

A weapon of mass destruction (WMD), or weapon of mass casualty (WMC), is an agent designed to bring about:

- Mass death
- Casualties
- Massive damage to property and infrastructure (bridges, tunnels, airports, and seaports)

To date, the preferred WMD for terrorists has been explosive devices. WMDs are relatively easy to obtain or

create and are specifically geared toward killing large numbers of people. In this lesson, we will discuss the harm caused by different types of agents.



Chemical agents are manufactured substances that can have devastating effects on living organisms. They can be produced in liquid, powder, or vapor form depending on the desired route of exposure and dissemination technique.

These agents can consist of the following types:

- Vesicants or blister agents.
- Respiratory or choking agents.
- Nerve agents, and.
- Metabolic agents or cyanides.

Chemical agents are liquids or gases that are dispersed to

kill or injure. The characteristics of an agent can be described as liquid, gas, or solid material. Persistent or nonvolatile agents can remain on a surface for long periods, usually longer than 24 hours. Non-persistent or volatile agents evaporate rapidly, when left on a surface in the optimal temperature range.

agents evaporate rapidly when left on a surface in the optimal temperature range.

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CHEMICAL AGENTS | ROUTE OF EXPOSURE

- Route of exposure is a term used to describe how the agent most effectively enters the body
  - ✓ Agents with a vapor hazard enter in the form of vapors
  - ✓ Agents with a contact hazard enter the body through the skin



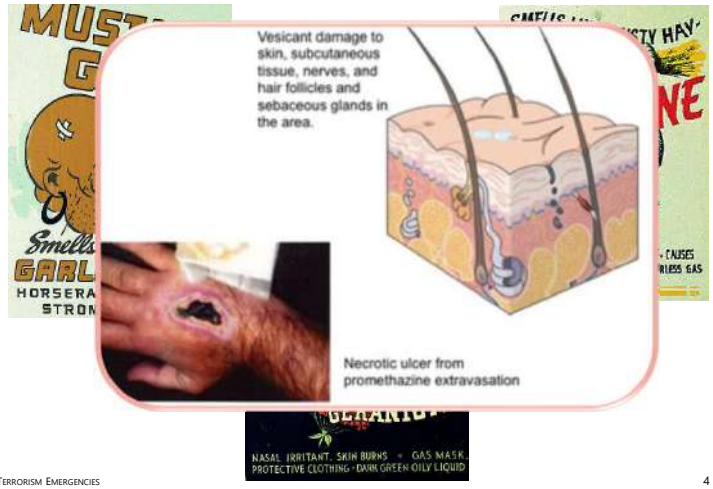
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Route of exposure is a term used to describe how the agent most effectively enters the body:

- Agents with a vapor hazard enter the body through the respiratory tract in the form of vapors.
- Agents with a contact hazard (or skin hazard) give off very little vapor or no vapors and enter the body through the skin.

VESICANTS

- Primary route is the skin
- Cause burn-like blisters
- Causes the most damage to damp or moist areas of the body
- Vesicant agents consist of:
  - ✓ Sulfur mustard (H)
  - ✓ Lewisite (L)
  - ✓ Phosgene oxime (CX)



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The primary route of exposure of blister agents, or vesicants, is the skin via contact. However, if vesicants are left on the skin or clothing long enough, they produce vapors that can enter the respiratory tract. Vesicants cause burn-like blisters to form on the victim's skin and in the respiratory tract. The vesicants usually cause the most damage to damp or moist areas of the body, such as the armpits, groin, and respiratory tract.

Vesicant agents consist of:

- Sulfur mustard (H)
- Lewisite (L), and
- Phosgene oxime (CX)

Sulfur mustard is a brownish-yellowish oily substance that is generally considered very persistent:

- As the agent is absorbed into the skin, it begins an irreversible process of damage to the cells.
- Mustard is considered a mutagen, which means that it mutates, damages, and changes the structures of cells.
- The patient will experience a progressive reddening of the affected area, which will gradually develop into large blisters.
- Mustard also attacks vulnerable cells within the bone marrow and depletes the body's ability to reproduce white blood cells.
- Sulfur mustard vapors can be inhaled, creating upper and lower airway compromise.

Lewisite and Phosgene oxime produce blister wounds very similar to those caused by mustard:

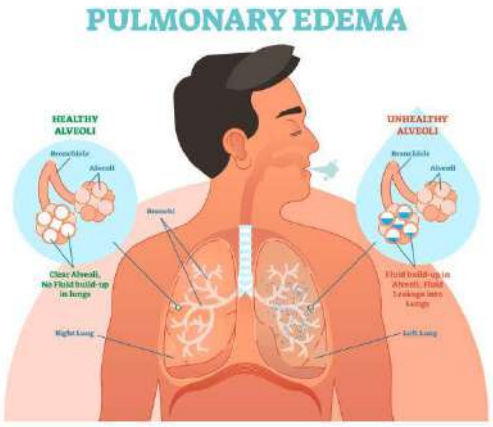
- These agents produce immediate intense pain and discomfort when contact is made.
- The patient may have a grayish discoloration at the

contaminated site.

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RESPIRATORY/PULMONARY AGENTS

- Gases that cause immediate harm
- Primary route is through the respiratory tract:
  - ✓ Once inside the lungs, damages lung tissue and fluid leaks into the lungs
  - ✓ Pulmonary edema develops



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Respiratory or Pulmonary agents are gases that cause immediate harm to persons exposed to them:

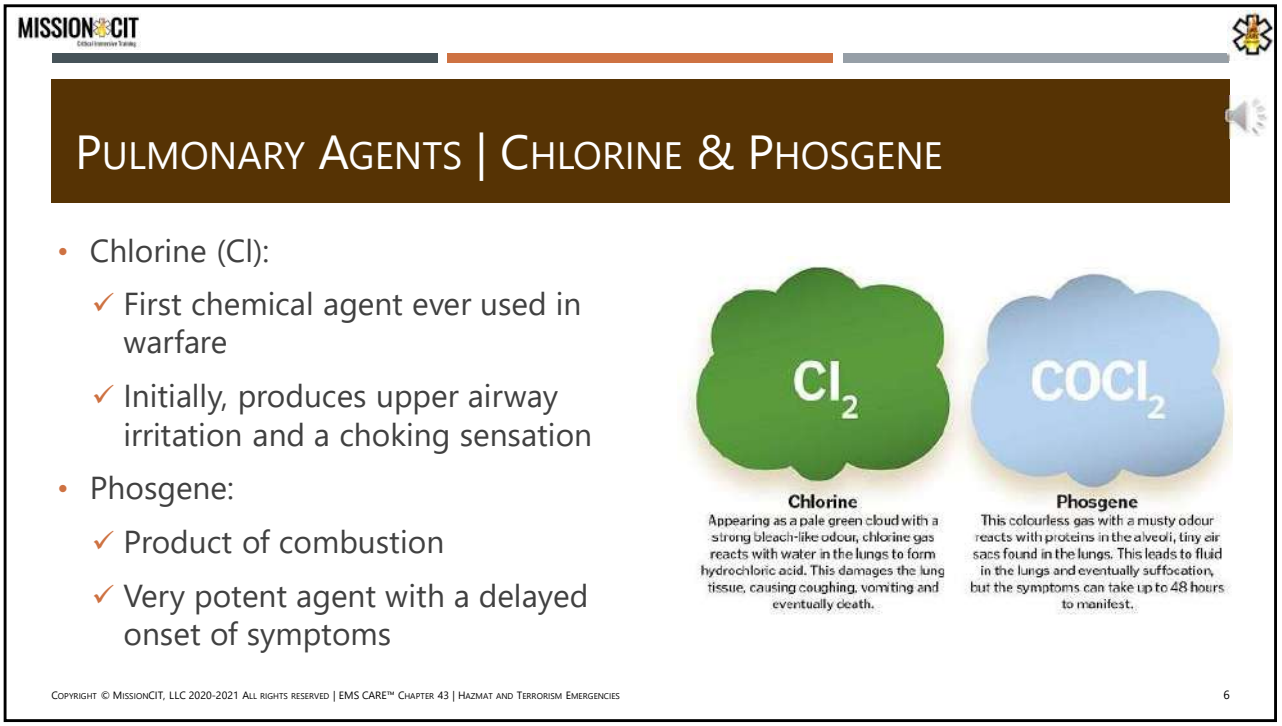
- Chlorine (Cl) and phosgene are examples of such gases.
- They produce respiratory-related symptoms such as dyspnea and tachypnea.

The primary route of exposure is through the respiratory tract, which makes them an inhalation or vapor hazard:

- Once inside the lungs, they damage the lung tissue,

and fluid leaks into the lungs.

- Pulmonary edema develops, resulting in difficulty breathing because of severely impaired gas exchange.



Chlorine or Cl was the first chemical agent ever used in warfare:

- Initially it produces upper airway irritation and a choking sensation.
- With severe exposures, patients may experience pulmonary edema, complete airway constriction, and death.

Phosgene has been produced for chemical warfare and is a product of combustion such as might be produced in a

fire:

- Phosgene is a very potent agent that has a delayed onset of symptoms, usually hours.
- The odor produced by the chemical is similar to that of freshly mown grass or hay. The result is that much more of the gas may enter the body unnoticed.

Signs and symptoms of mild exposure:

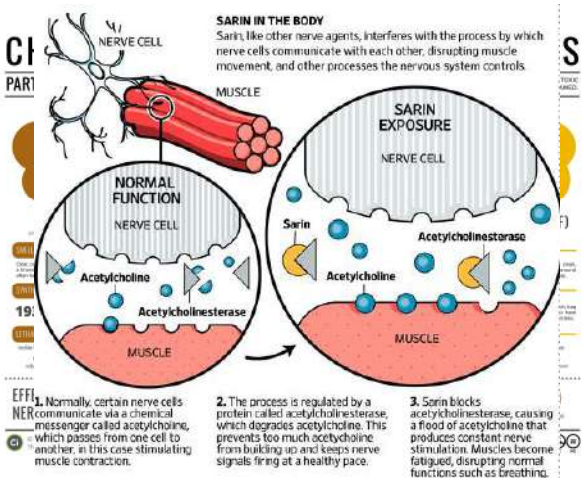
- Pulmonary edema may be so severe that the patient continually coughs up white or pink-tinged fluid.
- A severe exposure produces such large amounts of fluid in the lungs, that the patient may actually become hypovolemic and subsequently hypotensive.

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Nerve Agents

- Most deadly chemicals
- Cause cardiac arrest within seconds to minutes of exposure
- G agents came from the early nerve agents, the G series:
  - ✓ Sarin
  - ✓ Soman
  - ✓ Tabun
  - ✓ V agent



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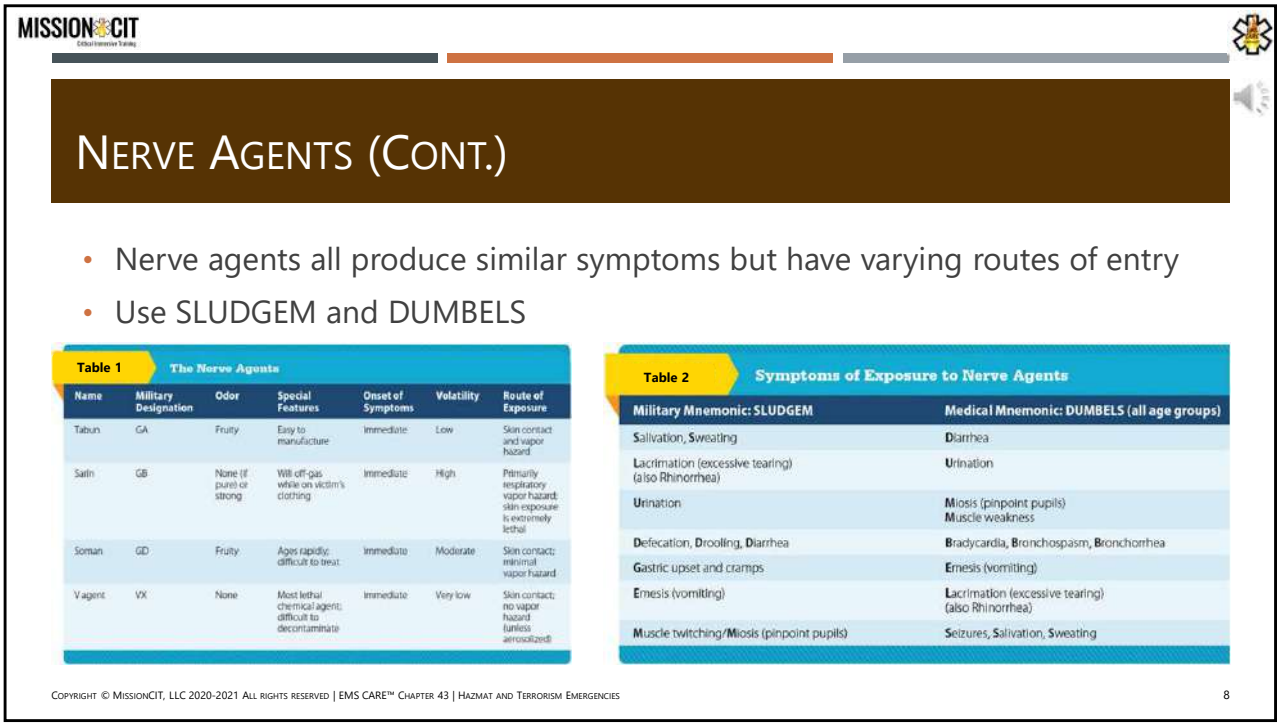
Nerve agents are among the most deadly chemicals developed:

- They are classified as WMDs.
- They are not readily available to the general public, and.
- Extremely toxic and rapidly fatal with any route of exposure.

- Nerve agents can cause cardiac arrest within seconds to minutes of exposure. They are a class of chemicals called organophosphates, which are found in household bug sprays, agricultural pesticides, and some industrial chemicals, though at much lower strengths than in the weaponized form.
- Organophosphates block an essential enzyme in the nervous system, causing the body's organs to become overstimulated and burn out.
- G agents came from the early nerve agents, the G series.
  - Sarin (GB) is a highly volatile colorless and odorless liquid. LD50 (the standard measurement that represents the amount that will kill 50% of a population exposed to this level) of about 1 drop. It is especially dangerous in enclosed environments. When it comes in contact with the skin, it is quickly absorbed and evaporates. When it is on clothing, it has the effect of off-gassing.
  - Soman (GD) is twice as persistent as Sarin and five times as lethal. This agent is a contact and an inhalation hazard. A unique additive in GD causes it to bind to

the cells that it attacks faster than any other agent.

- Tabun (GA) is approximately half as lethal as Sarin and 36 times more persistent. It is a contact and an inhalation hazard.
- V agent (VX) is a clear, oily agent that has no odor and looks like baby oil. It is more than 100 times more lethal than Sarin and is extremely persistent. It is easily absorbed into the skin, and the oily residue that remains is extremely difficult to decontaminate.



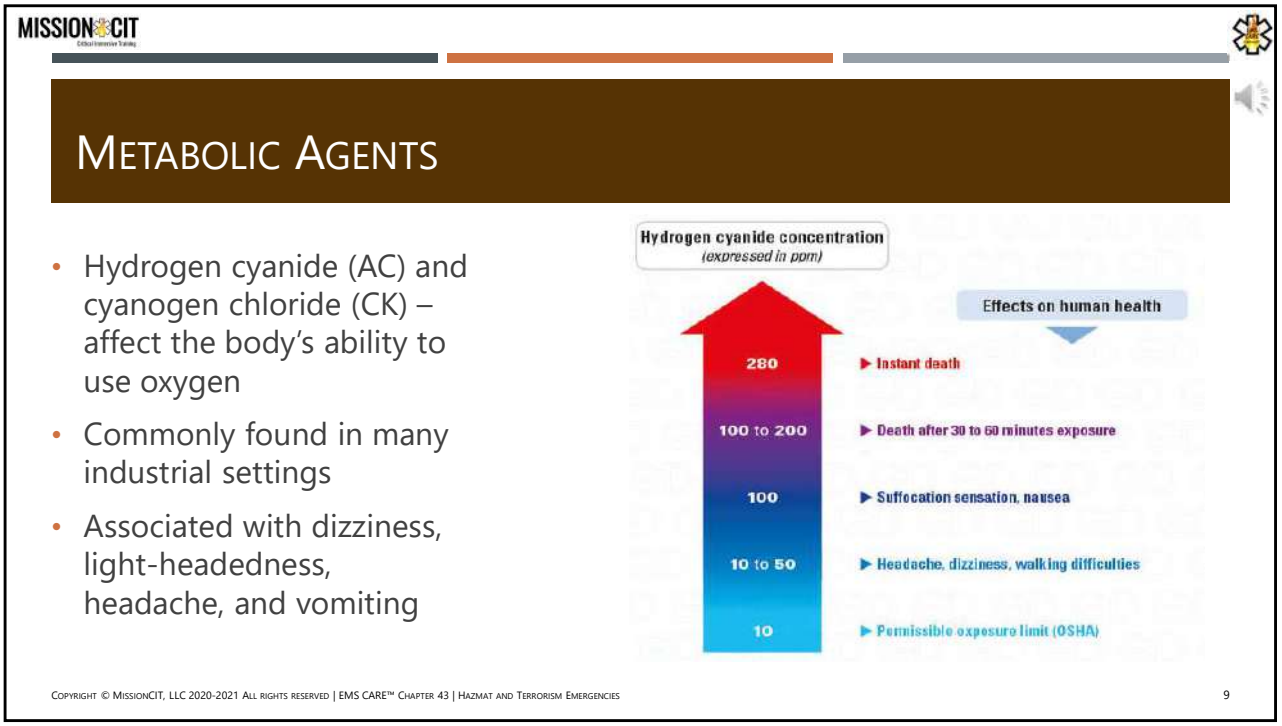
All nerve agents produce similar symptoms but have varying routes of entry:

- The symptoms are described using the military mnemonic SLUDGEM.
- The medical mnemonic DUMBELS is also used.

Miosis is the most common symptom of nerve agent exposure and can remain for days to weeks.

- It is seen quickly in vapor exposure and may occur later after isolated skin exposure.
- The patient may have been exposed to both.

The first table in the slide compares nerve agents. The second table shows the symptoms of exposure to nerve agents.



Now we will talk about Metabolic agents or cyanides. Hydrogen cyanide (AC) and cyanogen chloride (CK) are both agents that affect the body's ability to use oxygen:

- Cyanide is a colorless gas with an odor similar to almonds.
- Effects of cyanides begin on the cellular level and are very rapidly seen at the organ and system levels:
  - These deadly gases are commonly found in many industrial settings such as gold and silver mining, photography, and plastics processing.
  - They are often present in fires associated with textile and plastic factories.

In low doses, these chemicals are associated with dizziness, light-headedness, headache, and vomiting.

BIOLOGIC TERRORISM/WARFARE

- Manufactured synthetically for terrorist use
- The primary types are:
  - ✓ Viruses
  - ✓ Bacteria
  - ✓ Toxins



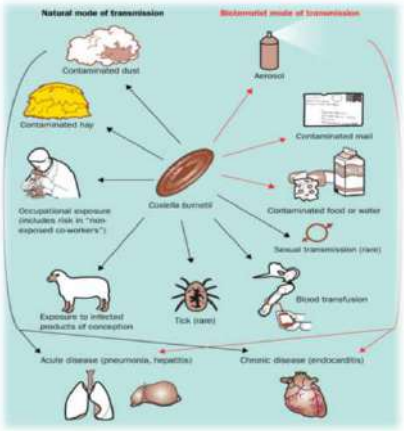
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Biologic agents are organisms that cause diseases. They are generally found in nature. However, for terrorist use they are cultivated, synthesized, and mutated in a laboratory. The weaponization of biologic agents is performed to maximize the target population's exposure to the germ artificially.
The primary types are:
Viruses.
Bacteria, and.
Toxins.

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BIOLOGIC AGENTS

- Can be almost completely undetectable
- Diseases similar to other minor illnesses
- May be spread in various ways:
  - ✓ Dissemination
  - ✓ A disease vector
- Communicability - indicated speed of spread
- Incubation – Time between exposure and symptoms



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Biologic agents pose many difficult issues when used as WMD. They can be almost completely undetectable. Most of the diseases caused by these agents will be similar to other minor illnesses.

Biologic agents are grouped as viruses, bacteria, and neurotoxins and may be spread in various ways.

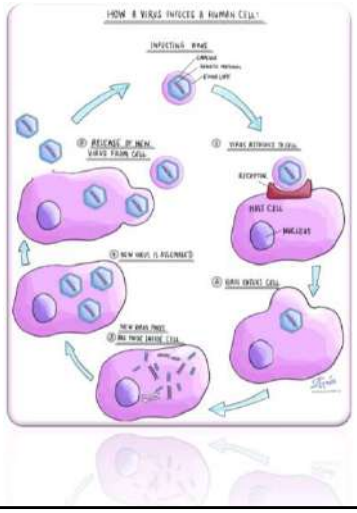
- Dissemination is the means by which a terrorist will spread the agent.
- A disease vector is an animal that, once infected, spreads disease to another animal.

How easily the disease is able to spread from one human to another human is called communicability. In instances when communicability is high, such as with smallpox, the person is considered contagious. Incubation is the period of time between the person becoming exposed to the agent and the appearance of the first symptoms.

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VIRUSES

- Require a living host to multiply and survive
- Invades healthy cells and replicates
- Moves from host to host



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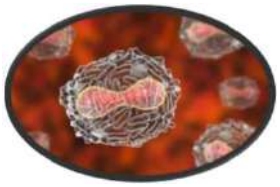
Viruses are germs that require a living host to multiply and survive. Once in the body, the virus invades healthy cells and replicates itself to spread through the host. Viruses move from host to host via the following methods
Via respiratory droplets,
Vector-borne,
Bloodborne or other body fluids,
Airborne,
Via contaminated food,water, and soil
And from animals to humans (zoonotic)

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VIRUSES | SMALLPOX

- Highly contagious
- Wear examination gloves, HEPA-filtered respirator, and eye protection
- Observe the size, shape, and location of the lesions

Characteristics of Smallpox	
Dissemination	Aerosolized for warfare or terrorist uses
Communicability	High from infected patients or contaminated items (such as blankets); person-to-person transmission possible
Route of entry	Inhalation of coughed droplets or direct skin contact with blisters
Signs and symptoms	Severe fever, malaise, body aches, headaches, small blisters on the skin, bleeding of the skin and mucous membranes; incubation period 10 to 12 days; duration of the illness, approximately 4 weeks
Medical management	Standard precautions; no specific treatment; provide supportive care (ABCs)





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- Smallpox is a highly contagious disease. All forms of standard precautions must be used to prevent cross-contamination.
- Wear examination gloves, a HEPA-filtered respirator, and eye protection.
- Before the rash and blisters show the illness will start with a high fever and body aches and headaches.

An easy, quick way to differentiate the smallpox rash from other skin disorders is to observe the size, shape, and location of the lesions:

- In smallpox, all the lesions are identical in their development.
- Smallpox blisters begin on the face and extremities and eventually move toward the chest and abdomen.
- The disease is in its most contagious phase when the blisters begin to form.

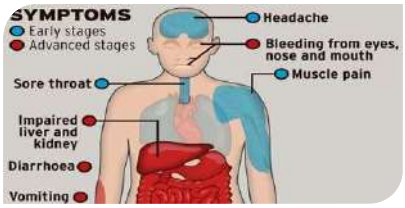
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VIRUSES | VIRAL HEMORRHAGIC FEVER (VHF)

- Causes blood to seep out from the tissues and blood vessels
- Flulike symptoms, progressing to internal and external hemorrhaging
- Standard precautions must be taken

Characteristics of Viral Hemorrhagic Fevers

Dissemination	Direct contact with infected body fluids; can be aerosolized for use in an attack
Communicability	Moderate from person to person or contaminated items
Route of entry	Direct contact with infected body fluids
Signs and symptoms	Sudden onset of fever, weakness, muscle pain, headache, and sore throat; all followed by vomiting and, as the virus runs its course, internal and external bleeding
Medical management	Standard precautions; no specific treatment; provide supportive care (ABCs) and treat for shock and hypotension, if present



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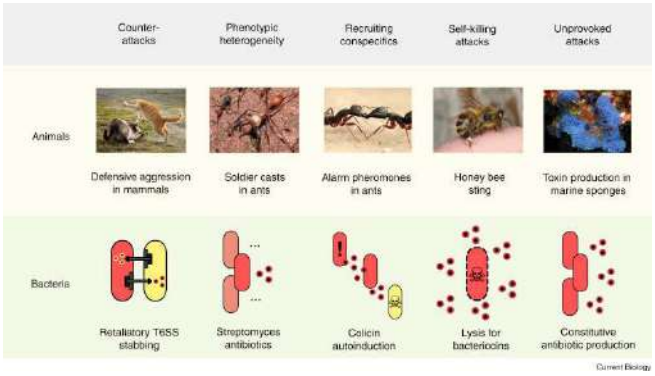
Viral hemorrhagic fevers (VHFs), consist of a group of diseases caused by viruses that include the Ebola, Rift Valley, Marburg, and yellow fever viruses, among others.

- This group of viruses causes the blood in the body to seep out from the tissues and blood vessels.
- Initially, the patient will have flu-like symptoms, progressing to more severe internal and external hemorrhaging symptoms.
- All standard precautions must be taken when treating these illnesses.

The table on this slide lists the characteristics of viral hemorrhagic fevers.

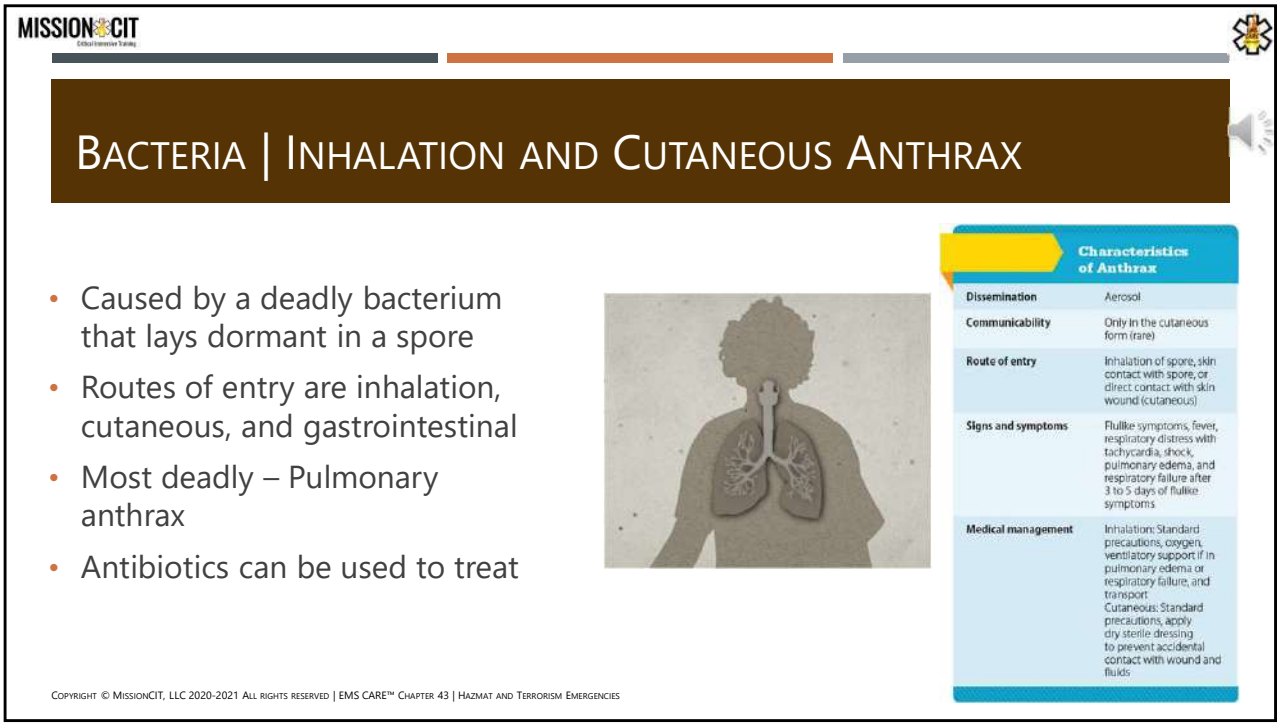
BACTERIA

- Do not require a host to multiply and live
- More complex than viruses, can grow up to 100 times larger
- Can be fought with antibiotics
- Generally begin with flulike symptoms



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Unlike viruses, bacteria do not require a host to multiply and live. Bacteria are much more complex and larger and can grow up to 100 times larger than the largest virus. Most bacterial infections can be fought with antibiotics. Most bacterial infections will generally begin with flu-like symptoms.



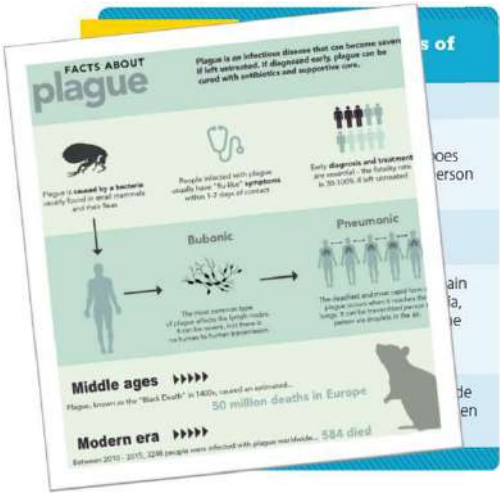
Inhalation and cutaneous anthrax (Bacillus anthracis) are caused by a deadly bacterium that lays dormant in a spore. When exposed to the optimal temperature and moisture, the germ will be released from the spore. The routes of entry are inhalation, cutaneous, and gastrointestinal.

- The inhalation form, or pulmonary anthrax, is the most deadly and often presents as severe cold.
- Pulmonary anthrax is associated with a 90% death rate if untreated. Antibiotics can be used to treat anthrax successfully.

The table on this slide lists the characteristics of anthrax.

BACTERIA | PLAGUE

- Natural vectors are rodents and fleas
- Bubonic plague infects the lymphatic system and creates buboes
- Pneumonic plague is a lung infection that results from inhalation of plague bacteria



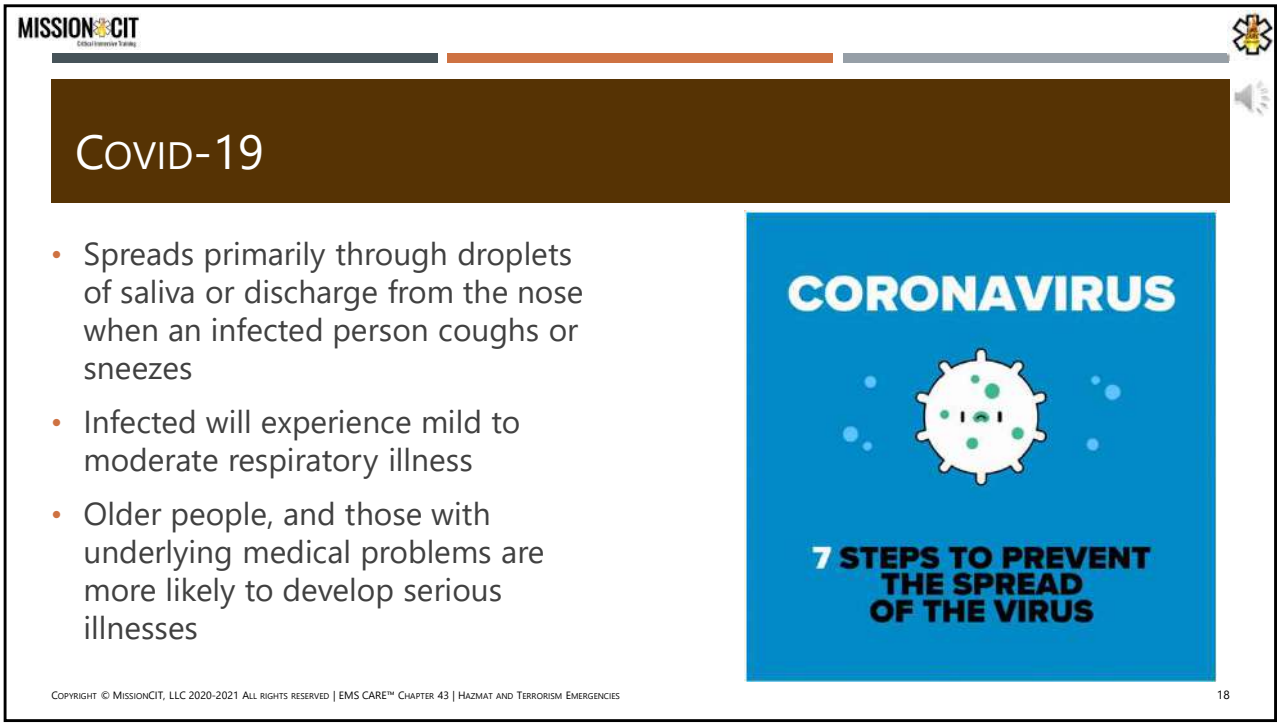
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The plague's natural vectors are infected rodents and fleas. Bubonic plague infects the lymphatic system. When this occurs, the patient's lymph nodes become infected and grow. The glands of the nodes will grow large and round, forming buboes. If left untreated, the infection may spread through the body, leading to sepsis and possibly death.

Pneumonic plague is a lung infection, also known as plague pneumonia, that results from inhalation of plague bacteria. This form of the disease is contagious and has a much higher death rate than the bubonic

form.

The table on this slide lists the characteristics of plague.



Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so it's important to practice respiratory etiquette (for example, by coughing into a flexed elbow).

Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people and those with underlying medical problems like

cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illnesses.

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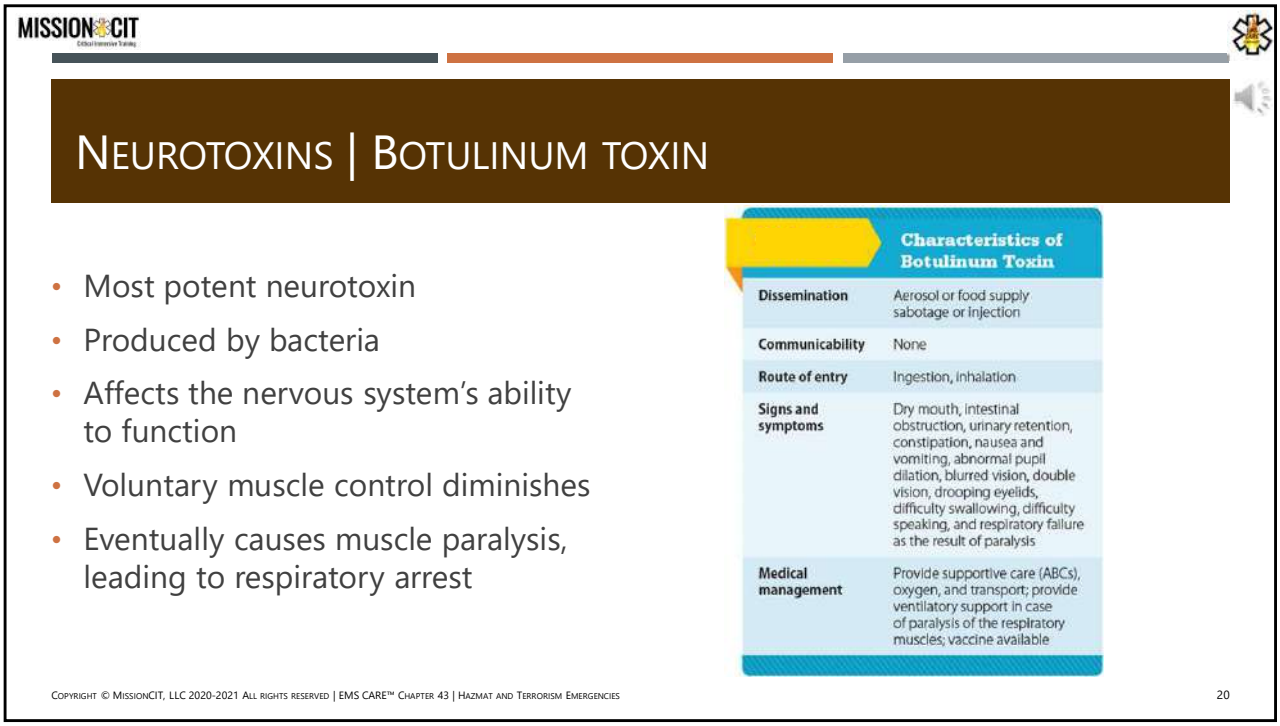
NEUROTOXINS

- Most deadly substances known to humans
- Produced from plants, marine animals, molds, and bacteria
- Route of entry is ingestion, inhalation, or injection
- Not contagious and have a faster onset of symptoms



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Neurotoxins are the most deadly substances known to humans. These toxins are produced from plants, marine animals, molds, and bacteria. The route of entry is through ingestion, inhalation from aerosols, or injection. Unlike viruses and bacteria, they are not contagious and have a faster onset of symptoms.



The most potent neurotoxin is botulinum, which is produced by bacteria. When introduced into the body, neurotoxin affects the nervous system's ability to function. Voluntary muscle control diminishes as the toxin spreads. Eventually, the toxin causes muscle paralysis, leading to respiratory arrest.

The table on this slide lists the characteristics of botulinum toxin.

Neurotoxins | Ricin

- Derived from mash of the castor bean
- Causes pulmonary edema and respiratory and circulatory failure, leading to death
- Quite stable and extremely toxic

Characteristics of Ricin

Dissemination	Released into indoor or outdoor air (aerosol) Food and water contamination
Communicability	None
Route of exposure	Inhalation, ingestion, injection
Signs and symptoms	Inhaled: cough, difficulty breathing, tightness in chest, nausea, muscle aches, pulmonary edema, and hypoxia Ingested: nausea and vomiting, internal bleeding, and death Injection: no signs except swelling at the injection site and death
Medical management	Provide supportive care (ABCs); no treatment or vaccine available



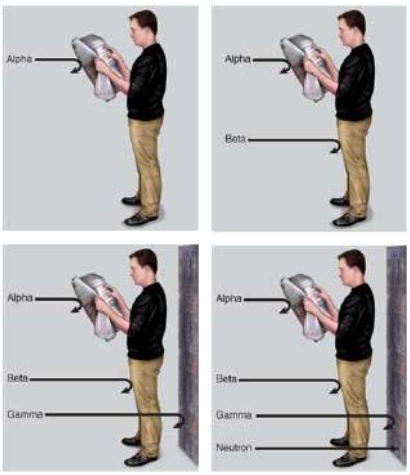
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Ricin is derived from mash that is left from the castor bean. When introduced into the body, ricin causes pulmonary edema and respiratory and circulatory failure, leading to death. The toxin is quite stable and extremely toxic by many routes of exposure, including inhalation.

The table on this slide lists the characteristics of ricin.

NUCLEAR/RADIOLOGIC TERRORISM

- Ionizing radiation is emitted in the form of rays, or particles
- Alpha, beta, gamma (x-ray), and neutron radiation:
  - ✓ Alpha is the least harmful type
  - ✓ Beta is slightly more penetrating
  - ✓ Gamma rays are faster and stronger
  - ✓ Neutron particles are the most powerful

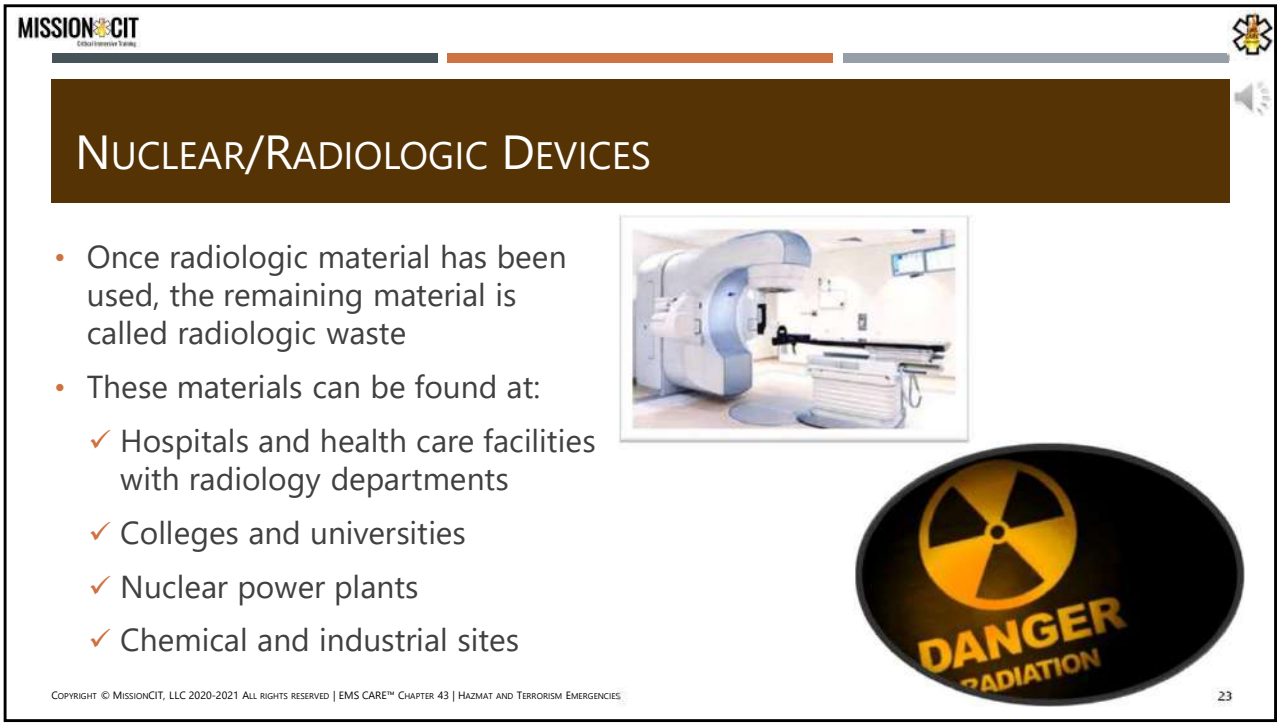


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Ionizing radiation is emitted in the form of rays, or particles. This energy can be found in radioactive material, such as rocks and metals.
Radioactive material is any material that emits radiation. This material is unstable, and it attempts to stabilize itself by changing its structure in a natural process called decay. The energy that is emitted from a strong radiologic source is alpha, beta, gamma (x-ray), or neutron radiation:

- Alpha is the least harmful penetrating type and cannot move through most objects.
- Beta radiation is slightly more penetrating than alpha and requires a layer of clothing to stop it.
- Gamma rays are far faster and stronger than alpha and beta rays.
- Neutron particles are among the most powerful forms of radiation.

The figures on this slide show what can deflect the four types of radiation, alpha, beta, gamma and neutron.



Radiologic materials are generally used for purposes that benefit humankind, such as:

- Medicine
- Killing germs in food (irradiating), and
- Construction

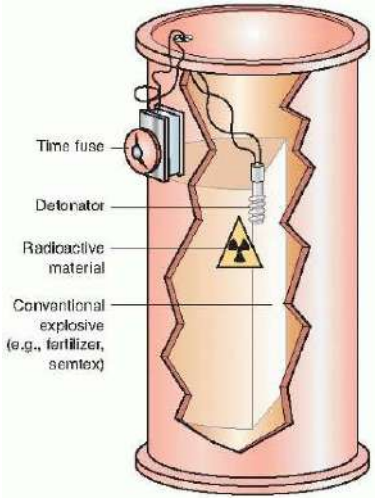
Once radiologic material has been used for its purpose, the material remaining is called radiologic waste; these materials can be found at:

- Hospitals and health care facilities with radiology departments
- Colleges and universities
- Nuclear power plants, and

- Chemical and industrial sites

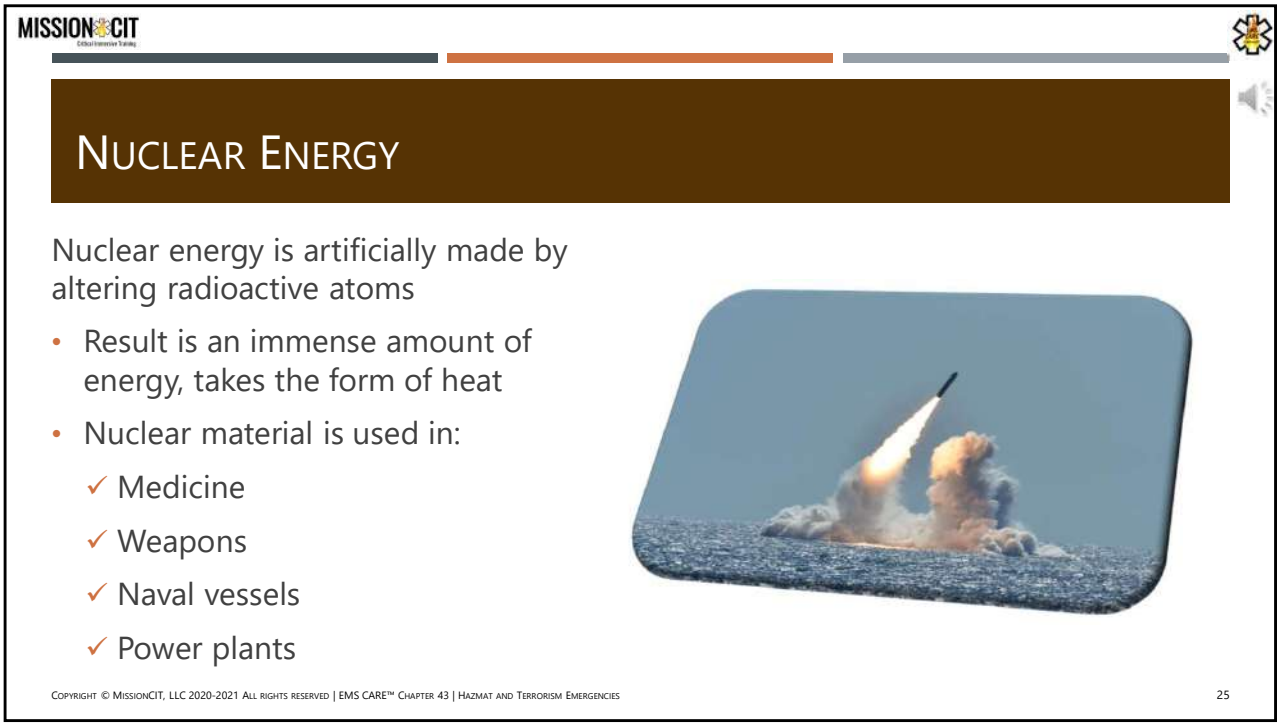
Radiologic Dispersal Devices (RDDs)

- Any container designed to disperse radioactive material
- A "dirty bomb" can injure victims with the radioactive or explosive material
- The dirty bomb is an ineffective WMD



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Radiologic dispersal devices (RDD) are containers that are designed to disperse radioactive material. A dirty bomb carries the potential to injure victims with not only the radioactive material, but also the explosive material used to deliver it. The destructive capability of a dirty bomb is limited to the explosives that are attached to it. The dirty bomb is an ineffective WMD.



Nuclear energy is artificially made by altering or splitting radioactive atoms. The result is an immense amount of energy that usually takes the form of heat. Nuclear material gives off all forms of radiation, including neutrons.

Nuclear materials are used in:

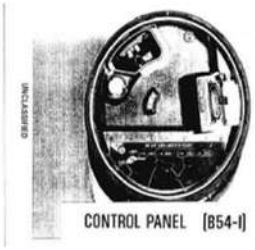
- Medicine
- Weapons
- Naval vessels, and
- Power plants

Nuclear Weapons

- Kept only in secure facilities
- Likelihood of a nuclear attack is extremely remote
- Whereabouts of many small nuclear devices are unknown
  - ✓ Special Atomic Demolition Munition (SADM)



Special Forces used the delivery container pictured above to protect bombs during parachute jumps. The container and the weapon inside were extremely heavy, adding 90 pounds to a paratrooper's load.
Sandia National Laboratories archive photo



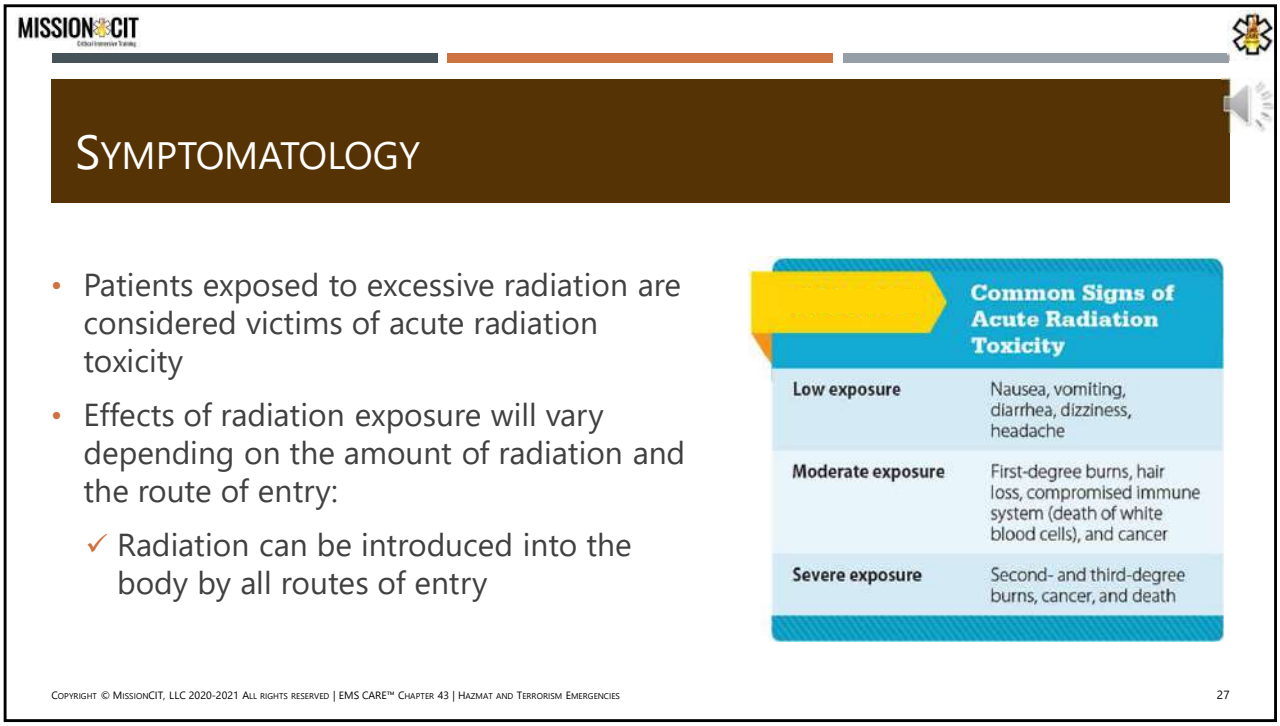
SADM control panel.
Archive scan via OpenNet



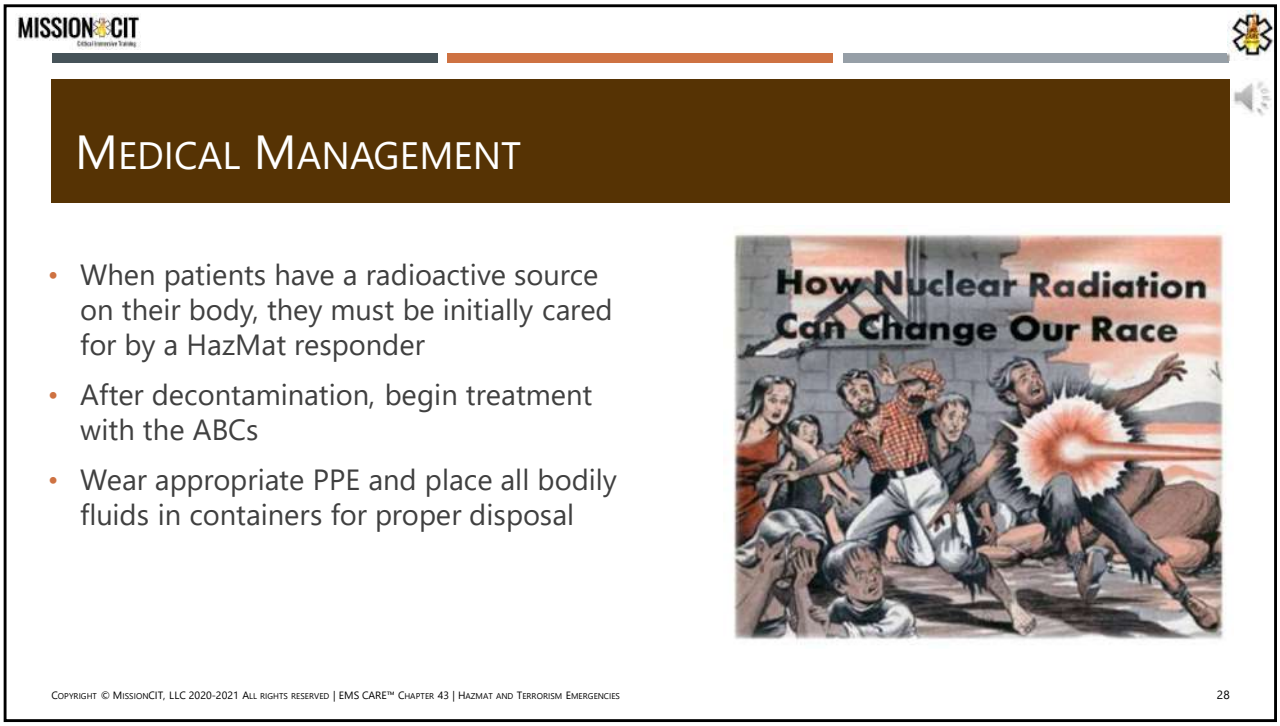
In a 1969 study, the U.S. Army tows an M-60 tank from a crater created by a simulated half-kiloton ADM blast to test the difficulty the weapons would pose to the movement of enemy forces.

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Nuclear weapons are kept only in secure facilities throughout the world. The likelihood of a nuclear attack is highly remote. Since the collapse of the former Soviet Union, the whereabouts of many small nuclear devices are unknown. These small suitcase-sized nuclear weapons are called Special Atomic Demolition Munitions (S-A-D-Ms). Some of these are believed to be missing.

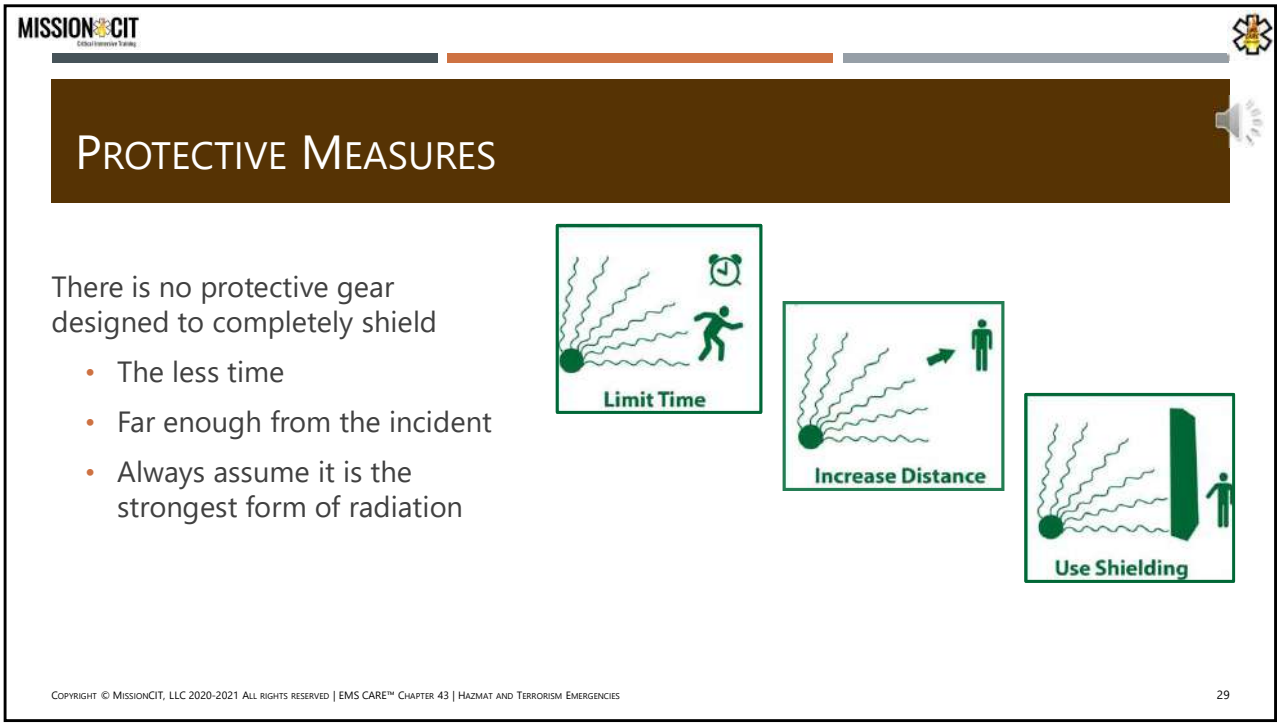


Patients exposed to a known or suspected source of excessive radiation are considered victims of acute radiation toxicity. The effects of radiation exposure will vary depending on the amount of radiation that a person receives, and the route of entry. Radiation can be introduced into the body by all routes of entry, as well as through the body (irradiation). Some common signs of acute radiation toxicity are listed in the table.



Being exposed to a radiation source does not make a patient contaminated or radioactive. However, when patients have a radioactive source on their bodies, they are contaminated and must be initially cared for by a HazMat responder. Once the patient is decontaminated, you may begin treatment with the ABCs and treat the patient for any burns or trauma. Wear appropriate PPE.

- Secure any bodily fluids obtained from the patient in plastic bags
- Place all body fluids in containers and properly dispose of them with other potentially radioactive waste



There are no suits or protective gear designed to completely shield you from radiation. The best ways to protect yourself from the effects of radiation are

1. The less time that you are exposed to the source, the less the effects will be.
2. Make sure that responders are stationed far enough from the incident.

The third is to always assume it is the most potent form of radiation and use concrete shielding.

With this, we have come to the end of this lesson, and next Justin will walk you through terrorism emergencies