  - Respiratory failure

- Systems affected through systemic absorption
  - GI
  - CNS
  - Bone marrow

- Symptoms of exposure may be delayed until hours after exposure
  - Major chemicals in this category
    - Sulfur mustard (H, HD, HT)
    - Nitrogen mustard (HN-1, HN-2, HN-3)
    - Lewisite (L, L-1, L-2, L-3)
  - Phosgene oxime is more urticant, producing irritation without blisters
    - Gas still is classified as vesicant

- Mustard (sulfur mustard and nitrogen mustard)
  - Oily liquid that comes in variety of colors ranging from brown to yellow
  - May smell like garlic, onion, horseradish, mustard
- Lewisite
  - Oily, odorless liquid
  - More volatile than mustard and smells like geraniums in its gaseous state
  - Causes immediate pain and irritation on contact



- Phosgene oxime
  - Colorless solid or yellowish brown liquid
  - May have peppery or pungent odor
  - Causes immediate pain and irritation on contact with skin or mucous membranes

- After ensuring personal safety (including use of appropriate personal protective equipment), initial assessment and treatment should begin with airway, ventilatory, circulatory support as needed
  - Immediate decontamination may reduce damage to tissue
  - All skin exposures should be treated with standard burn care
  - Advanced cardiac life support protocols should be followed for any patient with cardiac or respiratory problems

- Advanced trauma life support protocols should be followed for any trauma patient
  - Signs and symptoms may not develop for several hours following exposure to some blister agents
  - Patient with significant exposure should be evaluated by physician
  - Patients who have only mild symptoms should be advised to seek physician evaluation if signs and symptoms worsen

- Explosive is a bomb
  - Bombs can be made from variety of dangerous materials
  - Can be made in variety of sizes, weighing several ounces to several thousand pounds

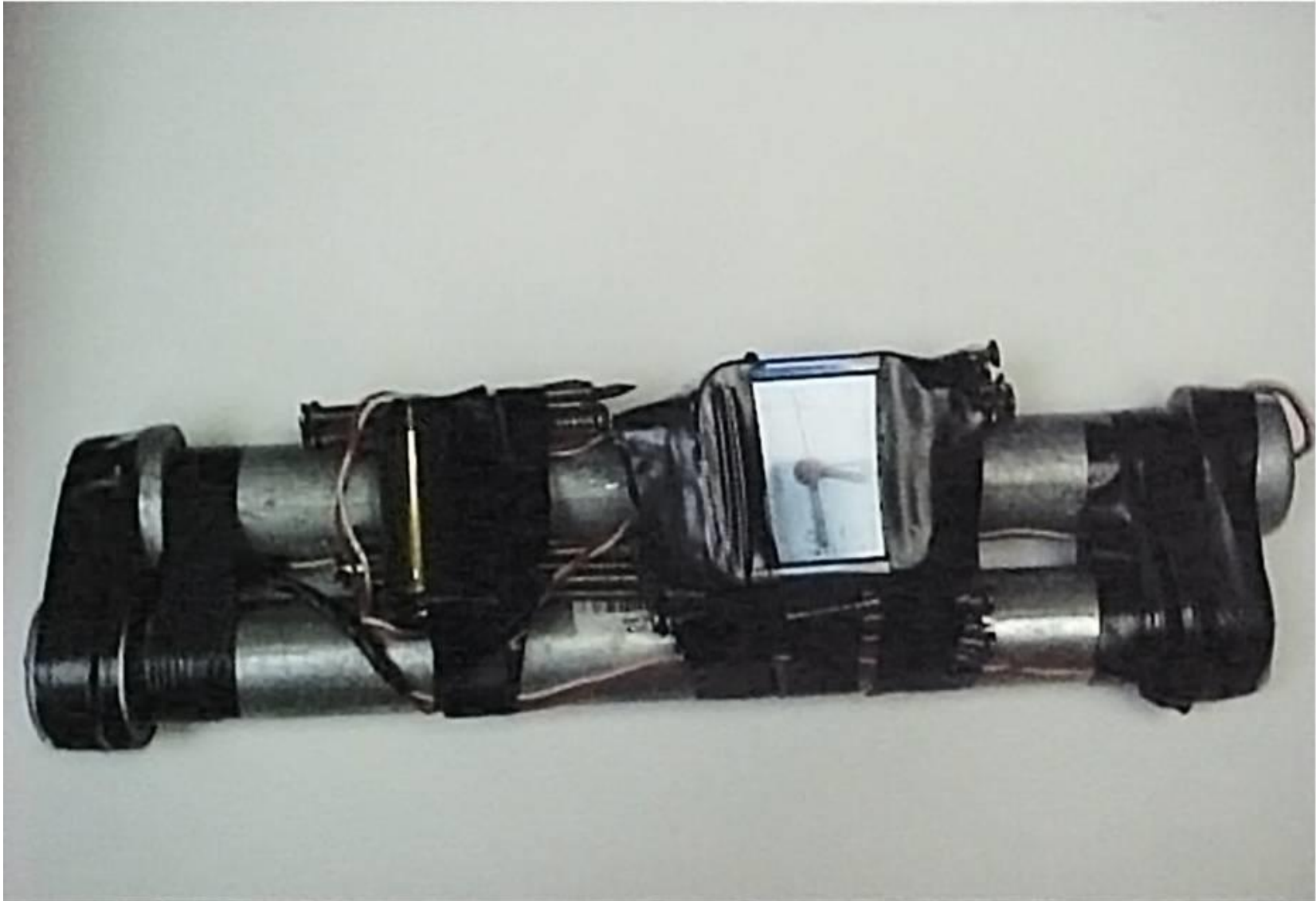
- Explosives used by terrorists are often classified by following categories
  - Unconventional use
    - Conventional object used in unconventional way to create mass destruction
    - In September 11, 2001, attack on World Trade Center and Pentagon, hijackers flew passenger planes into their intended targets, relying on impact of planes and their full fuel tanks to create havoc

- Vehicle bomb
  - Usually large powerful devices
    - Large quantity of explosives fitted with timed or remotely triggered detonator packed onto car or truck

- Pipe bomb
  - Quantity of explosives sealed into length of metal or plastic pipe
  - Timing fuse usually controls detonation, but other methods can be used
    - Electronic timers
    - Remote triggers
    - Motion sensors
  - Most common explosive devices
  - At opposite end of scale from vehicle bombs in terms of size and power

- Satchel charge
  - Old military term for explosive device in canvas-carrying bag
  - In recent history, “daypacks” or knapsacks have been used for carrying device, and explosives have contained antipersonnel materials such as nails and glass to inflict more casualties
- Package or letter bomb
  - Explosive material contained in package or letter that usually is triggered by opening of package





- Care for victims of explosion may vary
  - Treatment may require only minor wound care to several persons
  - Treatment could be large-scale event
  - Larger events may have many patients and casualties
  - Incident may involve secondary explosions and chemical and biological threats
    - Critical to personal safety not to enter scene until area is determined to be safe by proper personnel
    - Many injuries that result from explosive forces, including primary, secondary, and tertiary blast injuries

- Following terrorist attacks on World Trade Center in New York City on September 11, 2001, Department of Homeland Security was established through Homeland Security Act of 2002 (H.R. 5005)
  - Three primary missions of Department of Homeland Security
    - Prevent terrorist attacks within U.S.
    - Reduce America's vulnerability to terrorism
    - Minimize damage from potential attacks and natural disasters

- To meet mission, Homeland Security Advisory System was developed to inform federal agencies, state and local officials, and private sector of terrorist threats and appropriate protective actions
- Homeland Security Advisory System establishes five threat conditions with associated suggested protective measures

- Homeland Security Advisory System establishes two threat alerts when credible information is available
  - Imminent threat
  - Elevated threat

- Alerts will provide
  - Concise summary of potential threat
  - Information about actions being taken to ensure public safety
  - Recommended steps that individuals, communities, businesses, and governments can take to help prevent, mitigate, or respond to threat

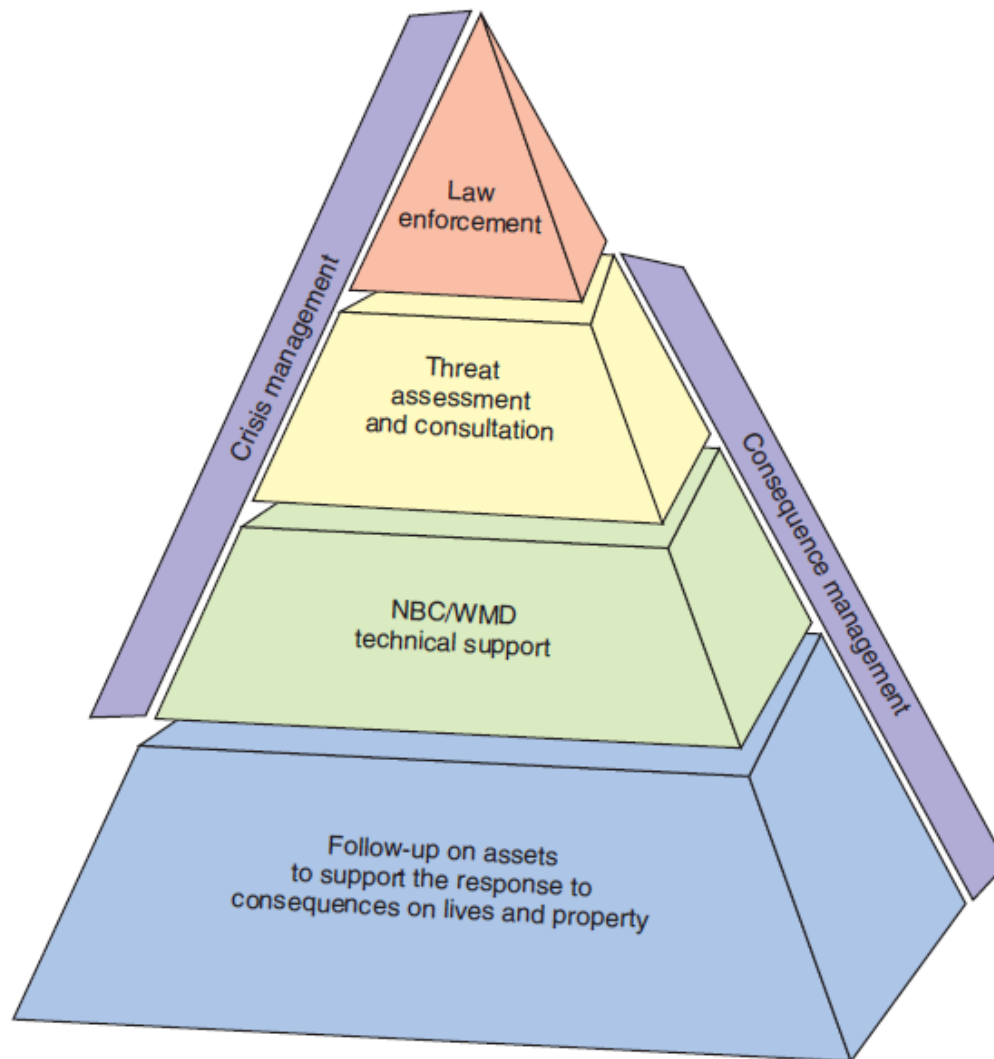
- NTAS alerts will be based on nature of threat
- In some cases, alerts will be sent to law enforcement or private sector of affected area
- Some will be issued more broadly to American people

- NTAS alerts contain sunset provision
  - Indicates a specific date when alert expires
    - Will not be constant alert or blanket warning
- If threat information changes for an alert, Secretary of Homeland Security may issue updated NTAS alert
  - All changes will be distributed same way as original alert



- Many aspects of WMD incident are comparable to other medical, trauma, and hazardous materials incidents
  - Some significant differences
    - Terrorists have been known to time secondary events (e.g., booby traps, additional bombs, and armed resistance) to injure emergency responders
  - Terrorist act is a criminal event
    - Site becomes crime scene
    - Everything is considered evidence of crime

- Fear and panic can be expected from public, patients, emergency responders
  - Makes scene safety, security, crowd control major issues with which to contend
  - Contingency plans for emergency responders at scene and at destination facilities will need to be in place
    - Will help emergency responders to deal with large numbers of upset, agitated, frightened, injured patients
    - Large-scale events will likely involve local, state, federal agency involvement



Why will correct, prompt information to the media be critical during a WMD event?

- Emergency responder guidelines established by Office of Justice Program, Office for Domestic Preparedness
  - Prepare for and respond to incidents of domestic terrorism
    - Chemical and biological agents
    - Nuclear, radioactive, explosive devices

- Recommended guidelines for EMS providers
  - Recognize hazardous materials incidents
  - Know protocols used to detect potential presence of WMD agents or materials
  - Know and follow self-protection measures for WMD events and hazardous materials events
  - Know procedures for protecting potential crime scene

- Recommended guidelines for EMS providers
  - Know and follow agency/organization scene security and control procedures for WMD and hazardous material events.
  - Possess and know how to use equipment properly to contact dispatchers or higher authorities to
    - Report information collected at scene
    - Request additional assistance or emergency response personnel

- Recommended guidelines for EMS providers
  - Know how to characterize WMD event and be able to identify available response assets within affected jurisdiction(s)
  - EMS agencies must be prepared to
    - Implement incident operations
    - Provide personal and public safety measures
    - Perform appropriate decontamination
    - Provide emergency medical care specific to incident



- There are five categories of weapons of mass destruction
  - Biological, nuclear, incendiary, chemical, and explosive
- Biological agents include anthrax, botulism, plague, ricin, tularemia, and smallpox
- Person-to-person spread is possible in patients who are infected with plague or smallpox

- Nerve agents include Sarin, Soman, Tabun, and VX
  - Exposure causes a cholinergic overdrive
  - Antidote for nerve agent exposure is atropine and pralidoxime chloride
- Poisonous gases such as chlorine and phosgene cause severe respiratory problems
  - Can cause skin and eye injury
  - Move exposed patients to safety, remove their clothing, and treat their symptoms

- Dirty bombs could cause heat damage and radiation sickness, severe burns, and cancer
- Emergency responders at a WMD incident should recognize hazmat incidents, know protocols to detect WMD, use PPE, know crime-scene procedures, know how to activate more resources, and implement incident operations